Final Alternative Scenarios Summary Report
Oahu Regional Transportation Plan 2035 Project

Deliverable 9.3.2

Mobilizing Oahu | Fulfilling Our Legacy

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Acronyms Used in this Document

HOV	High Occupant Vehicle
HOV2	Two-person High Occupant Vehicle
HOV3+	Three-or-More Person High Occupant Vehicle
LOS	Level of Service
ORTP	Oahu Regional Transportation Plan
SOV	Single Occupant Vehicle
TAA	Transportation Analysis Area
TAZ	Transportation Analysis Zone
TIP	Transportation Improvement Program
VMT	Vehicle Miles of Travel
VHT	Vehicle Hours of Travel
VHD	Vehicle Hours of Delay

Executive Summary

This report includes documentation of travel demand forecasting model results for three 2035 sensitivity scenarios.[1] The following hypothetical scenarios were tested:

1) A Level-of-Service (LOS) D scenario, in which highway capacity was added with the goal of eliminating peak period congestion;
2) A Managed Lane scenario, in which High-Occupancy Vehicle (HOV) lanes in the H-1 Corridor between H-2 and Pearl Harbor were converted to High-Occupancy Toll (HOT) lanes, where vehicles with three or more persons are allowed to use the facility free of charge while single occupant vehicles and vehicles with two persons are charged a fee for using the lanes; and,
3) A Cordon Pricing scenario, in which vehicles entering downtown Honolulu are charged a fee. The pricing area was defined as the area bounded by Nimitz Highway, River Street, Vineyard Street, and Alapai Street; vehicles using these facilities were only charged if they enter the pricing area.

The results of these forecasts are compared to the 2035 Baseline travel demand forecasting model results. The 2035 sensitivity scenarios' project overview, mode choice results, and assignment results are presented.

In the 2035 LOS D scenario, the key findings were: (1) the addition of capacity to the major roadways (234 additional lane miles over the Baseline) had significant impacts on trip distribution and mode choice, (2) auto travel times to key destinations improved compared to Baseline, (3) additional auto demand over the 2035 Baseline was seen on the freeways, expressways, and arterials (4) Vehicle Miles Traveled (VMT) increased by five percent while Vehicle Hours Traveled (VHT) decreased by the same amount compared to Baseline and Vehicle Hours of Delay (VHD) decreased significantly by 32 percent from the Baseline, and (5) even with significant capacity added (234 additional lane miles over the Baseline), some major roadways were still operating at LOS E and F. This scenario demonstrates that building enough highway capacity to eliminate congestion is infeasible.

In the 2035 Managed Lane scenario, the key findings were: (1) the 2035 Baseline had no excess capacity to sell in the AM zipper lane or the HOV 2+ lane due to forecasted 2035 HOV demand, so both the AM zipper lane and the HOV 2+ occupant lane were tolled for this scenario, essentially pricing out some HOV 2-occupant demand to provide capacity for the SOV demand, (2) a relatively high toll regime of $1.00/mile for SOVs, and $0.50/mile for HOV 2-occupant was required to ensure LOS D or better conditions on the managed lanes in the peak periods, (3) there was relatively no change in mode share between auto, transit, bicycle, and pedestrian between the Baseline and managed lane scenarios, but some non-toll auto trips shifted into the tolled auto trips, (4) there were very small changes in VMT, VHT and VHD between the Baseline and managed lane scenarios, and (5) there was

[1] The scenarios are describe in the *Sensitivity Test Scenarios Definition Technical Memorandum (Task 9.2).*

almost no change in transit boardings by time of day and mode between the Baseline and managed lane scenarios.

The key findings in the 2035 Cordon Pricing scenario are: (1) pricing auto trips to the downtown area causes significant modal shifts, including fewer auto trips and more transit and non-motorized trips, (2) increasing the cordon toll causes a higher shift to transit, bicycle, and walking and a shift away from auto, and (3) while regional VMT, VHT, and VHD do not change significantly, VMT, VHT, and VHD changed slightly for the priced area (area type 1), and (4) Nimitz Highway/Ala Moana Boulevard showed somewhat increased volumes to avoid the cordon area, but H-1 showed minimal change from the 2035 Baseline scenario.

At present, statutory authority for tolling (managed lanes) or cordon pricing (or congestion pricing) has not been granted by the Hawaii Legislature. Therefore, neither the State nor any of its counties have the ability to set tolls for the use of roads or entry into a cordoned area.

Article IX, Section 10, of the Hawaii State Constitution states:

> *The law of the splintered paddle, mamala-hoe kanawai, decreed by Kamehameha I – let every elder person, woman and child lie by the roadside in safety – shall be a unique and living symbol of the State's concern for public safety.*

One interpretation of the law of the splintered paddle is that it means the use of roads and highways are to remain free for travel. This is the prevailing interpretation of the Hawaii Legislature as articulated by the Chair of the Senate Transportation Committee in his presentation to the OahuMPO Citizen Advisory Committee on July 16, 2008.

He also noted that tolling of roads would not be successful in Hawaii due to the relatively small volume of users who would support a for-profit business venture.

Nonetheless, many citizens have lobbied aggressively for HOT lanes as a congestion mitigation measure. Separately, the City Council of Honolulu, in its Resolution 07-258, CD1, requested that DTS work with the OahuMPO to determine the feasibility of implementing congestion pricing in Honolulu. While it is recognized that these scenario tests provide preliminary guidance in terms of the opportunities and constraints of both tolling and cordon pricing, it was beyond the scope of the ORTP 2035 to undertake the level of study required to examine either of these pricing mechanisms in sufficient depth to determine their viability in Honolulu. Further study would be required in addition to the enabling legislation referenced above.

1 Introduction

1.1 Report Purpose

This report includes review and documentation of travel demand forecasting model results for three 2035 sensitivity scenarios. It is intended for the review of the reasonableness of the 2035 sensitivity scenario travel demand forecasts, and will be a complement to the ORTP 2035 deliverable 9.3.2 *Plan Scenario Summary Report*.

1.2 Report Overview

This report provides a review and evaluation of the forecasted 2035 sensitivity scenarios results affecting the transportation system on the island of Oahu. Chapter Two shows the results of the LOS D scenario, Chapter Three details the results of the Managed Lane scenario, and Chapter Four provides the results of the Cordon Pricing scenario. Each chapter provides an overview of the 2035 sensitivity scenario project definition, the travel demand forecasting results such as mode choice, the travel demand forecasting assignment results such as VMT, VHD, and transit boardings by mode.

2 LOS D Scenario

This chapter provides the results of the Level-of-Service (LOS) D sensitivity scenario.

2.1 LOS D Scenario Definition

In this scenario, the OahuMPO travel demand forecasting model was used to estimate how much highway expansion would be needed to achieve a global operating LOS D or better through capacity expansion alone. This involved adding lane capacity to identified capacity constrained areas (i.e., LOS E or F) in the travel demand model.

An initial list of improvements to attempt to bring various facilities up to LOS D or better was identified for testing. The initial list of improvements is shown in Table 2-1. The table describes the facility that will receive the treatment and the additional lanes that will be added to travel demand model highway network by direction for the 2035 Baseline AM peak period.

Table 2-1: Initial Recommended Improvements for LOS D Analysis Scenario

1. Dillingham Boulevard Koko Head-bound between Middle Street and Alakawa Street, needs one additional lane.
2. Farrington Highway Koko Head-bound between Maliona Street in Waianae and the H-1 on-ramp in Waipahu, needs one additional lane.
3. Fort Barrette Road between Kamaaha Avenue and Farrington Highway mauka-bound, add one additional lane.
4. Fort Weaver Road mauka-bound between Aawa Drive and the Farrington Highway underpass, add one additional lane.
5. Ka Uka Boulevard Interchange (over H-2), widen by one extra lane in both directions.
6. Kahekili Highway town-bound between Hui Iwa Street and Haiku Road, add one additional lane.
7. Kalaeloa Boulevard makai-bound between Farrington Highway and makai of Malakole Street, widen by two additional lanes.
8. Kalakaua Avenue Koko Head-bound between Kanunu Street and Kuhio Avenue, add one additional lane.
9. Kalanianaole Highway Ewa-bound between Lunalilo Home Road and Halemaumau Street, add one additional lane or add HOV contraflow in this area.
10. Kalanianaole Highway Ewa-bound between Halemaumau Street and H-1 at Ainakoa Avenue, widen by one additional lane.
11. Kamehameha Highway makai-bound between Whitmore Avenue in Wahiawa to the H-1/H-2 merge in Waipahu, widen by one lane.
12. Kapolei Parkway Waianae-bound between Kolowaka Drive and the new University of Hawaii West Oahu campus East Kapolei Road, widen by one lane (current widening project is not sufficient).
13. Kunia Road makai-bound between Kupuna Loop and the H-1 west-bound on-ramp, widen by one lane.
14. Kunia Road mauka-bound between Farrington Highway and the H-1 east-bound on-ramp, widen by one lane.
15. Likelike Highway town-bound in Kaneohe, widen by one lane.

16. Makakilo Drive makai-bound before the H-1 interchange, widen by one lane (may be relieved with the back side of Makakilo Drive joining with Kualakaʻi Parkway interchange).
17. Malakole Street, widen by one lane (may be relieved with the Hanua Street extension to the new Kapolei H-1 interchange).
18. Moanalua Freeway Koko Head-bound between Red Hill and Middle Street, widen by one lane.
19. Moanalua Road Koko Head-bound between the H-1 east-bound Waimalu/Pearlridge off-ramp and Honomanu Street, widen by one lane.
20. Nimitz Highway Koko Head-bound between Middle Street and Alakawa Street, needs one additional lane (may be relieved with the Nimitz Flyover).
21. North King Street Koko Head-bound between the North King Street off-ramp from Moanalua Road to Liliha Street, widen by one lane.
22. Old Waialae Road Ewa-bound over H-1 to South King Street, widen by one lane.
23. Pali Highway town-bound, widen by one lane from Kaneohe to Downtown (Vineyard Boulevard).
24. Puuloa Road mauka-bound toward H-1 makai of Pukoloa Street, widen by one lane.
25. Wilikina Drive town-bound between McCornack Road and H-2, widen by one lane.
26. H-1 Ewa-bound between the H-1 / H-2 merge and Paiwa Street, widen by one lane.
27. H-1 Ewa-bound between Fifth Avenue and Middle Street, widen by one lane. (Closing some of the on-ramps in this section might help the congestion.)
28. H-1 Koko Head-bound between the Kapolei Interchange at Kalaeloa Boulevard to the Halawa Interchange, widen by one lane.
29. H-1 Koko Head-bound Middle Street merge to Punahou Street, widen by one lane.

The results of the initial test indicated that there were still a number of facilities that were operating below LOS D even with the initial set of capacity improvements. An additional set of improvements was subsequently identified to bring these facilities up to LOS D. These improvements are presented in Table 2-2.

Table 2-2: Additional Set of Improvements for LOS D Analysis Scenario

1. Farrington Highway Koko Head-bound between Maliona Street in Waianae and just Koko Head of Laaloa Street, add one additional lane.
2. Farrington Highway Koko Head-bound between Paiwa Street and just Koko Head of Waipio Access Point Road, add one additional lane.
3. H-1 Koko Head-bound between the H-1/H-2 merge and the Waimalu off-ramp, add two additional lanes.
4. H-1 Koko Head-bound between Kunia Road on-ramp and Manager's Drive (first entrance to AM zipper lane), add one additional lane.
5. H-1 Koko Head-bound between the Waimalu off-ramp and the Halawa Interchange, add one additional lane.
6. H-1 Koko Head-bound Middle Street merge to the Bingham Street off-ramp, widen by 1 lane.
7. Kahekili Highway town-bound between Waihee Road and Hui Iwa Street, add one additional lane.
8. Kalaeloa Boulevard mauka-bound between Kapolei Parkway and the Farrington Highway Waianae-bound on-ramp, add one additional lane.
9. Kamehameha Highway Koko Head-bound between Kaahumanu Street and the H-1 at Aiea on-ramp, add one additional lane.

10. Kamehameha Highway makai-bound between makai of Lanikuhana Avenue and Pearl Highlands, add one additional lane.
11. Kamokila Boulevard/Farrington Highway Koko Head-bound between Uluohia Street and Fort Barrette Road, add one additional lane.
12. Moanalua Freeway Koko Head-bound between Red Hill and Middle Street, widen by one additional lane.
13. Moanalua Road Koko Head-bound between Kaahumanu Street and Honomanu Street, add one additional lane.
14. Pali Highway town-bound between Old Pali Road and Vineyard Boulevard, add one additional lane.

Table 2-3 shows the number of lane miles by facility type and area type while Table 2-4 shows the additional lane miles added to the Baseline scenario to bring the facilities up to LOS D while Figure 2-1 shows this visually. In summary, 235 lane miles of capacity were added to the 2035 Baseline scenario network, for a capacity increase of approximately eight percent, with over 55 percent of that capacity increase on freeways or expressways.

Table 2-3: 2035 LOS D Scenario Project Lane Miles by Facility Type and Area Type

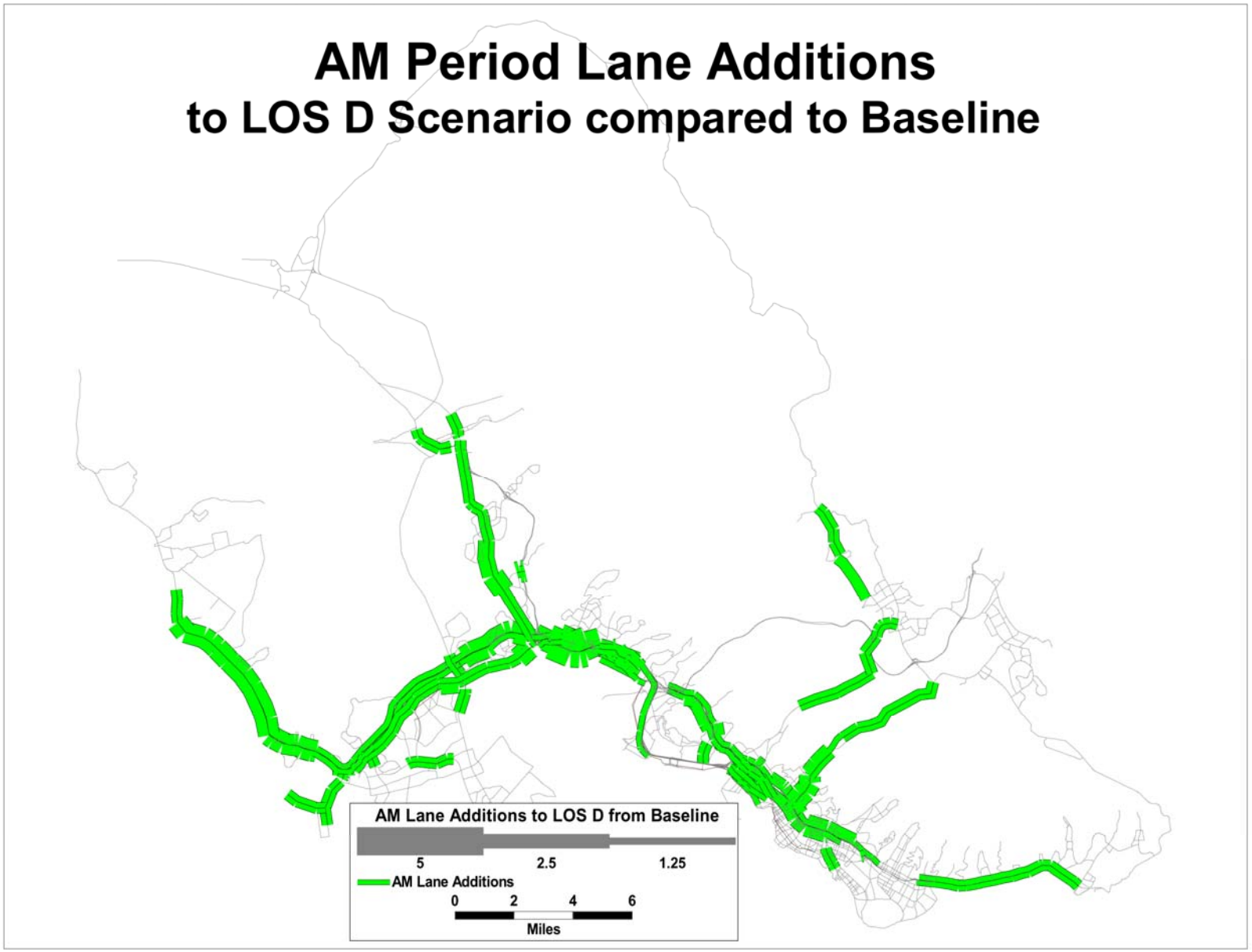
	Area Type[2]								
Facility Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**All Areas**
Freeways*	0	8	26	83	180	35	59	22	413
Expressways	0	0	5	21	50	42	57	20	195
Class I Arterials	11	17	36	62	127	8	82	18	361
Class II Arterials	6	17	38	30	59	20	75	40	285
Class III Arterials	4	4	25	33	111	5	38	1	221
Class I Collectors	2	6	14	64	91	3	41	6	227
Class II Collectors	1	4	26	45	195	8	127	14	420
Local Streets	4	2	11	39	76	5	68	10	215
High Speed Ramps	0	0	1	6	20	3	10	1	41
Low Speed Ramps	0	3	4	21	23	1	12	1	65
Centroid Connectors	6	11	41	80	167	17	105	55	482
Rail	2	1	3	14	15	0	3	0	38
All Facility Types	**36**	**73**	**230**	**498**	**1,114**	**147**	**677**	**188**	**2,963**

[2] See Appendix, Table A - 1 for area type definitions.
* The zipper lane (both AM and PM) and HOV lanes are included under the freeway facility type. The Baseline scenario contains the PM contra flow lane between Radford Drive and the Waiawa interchange. When in operation, the zipper lane takes away one lane from the general purpose lanes traveling in the opposite direction.

Table 2-4: Difference in Project Lane Miles between LOS D Scenario and Baseline by Facility Type and Area Type

	Area Type								
Facility Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**All Areas**
Freeways	0	2	10	16	31	0	8	2	**69**
Expressways	0	0	2	8	17	14	17	7	**65**
Class I Arterials	0	1	0	10	26	1	14	1	**53**
Class II Arterials	0	2	1	4	7	0	1	0	**15**
Class III Arterials	0	0	1	6	7	1	7	0	**22**
Class I Collectors	0	0	0	7	1	0	0	0	**8**
Class II Collectors	0	0	0	1	0	0	0	0	**1**
Local Streets	0	0	0	0	0	0	0	0	**0**
High Speed Ramps	0	0	0	0	0	0	1	0	**1**
Low Speed Ramps	0	0	0	1	0	0	0	0	**1**
Centroid Connectors	0	0	0	0	0	0	0	0	**0**
Rail	0	0	0	0	0	0	0	0	**0**
All Facility Types	**0**	**5**	**14**	**53**	**89**	**16**	**48**	**10**	**235**

Figure 2-1: Number of Additional Lane Miles added to the Baseline Scenario for LOS D Scenario



2.2 LOS D Scenario Person Trips by Purpose and Mode

This section describes the basic travel demand forecasting model results such as person trips and mode choice associated with the 2035 LOS D sensitivity scenario, comparing it to the 2035 Baseline scenario results.

As compared to the Baseline, total system-wide daily person trips remain nearly the same for the 2035 LOS D scenario. Transit mode share for total daily trips is projected to decrease very slightly for the 2035 LOS D scenario (Table 2-5).

Table 2-5: Total Daily Person Trips by Mode—2035 Baseline vs. 2035 LOS D Scenario

Alternative	2035 Baseline		2035 LOS D Scenario		Percentage Change
	Number	Percent by Category	Number	Percent by Category	
Trips by Residents					
Private automobile	3,335,857	83%	3,359,004	83%	1%
Transit	245,727	6%	242,659	6%	-1%
Bike/walk	461,617	11%	443,584	11%	-4%
Total Trips by Residents	4,043,201	100%	4,045,247	100%	0%
Trips by Visitors					
Private Automobile	121,092	32%	120,983	32%	0%
Transit	30,235	8%	30,236	8%	0%
Taxi	9,540	3%	9,507	3%	0%
Tour Bus	57,953	16%	58,276	16%	1%
Bike/Walk	154,265	41%	155,087	41%	1%
Total Trips by Visitors	373,085	100%	374,089	100%	0%
Ground Access Trips by Air Passengers					
Private Automobile	28,841	26%	28,805	26%	0%
Transit	4,372	4%	4,332	4%	-1%
Taxi	17,269	15%	17,229	15%	0%
Tour Bus	22,486	20%	22,486	20%	0%
Shuttle Bus	39,732	35%	39,847	35%	0%
Total Trips by Air Passengers	112,700	100%	112,699	100%	0%
Truck Trips					
Total Trips by Truck	237,306	100%	237,306	100%	0%
Total Daily Trips (All)	*4,766,292*	*100%*	*4,769,341*	*100%*	*0%*

Table 2-6 shows the mode choice results by purpose for residents in the 2035 LOS D scenario model run. Eighty-three percent of all resident trips were made by private vehicles (single, 2, and 3+ occupants), while about six percent of all resident trips were made by transit (express, local, fixed guideway, park-and-ride, or kiss-and-ride). About 11 percent of the resident trips were made by bicycle or walking. The journey-to-work/home-based-work-trip purpose shows that nearly 12 percent of the trips are made by transit. Home-based-college-trips also show a high percentage is made by transit (over 24 percent). These purposes show a much higher percentage of trips on transit compared to the overall six percent.

Table 2-7 shows the comparison of the 2035 LOS D mode choice results by purpose to the 2035 Baseline alternative results. This table shows the change and the percent change between 2035 Baseline and the LOS D scenario. The drive-alone and shared-ride-2-person modes increased slightly (1 percent), while the shared-ride 3-plus-person mode decreased very slightly. The walk-to-express bus and local-bus modes increased slightly as the LOS on the roadways improved for the buses. The walk-to-fixed-guideway, drive- transit, and auxiliary modes decreased slightly as some travelers switched to the faster auto modes.

Table 2-6: 2035 LOS D Scenario Mode Choice Summary Results by Trip Purpose for Residents

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	547,280	82,493	163,460	29,178	116,832	2,939	8,424	36,931	112,744	265,282	142,468	*1,508,031*
	60%	37%	67%	32%	53%	24%	3%	50%	29%	27%	23%	*37%*
Double-occupant vehicle	155,218	75,340	43,194	34,095	30,211	1,714	67,354	8,702	131,781	301,721	222,108	*1,071,438*
	17%	34%	18%	38%	14%	14%	24%	12%	34%	31%	35%	*26%*
Three-or-more occupant vehicle	36,516	45,110	11,758	16,088	11,756	429	106,730	2,633	95,356	248,072	205,087	*779,535*
	4%	20%	5%	18%	5%	4%	38%	4%	25%	25%	33%	*19%*
Walk to express transit	3,609	239	2	555	0	0	251	210	0	0	0	*4,866*
	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	*0%*
Walk to local bus transit	54,857	4,431	7,247	5,192	4,541	4,582	16,555	9,672	9,801	26,127	3,726	*146,731*
	6%	2%	3%	6%	2%	38%	6%	13%	3%	3%	1%	*4%*
Walk to fixed guideway transit	27,319	1,837	4,860	2,003	1,718	1,141	3,121	5,249	1,296	9,825	1,825	*60,194*
	3%	1%	2%	2%	1%	9%	1%	7%	0%	1%	0%	*1%*
Informal Park-and-ride transit	1,058	48	0	7	0	0	264	94	140	218	0	*1,829*
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	*0%*
Formal Park-and-ride transit	11,922	0	0	0	0	0	3	1,277	12	558	0	*13,772*
	1%	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	*0%*
Kiss-and-ride transit	9,458	249	14	0	1	1	1,535	1,637	753	1,617	3	*15,268*
	1%	0%	0%	0%	0%	0%	1%	2%	0%	0%	0%	*0%*
Walk	46,366	10,053	12,463	2,808	51,881	1,218	69,248	4,125	29,680	120,984	50,337	*399,163*
	5%	5%	5%	3%	24%	10%	25%	6%	8%	12%	8%	*10%*
Bike	11,389	1,782	871	31	2,095	12	8,470	3,313	2,534	11,399	2,525	*44,421*
	1%	1%	0%	0%	1%	0%	3%	4%	1%	1%	0%	*1%*
Total	*904,992*	*221,581*	*243,869*	*89,957*	*219,035*	*12,036*	*281,955*	*73,843*	*384,097*	*985,803*	*628,079*	*4,045,248*

Table 2-7: Comparison of 2035 LOS D Scenario to 2035 Baseline Mode Choice Results by Purpose for Residents (Change and Percent Change)

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	9,096	1,090	1,245	-70	995	-17	176	1,018	289	1,121	237	*15,180*
	2%	1%	1%	0%	1%	-1%	2%	3%	0%	0%	0%	*1%*
Double-occupant vehicle	4,432	1,589	1,101	357	307	6	1,980	207	-106	1,087	597	*11,557*
	3%	2%	3%	1%	1%	0%	3%	2%	0%	0%	0%	*1%*
Three-or-more occupant vehicle	-4,500	-1,342	-915	115	113	2	1,929	-230	-72	822	488	*-3,590*
	-11%	-3%	-7%	1%	1%	0%	2%	-8%	0%	0%	0%	*0%*
Walk to express transit	161	17	0	28	0	0	11	4	0	0	0	*221*
	5%	8%	0%	5%	0%	0%	5%	2%	0%	0%	0%	*5%*
Walk to local bus transit	-672	173	134	49	68	36	478	195	-108	4	55	*412*
	-1%	4%	2%	1%	2%	1%	3%	2%	-1%	0%	1%	*0%*
Walk to fixed guideway transit	-30	-5	-173	161	44	29	-65	-468	-26	-752	-30	*-1,315*
	0%	0%	-3%	9%	3%	3%	-2%	-8%	-2%	-7%	-2%	*-2%*
Informal Park-and-ride transit	-71	0	0	0	0	0	3	-2	1	3	0	*-66*
	-6%	0%	0%	0%	0%	0%	1%	-2%	1%	1%	0%	*-3%*
Formal Park-and-ride transit	-610	0	0	0	0	0	1	-285	0	21	0	*-874*
	-5%	0%	0%	0%	0%	0%	50%	-18%	0%	4%	0%	*-6%*
Kiss-and-ride transit	-1,206	-4	-1	0	0	0	-17	-201	2	-19	0	*-1,446*
	-11%	-2%	-7%	0%	0%	0%	-1%	-11%	0%	-1%	0%	*-9%*
Walk	-5,344	-751	-1,300	-301	-882	-22	-5,127	7	-400	-1,588	-775	*-16,483*
	-10%	-7%	-9%	-10%	-2%	-2%	-7%	0%	-1%	-1%	-2%	*-4%*
Bike	-1,220	-75	-79	-2	-11	0	1	-112	-33	-4	-15	*-1,550*
	-10%	-4%	-8%	-6%	-1%	0%	0%	-3%	-1%	0%	-1%	*-3%*
Total	*36*	*692*	*12*	*337*	*634*	*34*	*-630*	*133*	*-453*	*695*	*557*	*2,046*
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*

2.3 LOS D Scenario Assignment Results

This section describes the assignment results such as VMT, VHT, VHD, and transit boardings by mode associated with the 2035 LOS D sensitivity test scenario, with comparisons to the 2035 Baseline scenario.

2.3.1 LOS D Highway Assignment

The highway assignment in the model produces summaries of the total islandwide daily VMT by motorized vehicles (automobiles, buses, and commercial vehicles) as estimated by the travel demand forecasting model. Table 2-8 shows the summary of the daily VMT by facility type and area type.[3] Of the more than 16.4 million daily VMT estimated, approximately 41 percent are anticipated to occur on the Interstate freeway system (e.g., Interstate Routes H-1, H-2, H-3, and Moanalua Freeways), while the forecasted percentages of VMT on the expressways (e.g., Likelike Highway and Pali Highway), ramps, arterials (e.g., Nimitz Highway, Dillingham Boulevard, and Moanalua Road) and collectors (e.g., Kaahumanu Street and Waipahu Street) would be 13 percent, five percent, 31 percent, and 11 percent, respectively.

Table 2-9 shows that the VMT would increase by five percent over 2035 Baseline scenario due to longer trip lengths and more auto demand as a result of less congested roadways. This shows that increasing capacity on the roadways adds more auto demand.

Table 2-10 shows VHT by facility type and area type in 2035, and Table 2-11 shows the percent change in VHT from 2035 Baseline scenario to 2035 LOS D scenario. The model forecasts 439,331 hours of travel in the 2035 LOS D scenario, a decrease of 5 percent from the 2035 Baseline scenario. Arterials are expected to carry the greatest share of VHT, with 37 percent of the total, followed by freeways (27 percent) and collectors (17 percent).

Table 2-12 shows 2035 LOS D scenario VHD forecasted by the travel demand forecasting model, and Table 2-13 shows the percent change in VHD between the 2035 Baseline and the 2035 LOS D scenario. VHD is projected to decrease by 32 percent in total due to the reduction in congested conditions. The largest forecasted decreases in delay are expected on expressways (62 percent), freeways (57 percent), and arterials (41 percent).

Figure 2-2 shows the auto travel time to Downtown for the 2035 LOS D scenario while Figure 2-3 through Figure 2-8 shows the difference in auto travel times to key destinations between the 2035 LOS D and the 2035 Baseline scenarios, from the static equilibrium two-hour AM peak period highway assignment. The lane miles added to key areas on freeways, expressways, and arterials improved auto travel

[3] See Appendix Table A - 1 for area type definitions.

times significantly in the LOS D scenario as shown in the difference in auto travel time plots.

The improved LOS compared to the Baseline scenario on key facilities is shown in Figure 2-9 through Figure 2-13. However, there are still some facilities that are LOS E and F, most notably, the H-1 freeway after the H-1/H-2 merge. Based on the 2035 Baseline demand, this area required an increase of four lanes in each direction; yet even with this increase the travel demand forecasting model still predicts LOS E on this facility. This is due to the increased travel on H-1 due to trip distribution, mode, and route choice changes that result from additional capacity. A significant increase in AM 2-hour auto volumes compared to Baseline is shown in Figure 2-10. The increase in auto demand near the H-1/H-2 merge shows that it is practically infeasible to add enough capacity on H-1 to completely eliminate congestion on this facility.

Table 2-8: 2035 LOS D Scenario VMT by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0	180,622	628,385	1,255,082	2,914,992	361,331	816,725	228,584	6,385,721
Expressways	0	0	46,573	215,143	577,549	411,811	569,008	197,980	2,018,064
Ramps	0	18,066	41,445	169,707	373,667	28,779	181,869	17,146	830,679
Arterials	118,245	229,633	598,048	740,195	1,588,465	262,561	1,095,503	394,791	5,027,441
Collectors	13,905	31,607	140,824	382,346	766,270	14,786	385,973	39,448	1,775,159
Total	132,150	459,928	1,455,275	2,762,473	6,220,943	1,079,268	3,049,078	877,949	16,037,064

Table 2-9: Percent Change from 2035 Baseline to 2035 LOS D Scenario VMT by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0%	19%	24%	7%	7%	-2%	0%	-3%	7%
Expressways	0%	0%	24%	26%	29%	11%	10%	24%	18%
Ramps	0%	6%	17%	2%	2%	1%	13%	-5%	5%
Arterials	-7%	-9%	-4%	2%	4%	0%	4%	-1%	1%
Collectors	-5%	-5%	1%	2%	-1%	-24%	-1%	0%	0%
Total	-7%	1%	9%	6%	7%	3%	4%	3%	5%

Table 2-10: 2035 LOS D Scenario VHT by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0	3,903	12,354	22,405	52,822	6,474	14,787	3,903	116,648
Expressways	0	0	894	4,148	11,109	7,856	10,293	3,555	37,855
Ramps	0	2,140	4,227	10,199	19,567	655	7,918	902	45,608
Arterials	5,277	10,406	27,301	25,808	50,626	7,481	28,412	9,153	164,464
Collectors	678	2,252	7,623	16,674	33,637	472	12,413	1,007	74,756
Total	5,955	18,701	52,399	79,234	167,761	22,938	73,823	18,520	439,331

Table 2-11: Percent Change from 2035 Baseline to 2035 LOS D Scenario VHT by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0%	3%	-24%	-11%	-6%	-6%	-9%	-17%	-10%
Expressways	0%	0%	3%	-21%	6%	-15%	-5%	13%	-5%
Ramps	0%	30%	65%	0%	14%	0%	5%	4%	12%
Arterials	-9%	-18%	-5%	-9%	-8%	-1%	-6%	-2%	-8%
Collectors	-6%	-14%	5%	-4%	-1%	-31%	-1%	0%	-2%
Total	-9%	-10%	-6%	-8%	-3%	-8%	-5%	-3%	-5%

Table 2-12: 2035 LOS D Scenario VHD by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0	941	2,052	2,162	6,551	739	1,825	275	14,545
Expressways	0	0	92	501	1,483	992	965	310	4,343
Ramps	0	1,552	3,055	5,530	10,863	75	3,911	531	25,517
Arterials	547	1,220	3,376	4,890	5,818	912	3,065	752	20,580
Collectors	123	986	1,988	3,617	6,955	32	2,342	133	16,176
Total	670	4,699	10,563	16,700	31,670	2,750	12,108	2,001	81,161

Table 2-13: Percent Change from 2035 Baseline to 2035 LOS D Scenario VHD by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0%	-27%	-74%	-66%	-49%	-30%	-45%	-72%	-57%
Expressways	0%	0%	-58%	-78%	-51%	-67%	-59%	-40%	-62%
Ramps	0%	44%	98%	-1%	25%	-7%	-1%	9%	19%
Arterials	-22%	-53%	-17%	-39%	-52%	-8%	-48%	-10%	-41%
Collectors	-13%	-24%	19%	-23%	0%	-71%	-4%	2%	-7%
Total	-20%	-25%	-32%	-38%	-27%	-47%	-33%	-32%	-32%

Figure 2-2: 2035 LOS D Scenario AM 2-Hour Static Assignment Auto Time to Downtown

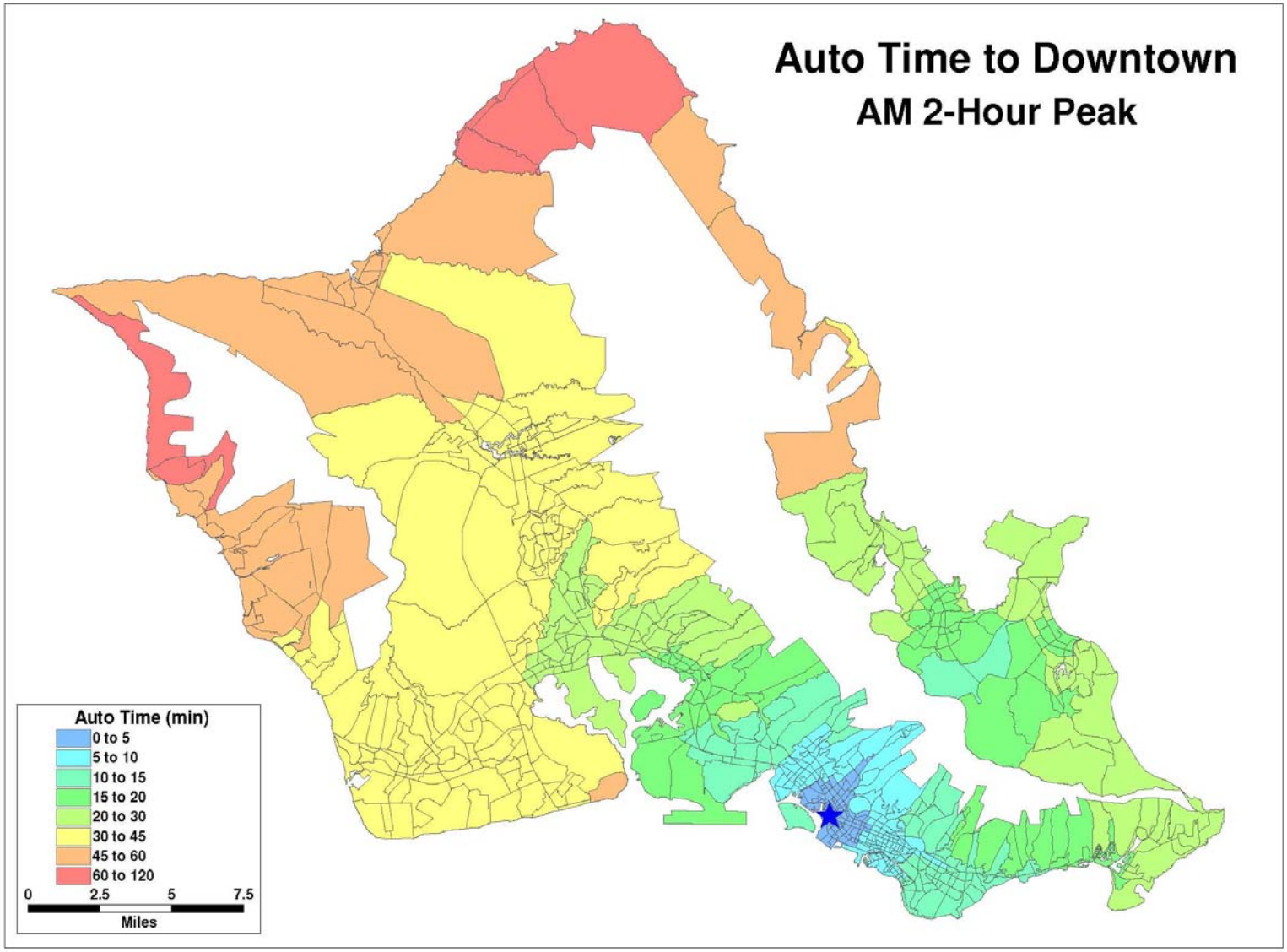


Figure 2-3: Difference in AM 2-Hour Static Assignment Auto Time to Downtown – LOS D vs. Baseline

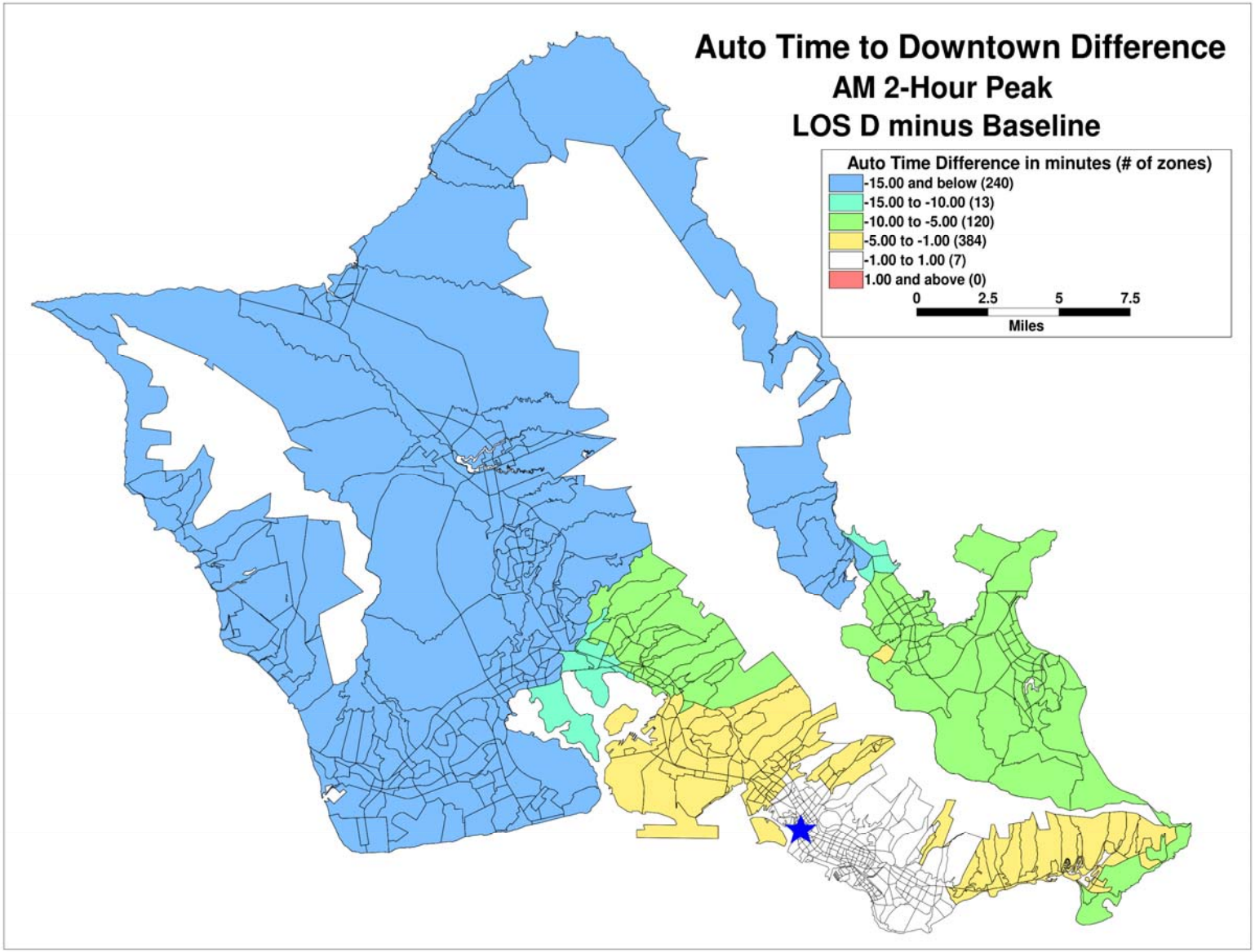


Figure 2-4: Difference in AM 2-Hour Static Assignment Auto Time to Airport – LOS D vs. Baseline

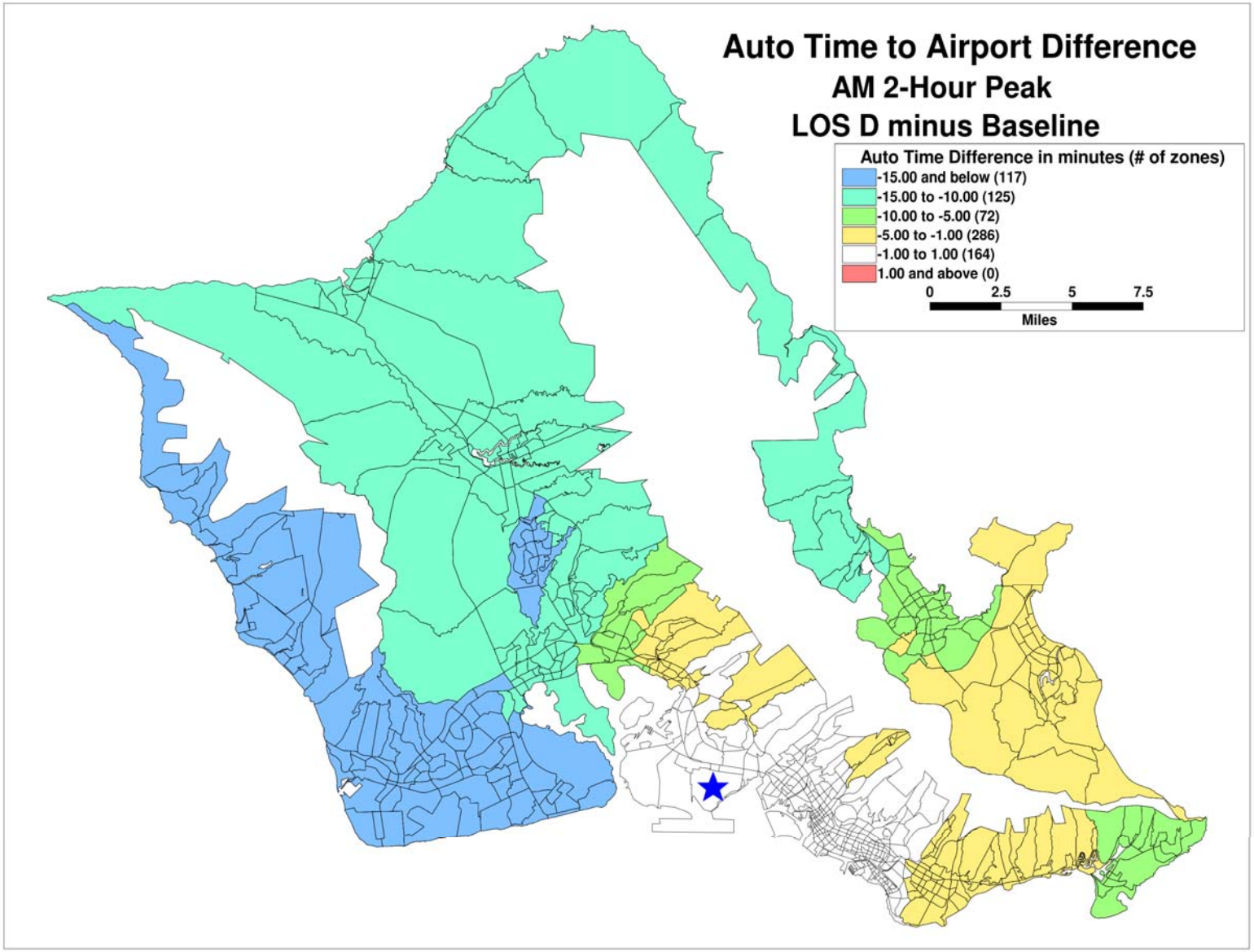


Figure 2-5: Difference in AM 2-Hour Static Assignment Auto Time to Ewa – LOS D vs. Baseline

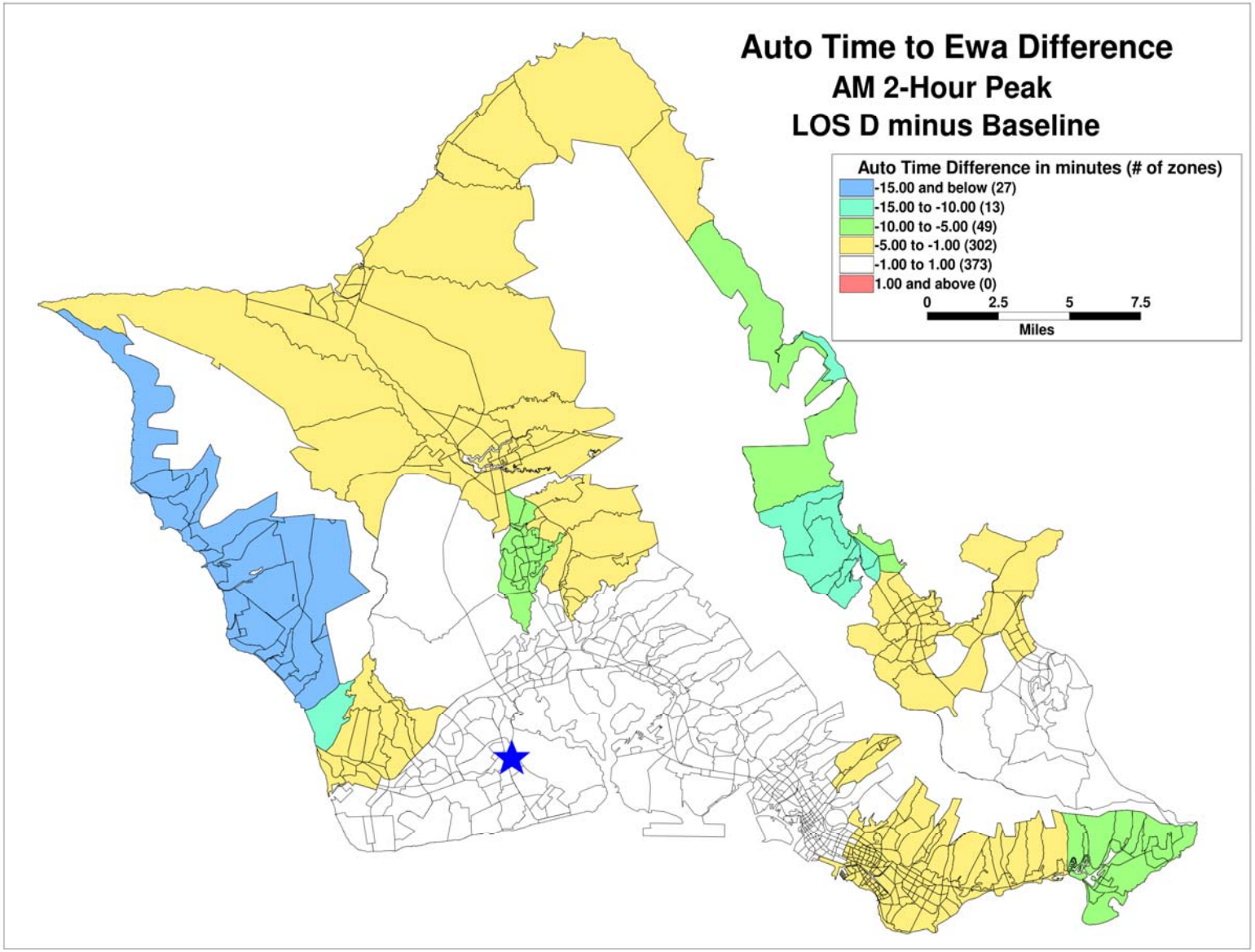


Figure 2-6: Difference in AM 2-Hour Static Assignment Auto Time to Kapolei – LOS D vs. Baseline

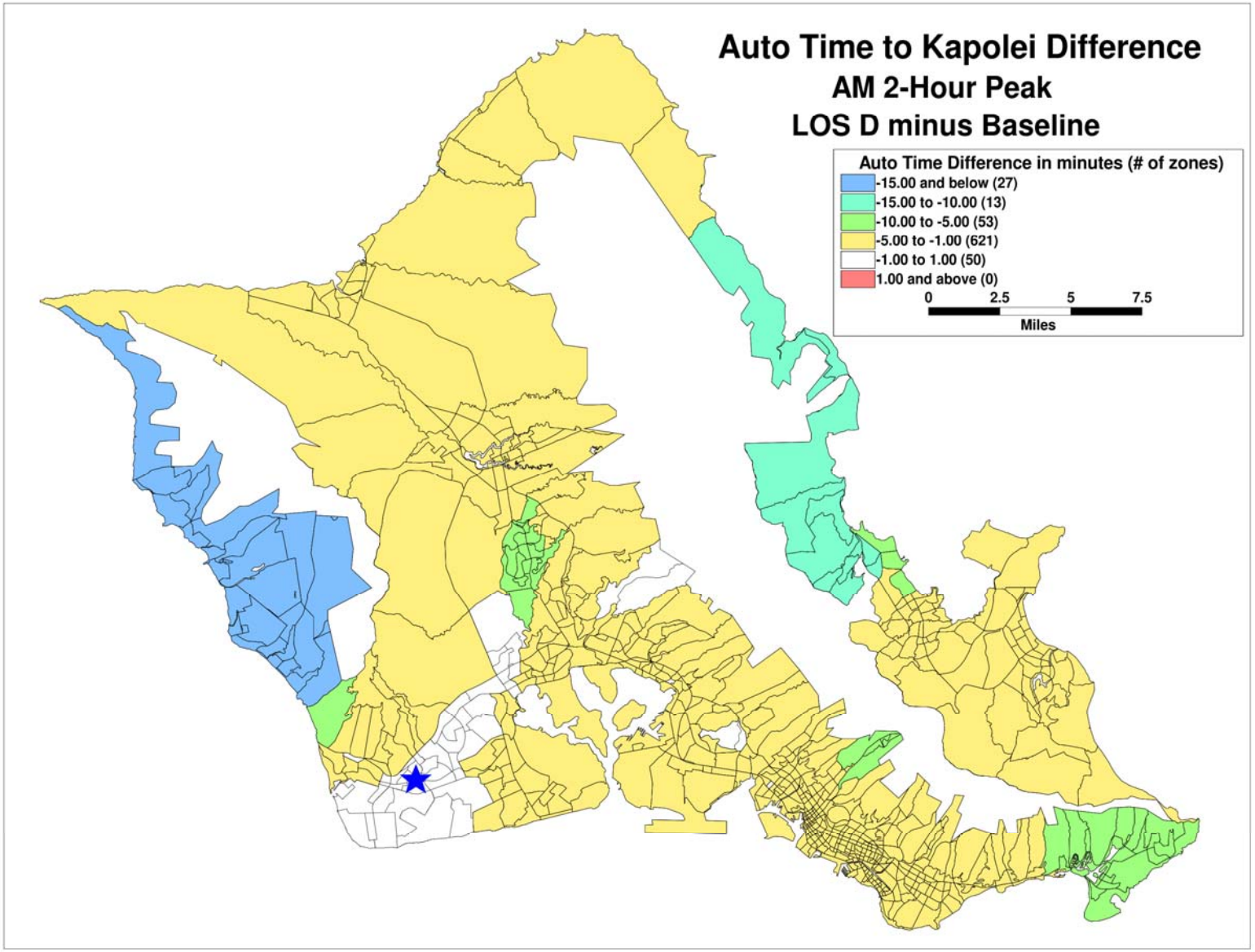


Figure 2-7: Difference in AM 2-Hour Static Assignment Auto Time to Mililani – LOS D vs. Baseline

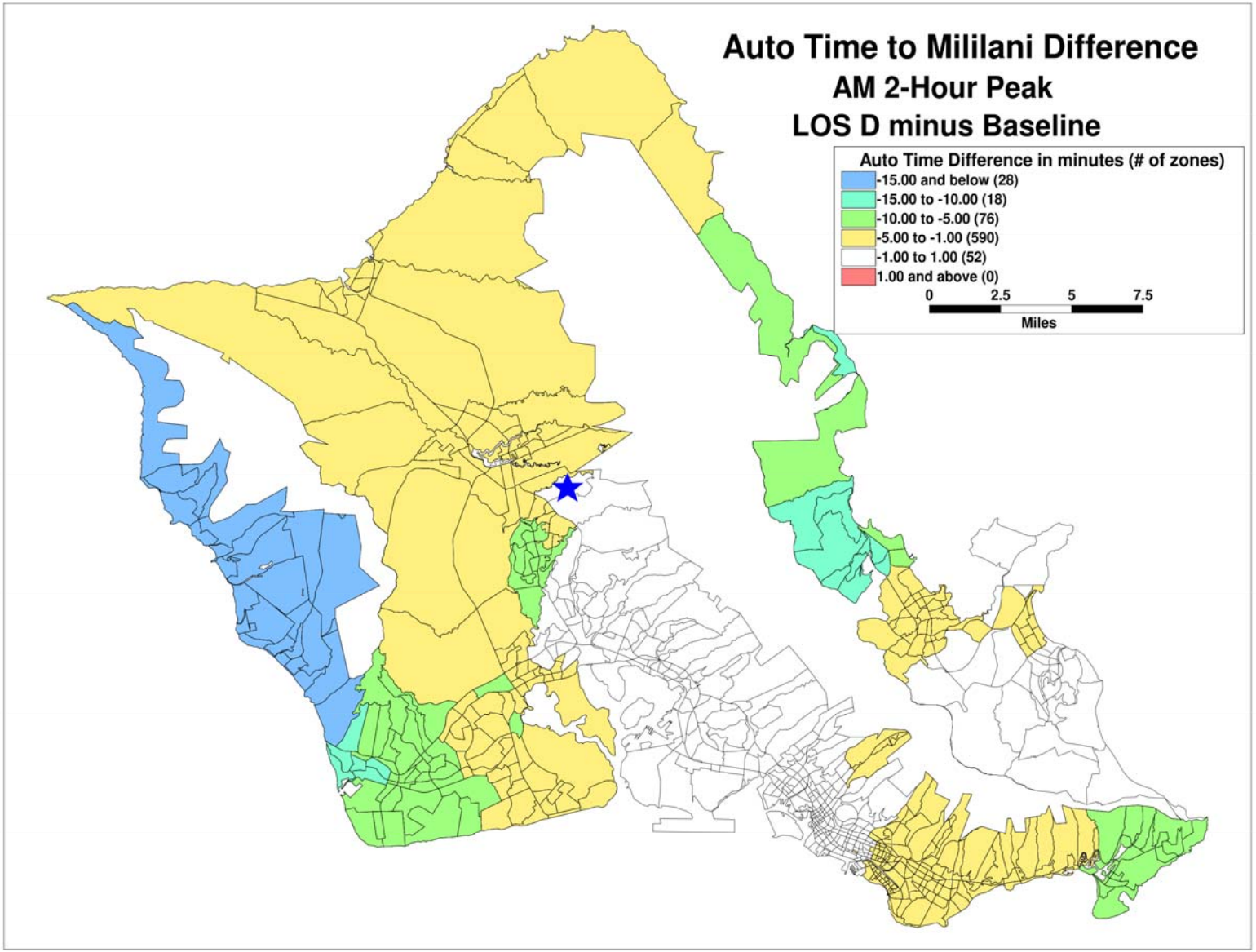


Figure 2-8: Difference in AM 2-Hour Static Assignment Auto Time to Waikiki – LOS D vs. Baseline

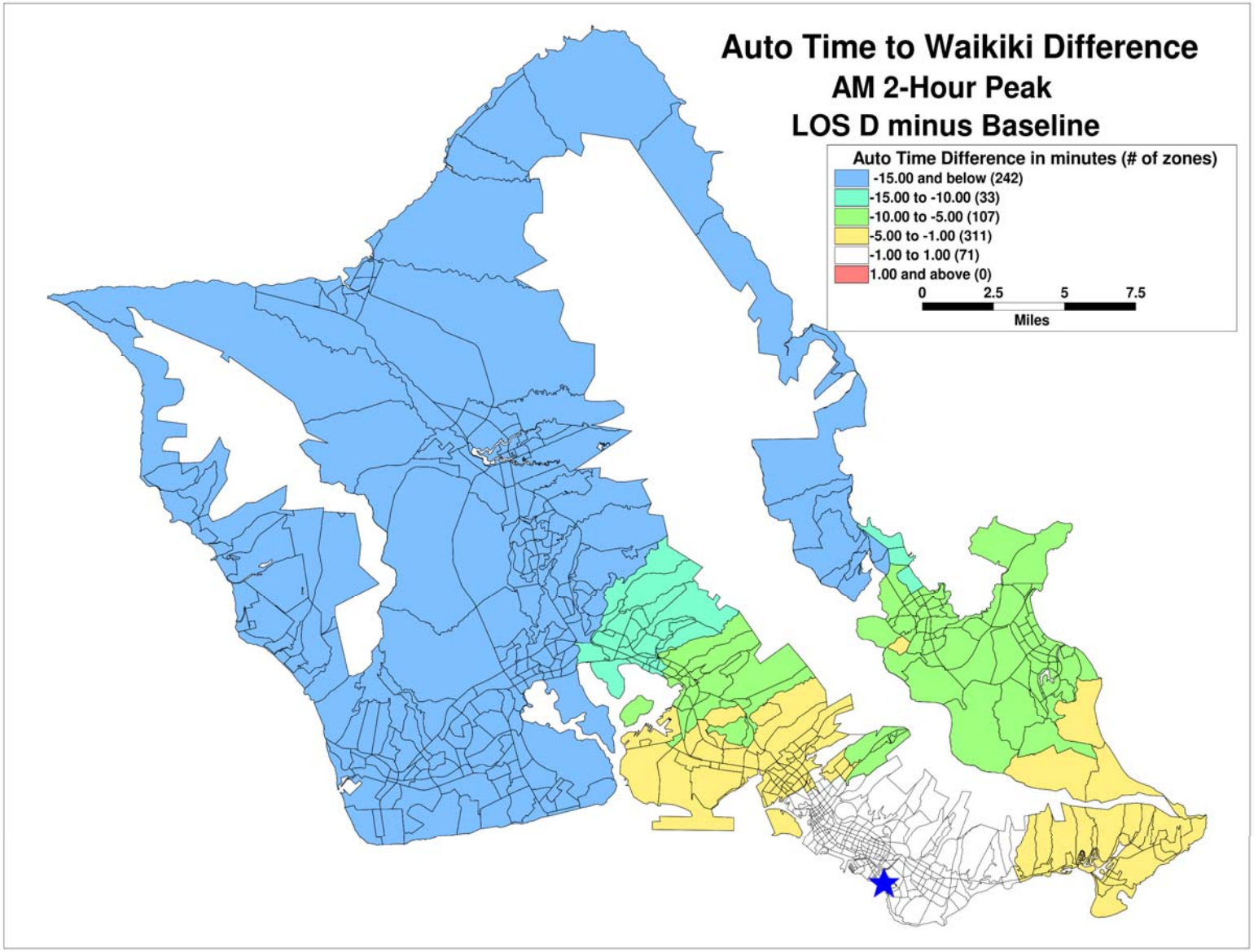


Figure 2-9: 2035 LOS D Scenario Static Assignment AM 2-Hour Level-of-Service and Auto Volumes – Oahu

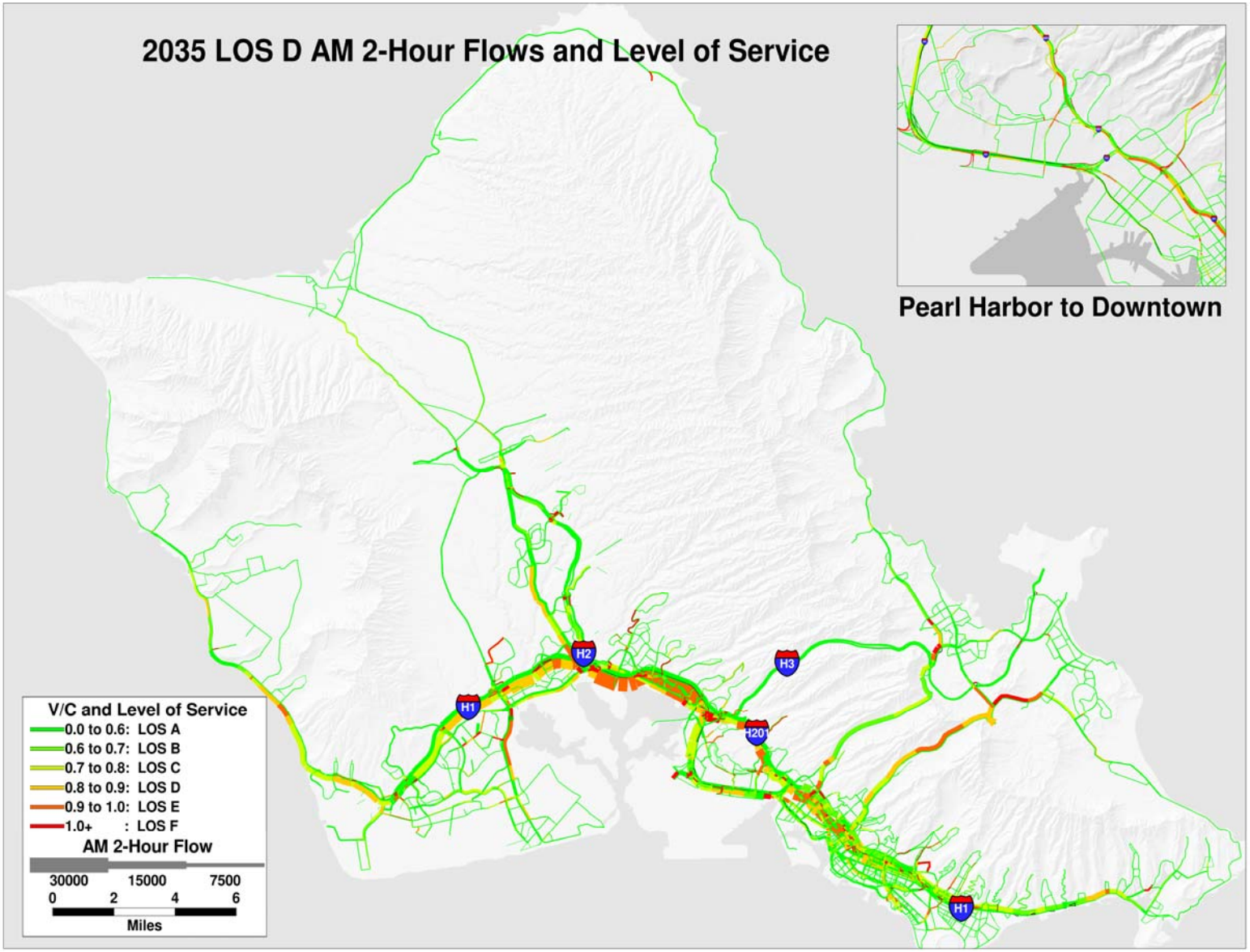


Figure 2-10: 2035 LOS D Scenario Static Assignment AM 2-Hour Level-of-Service and Auto Volumes – Kapolei and Ewa Area

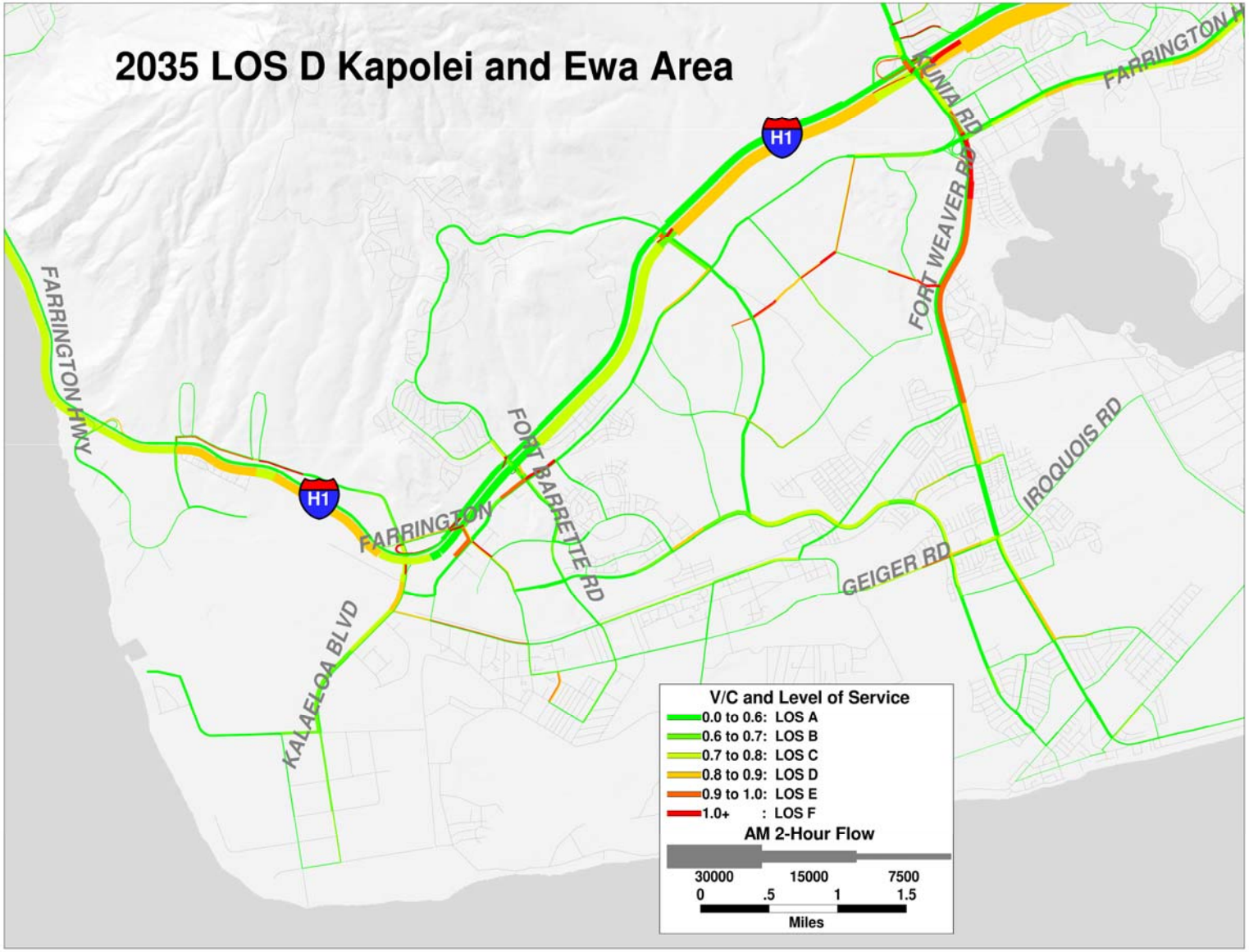


Figure 2-11: 2035 LOS D Scenario Static Assignment AM 2-Hour Level-of-Service and Auto Volumes – H1/H2 Merge

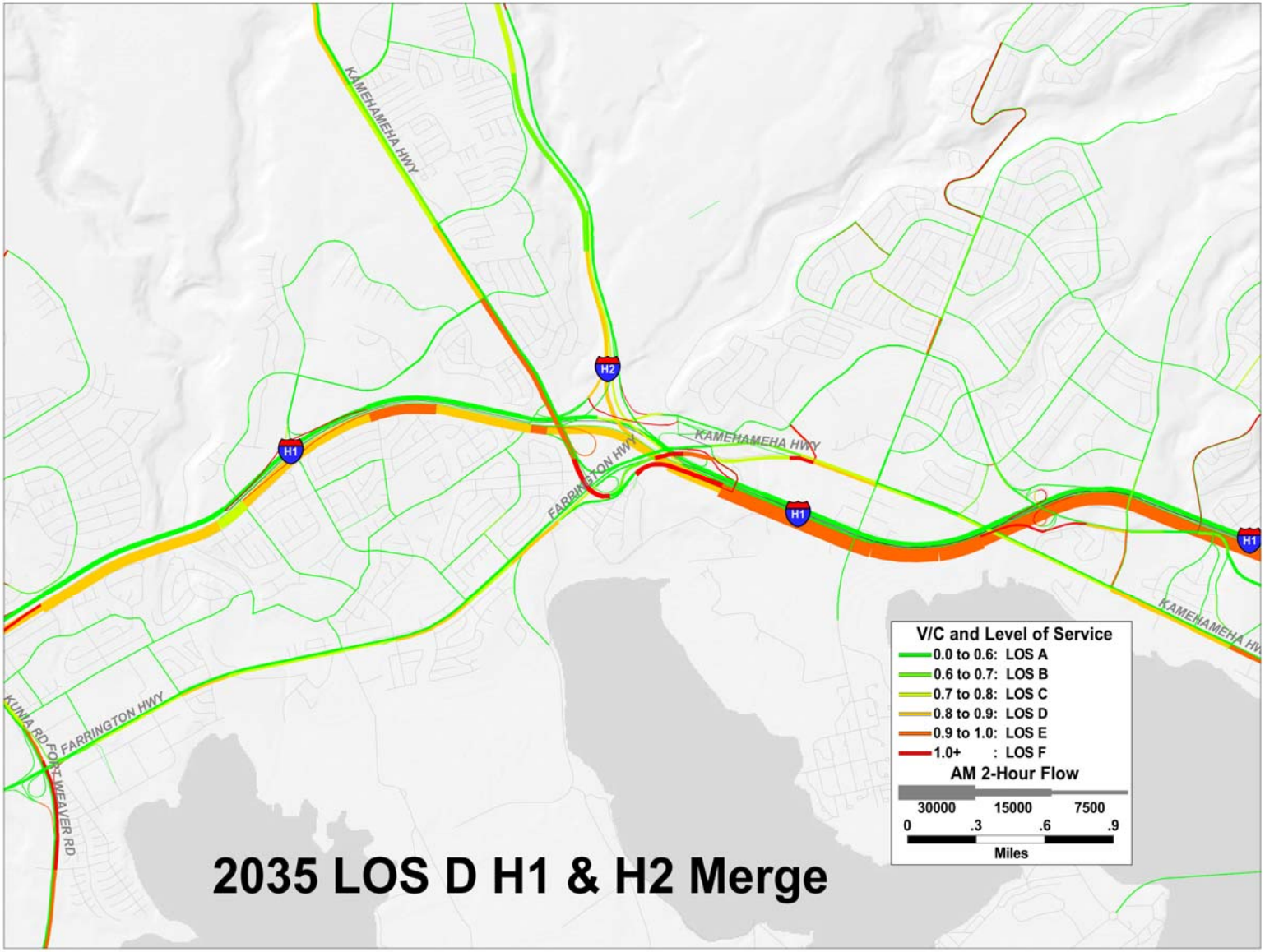


Figure 2-12: 2035 LOS D Static Assignment AM 2-Hour Level-of-Service and Auto Volumes – H1/H201/H3 Merge

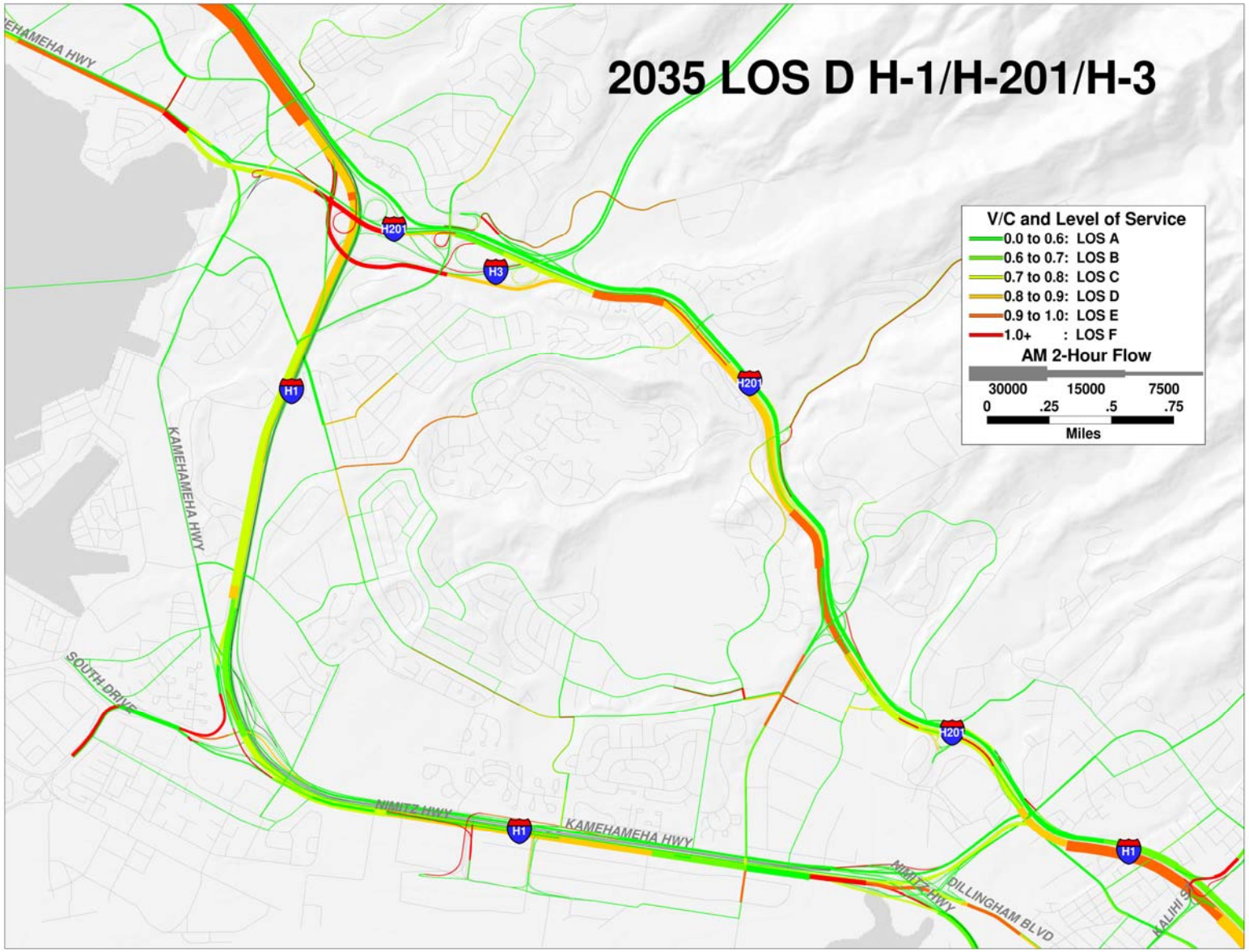


Figure 2-13: 2035 LOS D Static Assignment AM 2-Hour Level-of-Service and Auto Volumes – Downtown

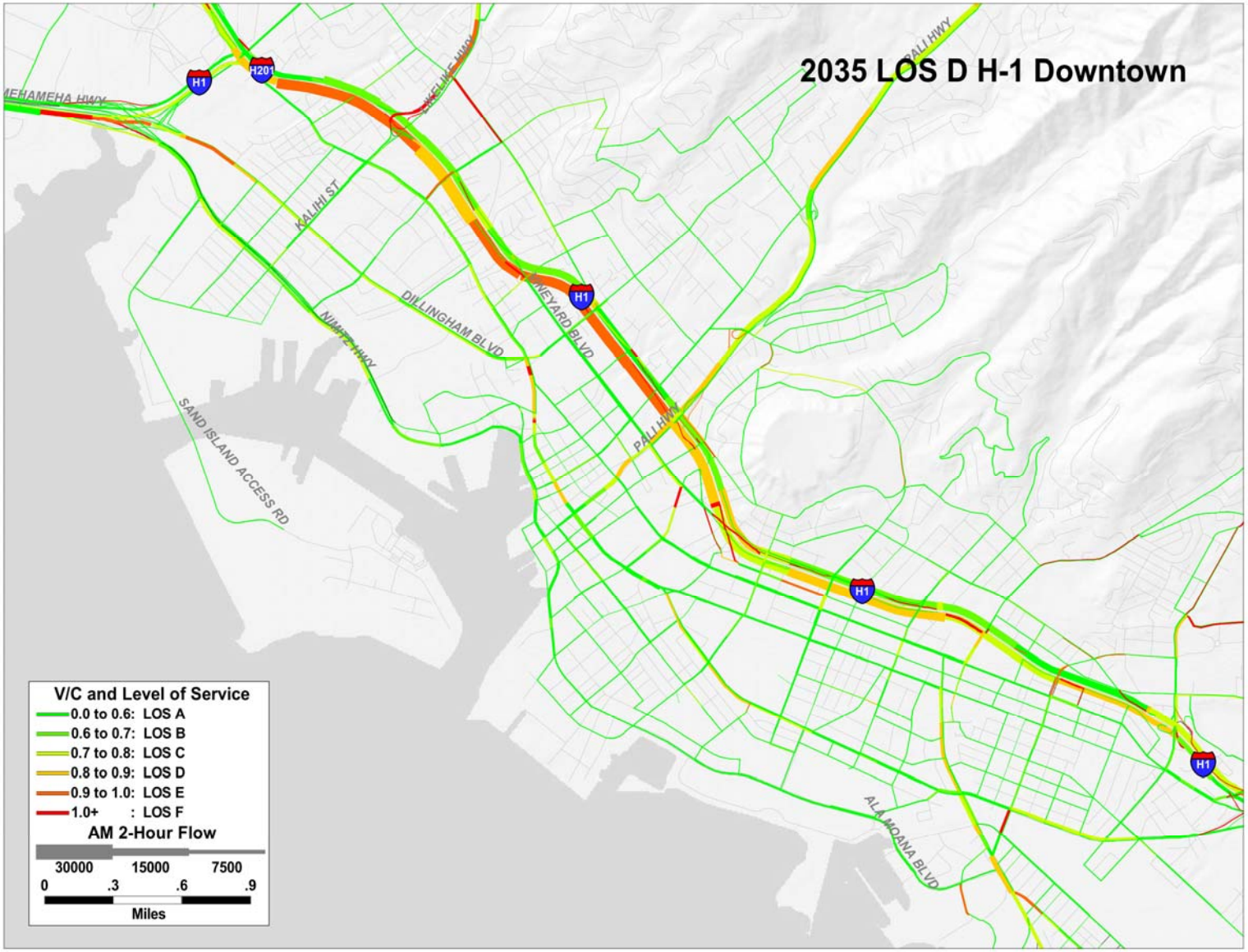


Figure 2-14: Difference in AM 2-Hour Flows – LOS D Scenario vs. Baseline

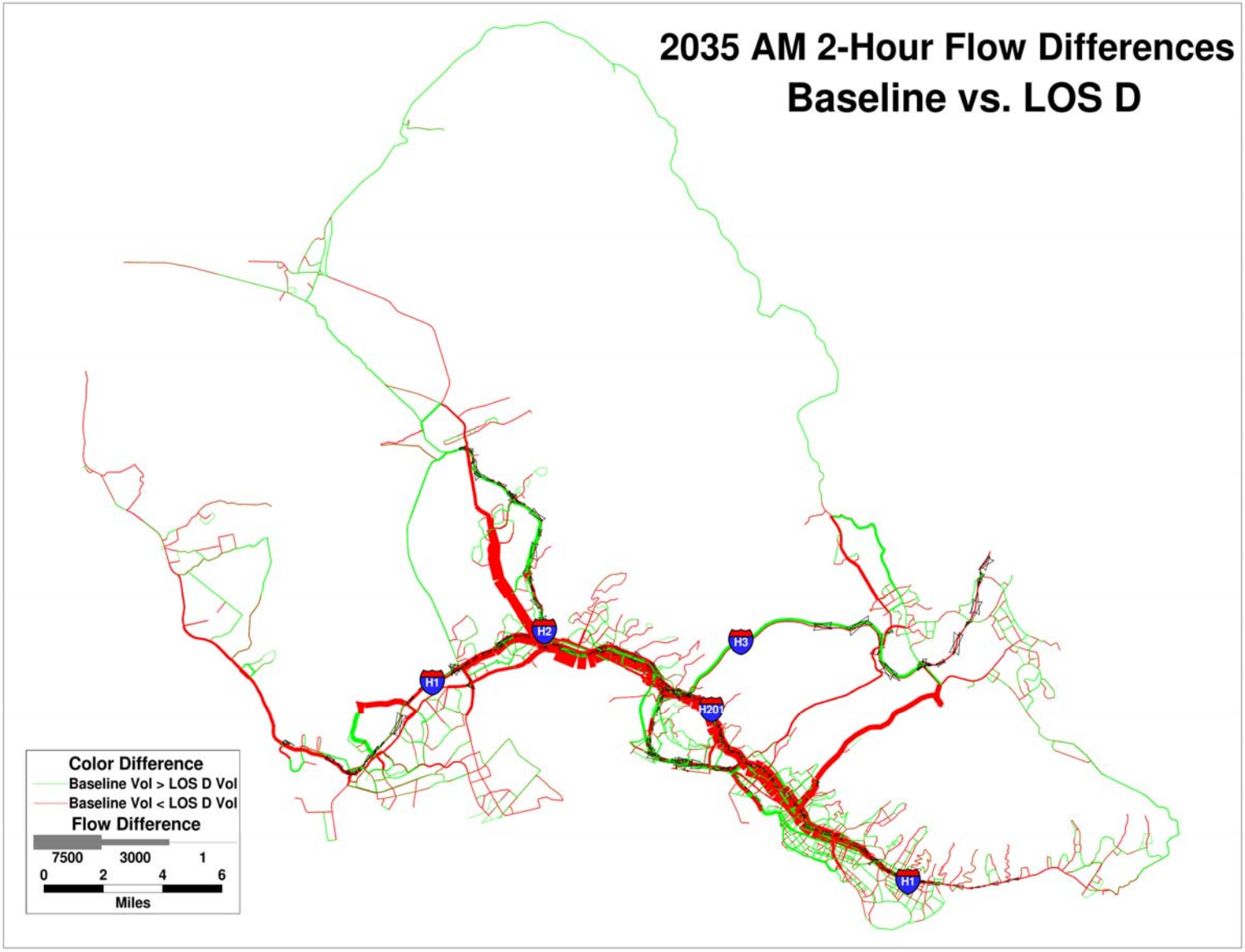
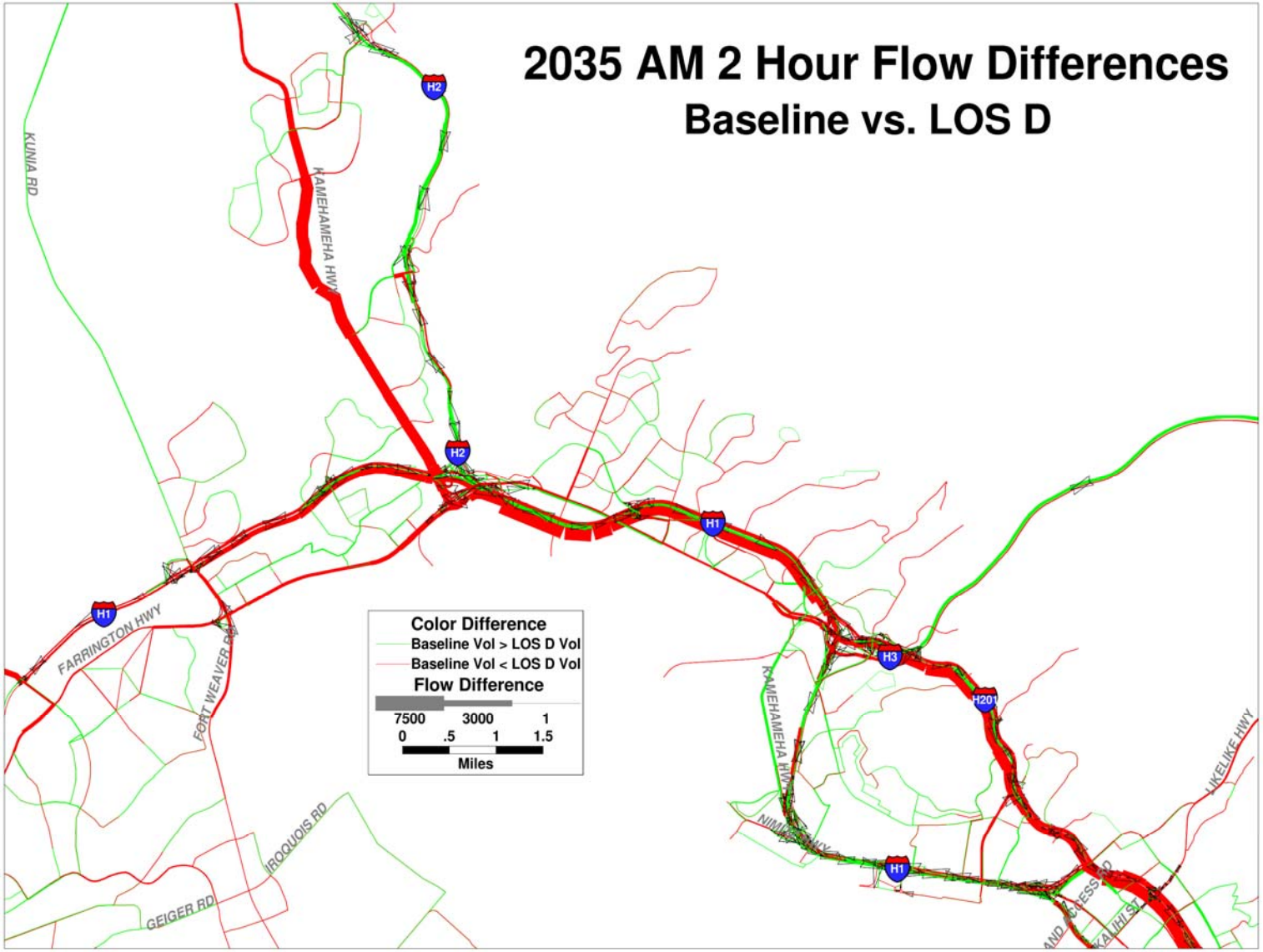


Figure 2-15: Difference in AM 2-Hour Flows – LOS D Scenario vs. Baseline – H1/H2 Merge



2.3.2 LOS D Scenario Transit Assignment

Table 2-14 shows 2035 LOS D scenario transit boardings by period (peak versus off-peak) and mode for residents, visitors, and ground access air passengers. Table 2-15 shows the percent change in transit boardings from 2035 Baseline scenario to the LOS D scenario. Total boardings decrease by one percent, with approximately 25 percent of total system-wide boardings on fixed-guideway transit.

Figure 2-16 through Figure 2-21 show AM peak period transit travel times to key destinations for the 2035 LOS D scenario. Figure 2-22 shows the difference in transit travel time to Downtown between the LOS D and Baseline scenarios. These figures show that the transit times in the fixed guideway corridor are not different as these times are not dependent on the roadway travel times. The difference in travel times are small compared to difference in the auto travel times to Downtown. This is one of the reasons why there was a shift from the transit mode to the auto mode.

Table 2-14: 2035 LOS D Scenario Transit Boardings by Period and Mode

	Boardings By Mode					
Period/Mode	Local	Express	Limited	Guideway	Ferry	Total
Peak	173,667	7,902	7,467	69,973	0	259,009
Off-Peak	92,807	0	4,716	26,709	0	124,232
Total	266,474	7,902	12,183	96,682	0	383,241

Table 2-15: Percent Change in Transit Boardings, Baseline to LOS D Scenario

	Boardings By Mode					
Period/Mode	Local	Express	Limited	Guideway	Ferry	Total
Peak	0%	5%	10%	-4%	0%	-1%
Off-Peak	-1%	0%	-7%	-3%	0%	-1%
Total	0%	5%	2%	-4%	0%	-1%

Figure 2-16: 2035 LOS D Scenario AM Two-Hour Transit Time to Downtown

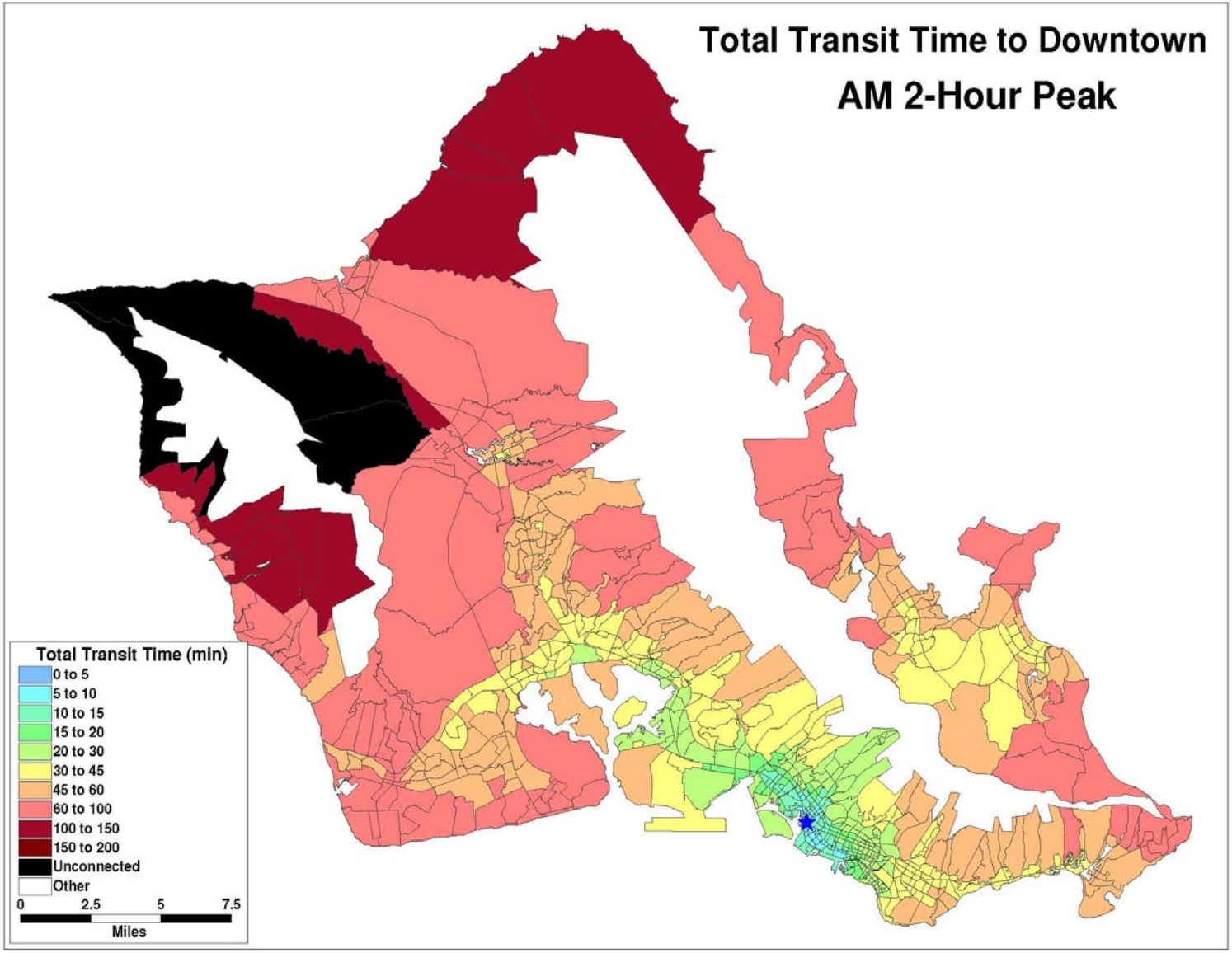


Figure 2-17: 2035 LOS D Scenario AM Two-Hour Transit Time to Airport

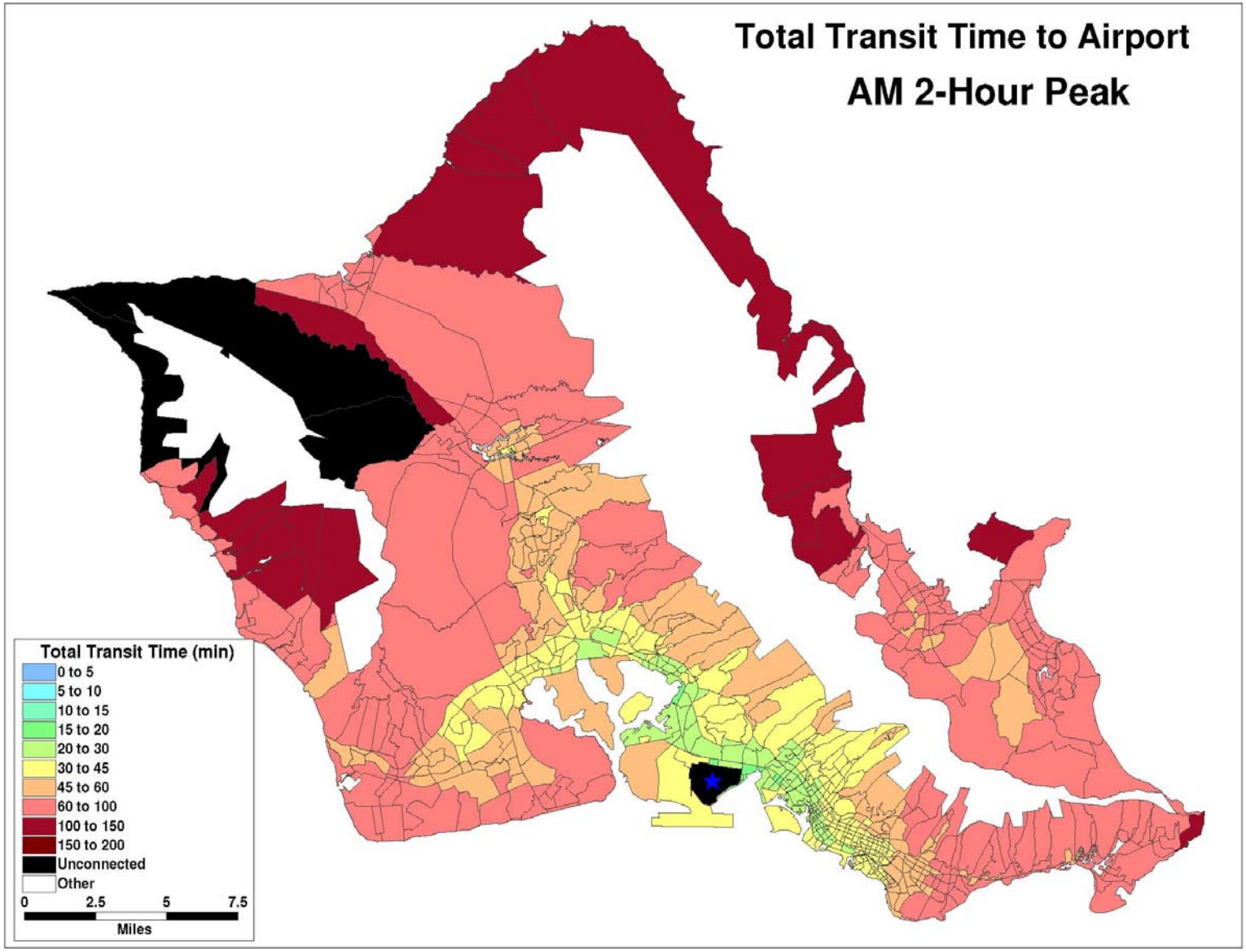


Figure 2-18: 2035 LOS D AM Two-Hour Transit Time to Ewa

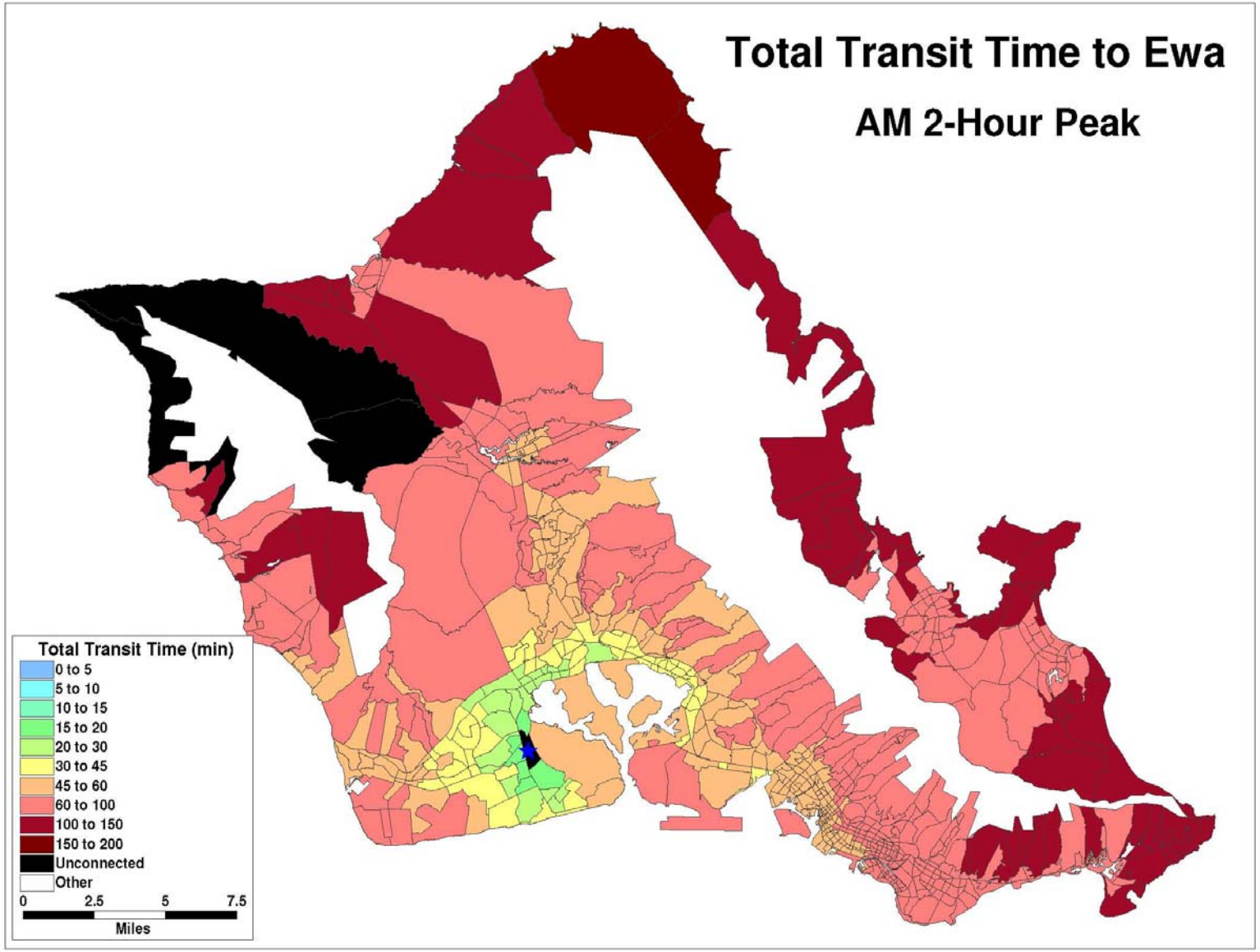


Figure 2-19: 2035 LOS D Scenario AM Two-Hour Transit Time to Kapolei

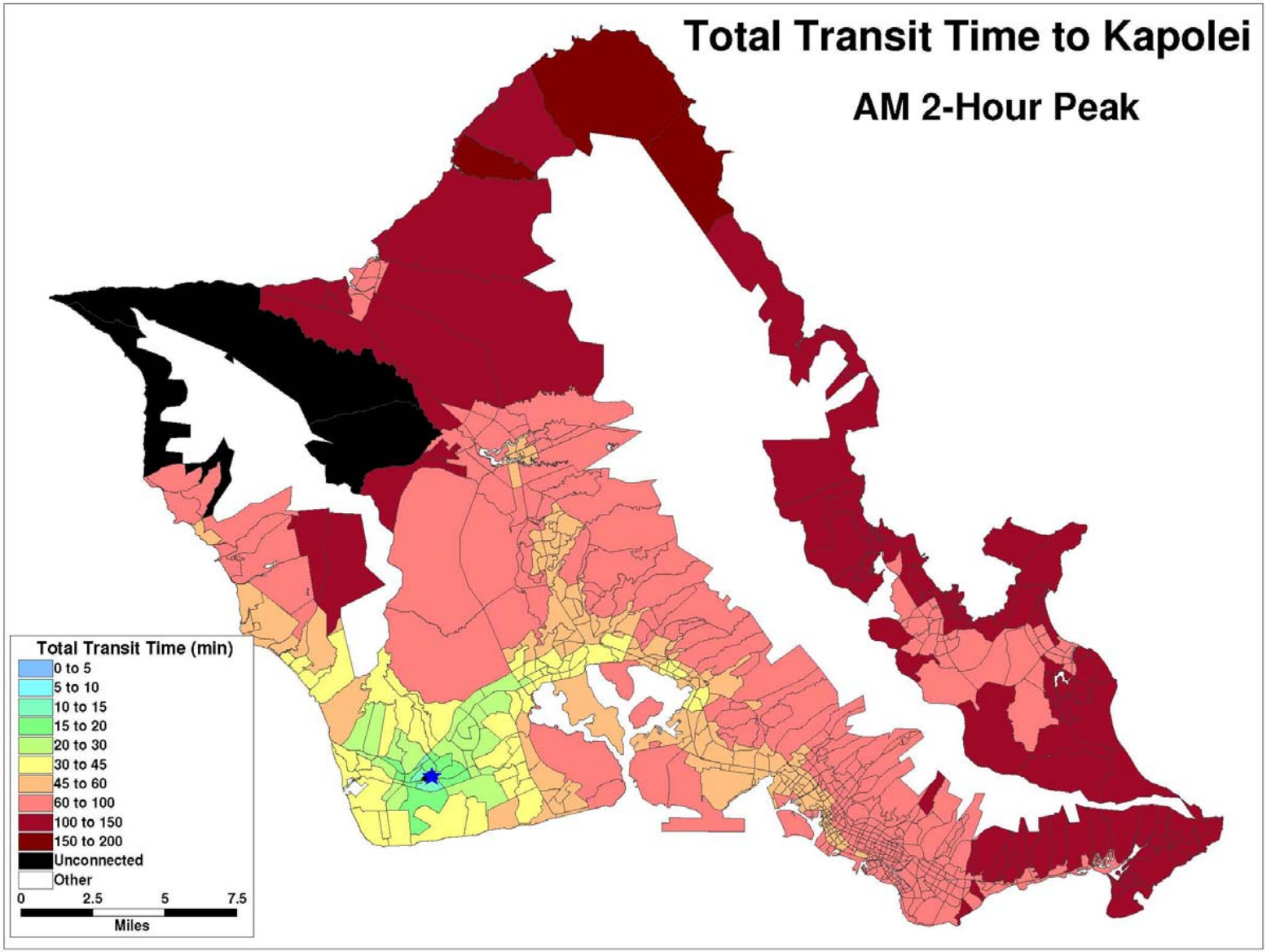


Figure 2-20: 2035 LOS D Scenario AM Two-Hour Transit Time to Mililani

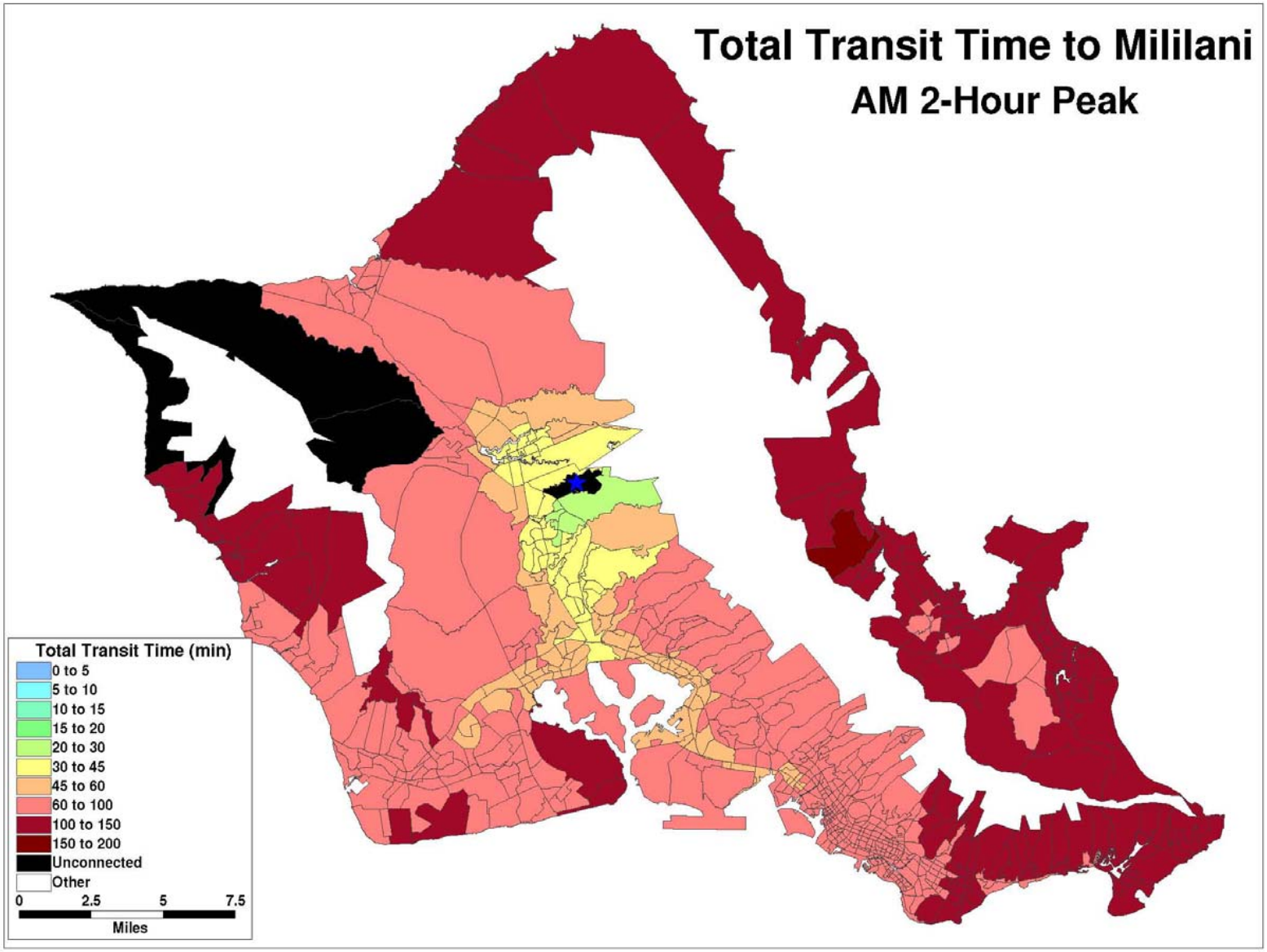


Figure 2-21: 2035 LOS D Scenario AM Two-Hour Transit Time to Waikiki

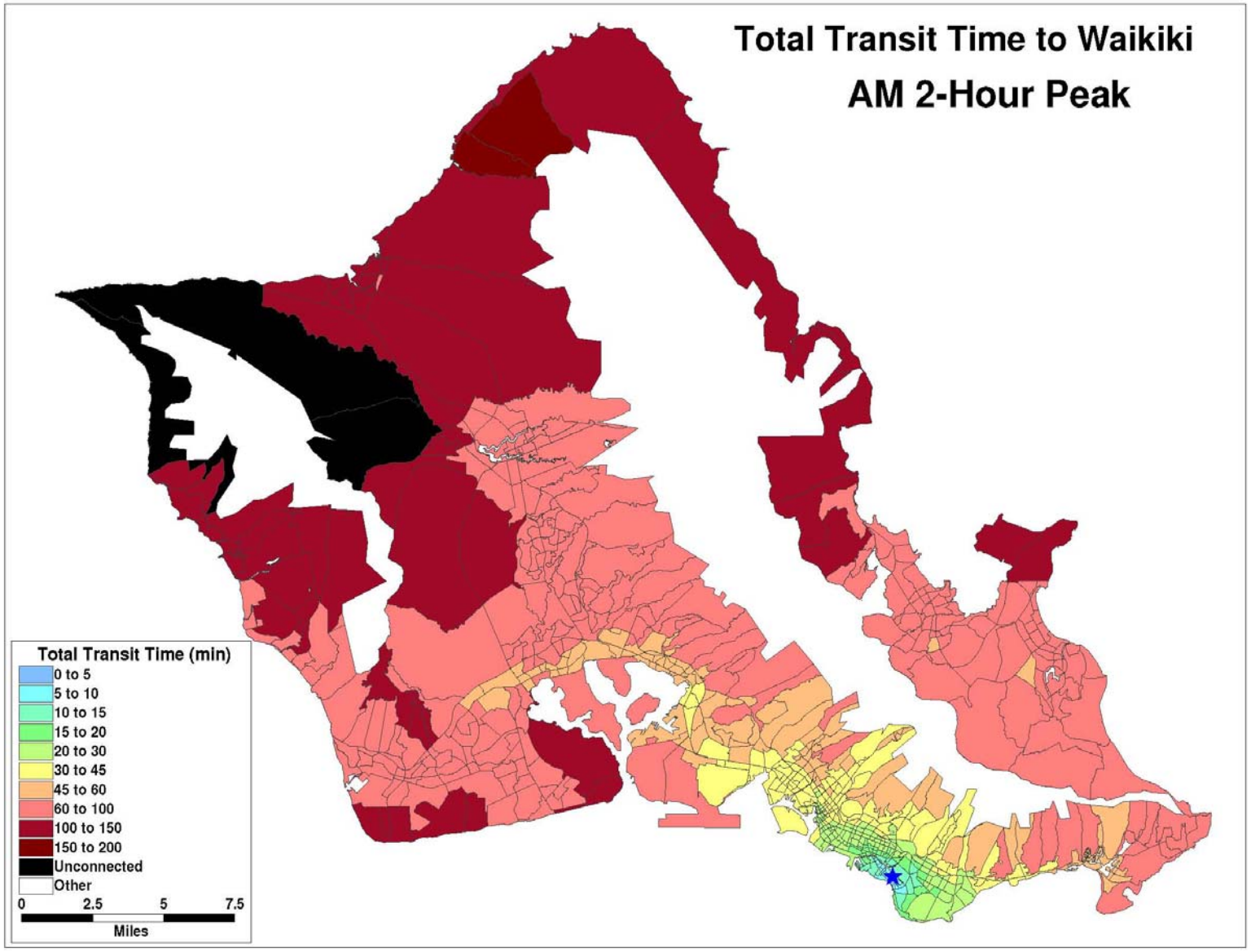
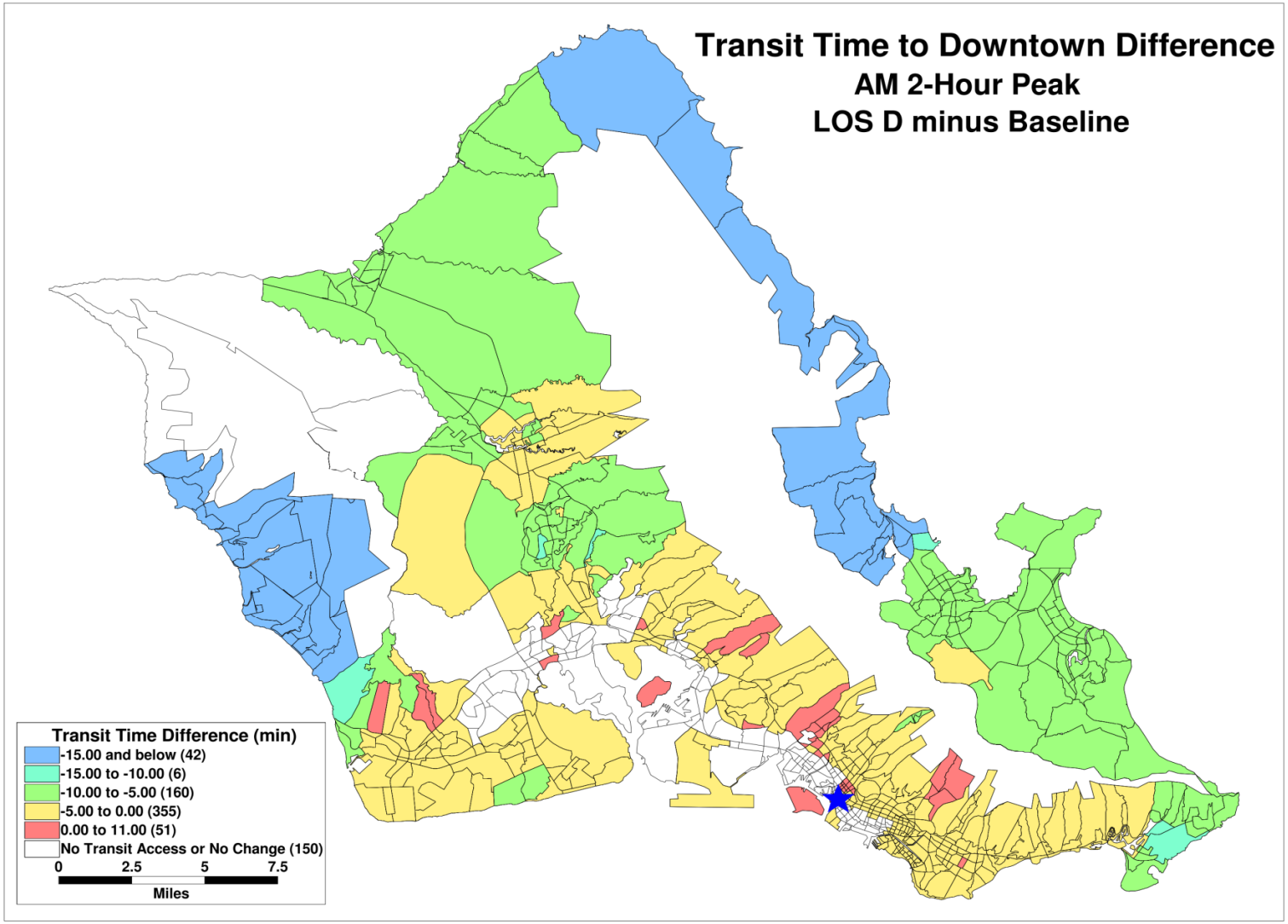


Figure 2-22: Difference in AM 2-Hour Transit Time to Downtown – LOS D vs. Baseline



2.4 Summary of Financial Assessment

Earlier in this chapter, it was stated that 235 lane miles of roadway was added to the Baseline network to achieve LOS D conditions for at least a substantial portion of the island. Based on a per-lane-mile factor of $8.35 million[4] per mile, the rough order of magnitude estimate for constructing these additional lane miles would be $1,954 billion.

It should be noted that the above cost estimate for the lanes miles being analyzed in this particular analysis are very rough and should be considered in that light. More detailed corridor analyses and cost estimation work would be required to develop a clearer definition of the projects and their cost for implementation.

2.5 Summary of LOS D Scenario Findings

These are the key findings of the LOS D scenario:

- The addition of capacity to the major roadways (235additional lane miles over the Baseline) had significant impacts on trip distribution, mode choice, and route choice.
- Auto travel times to key destinations improved compared to the Baseline.
- The additional capacity resulted in additional auto demand due to improved travel times on the freeways, expressways, and arterials.
- VMT increased by five percent while VHT decreased by the same amount. VHD decreased significantly, by 32 percent, due to reduction in congested conditions.
- Even with significant capacity added (235 additional lane miles over the Baseline), some major roadways were still operating at LOS E and F. This shows that it is practically infeasible to add enough capacity to completely eliminate congestion on Oahu's roadways.
- Using a rough order of magnitude cost estimation approach, it would take over $1.9 billion (2010 dollars) to widen the island's roadways by 235 lane miles. The exorbitant costs associated with adding this amount of infrastructure makes the option financially infeasible and would likely lead to severe environmental and neighborhood impacts throughout the island.

[4] In 2010 dollars. This factor was based on a Hawaii Department of Transportation costing analysis and adjusted for inflation and project contingency.

3 Managed Lane Scenario

This chapter provides the results of the Managed Lane sensitivity scenario.

3.1 Managed Lane Scenario Definition

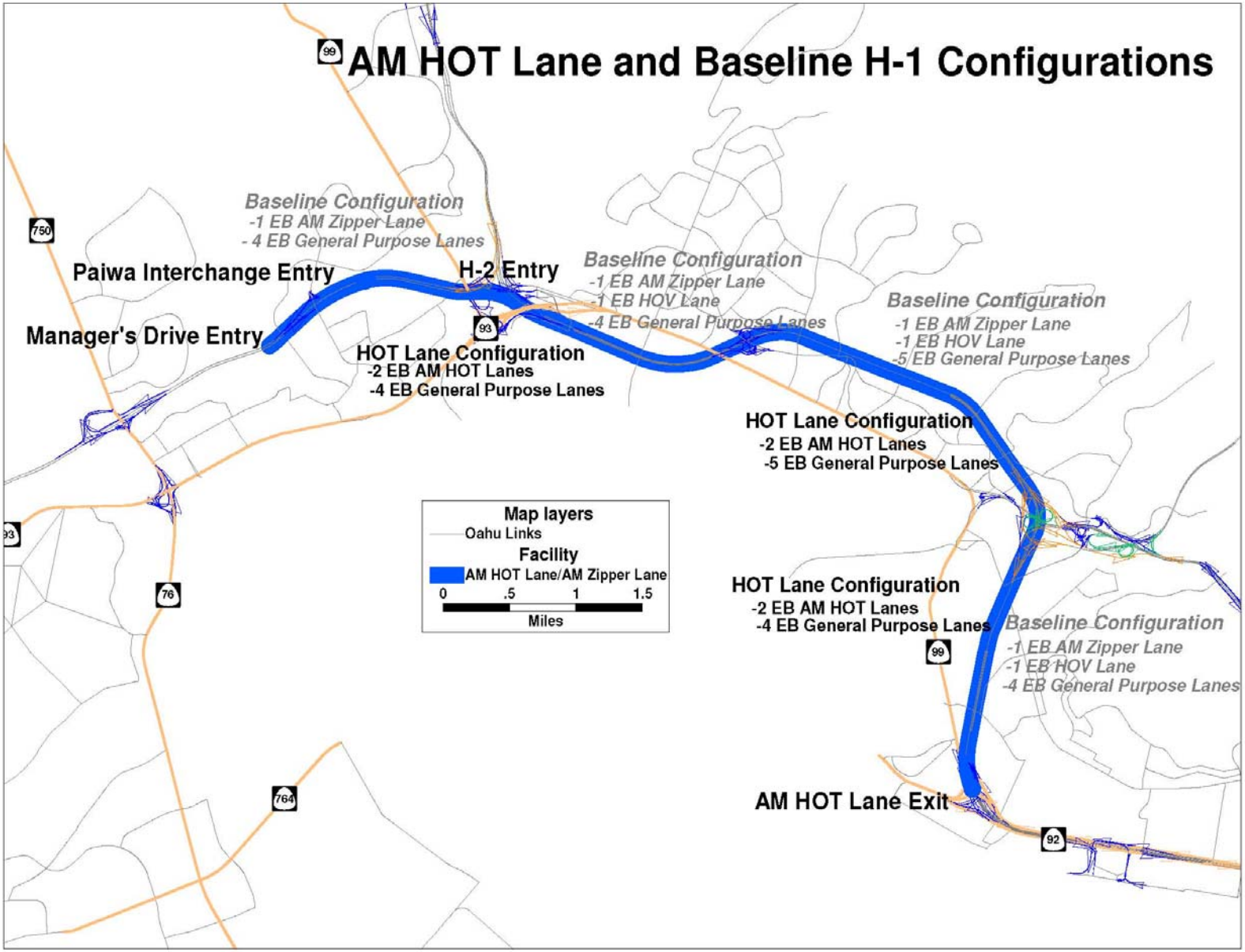
In the Managed Lane scenario, High-Occupancy Vehicle (HOV) lanes in the H-1 Corridor between H-2 and Pearl Harbor were converted to High-Occupancy Toll (HOT) lanes, where vehicles with three-or-more persons (HOV3+) are allowed to use the facility free of charge while single occupant vehicles and vehicles with two persons (HOV2) are charged a fee for using the lanes in the AM peak period. Access to these lanes would be provided at the end points of the facility (i.e., at the current AM Zipper lane entrances before the H-1/H-2 merge, and the Waiawa and Pearl Harbor interchanges). No other access or egress would be provided between those two locations. During operational hours, transit vehicles and HOV3+ vehicles would be allowed to use the lanes free of charge. In addition, vehicles with fewer than three occupants would be allowed to enter the managed lanes by paying a toll.

Table 3-1 shows that in 2035, there will be sufficient HOV2 and HOV3+ demand to consume capacity in the AM zipper lane and the HOV2+ lane at LOS D conditions. Therefore, in this scenario, both the AM zipper lane and the existing HOV 2+ lane would be tolled in order to provide enough capacity for single-occupant vehicles. Figure 3-1 displays the managed lane configuration.

Table 3-1: 2035 Baseline AM 2-Hour Volumes on Pearl City Viaduct

Facility	SOV	HOV 2	HOV 3+	Truck	Total	v/c
H-1 General Purpose Lanes	18,957	602	90	744	20,393	1.16
H-1 HOV 2+ Lane	n/a	4,684	520	n/a	5,204	1.18
H-1 Zipper (3+) Lane	0	0	3,476	0	3,476	0.79

Figure 3-1: Managed Lane Entry and Exit Points and Lane Configurations



3.2 Toll Analysis

Initial tolls were set at $0.80 a mile for single-occupant vehicles (SOV), and $0.40 a mile for two-occupant vehicles. Figure 3-2 shows toll-eligible vehicle trips by time savings. The figure shows that that nearly 37,000 SOVs and 11,000 two-occupant vehicles would save 16 minutes traveling on the toll facility; in total, approximately 45,000 SOV s and 25,000 HOV2 vehicles could pay the toll and use the facility. Therefore, a higher toll is necessary to manage demand and ensure LOS D or better conditions.

Figure 3-2: Number of Toll Eligible Trips by Time Savings and Vehicle Occupancy for the Peak Period for the Initial Toll Regime

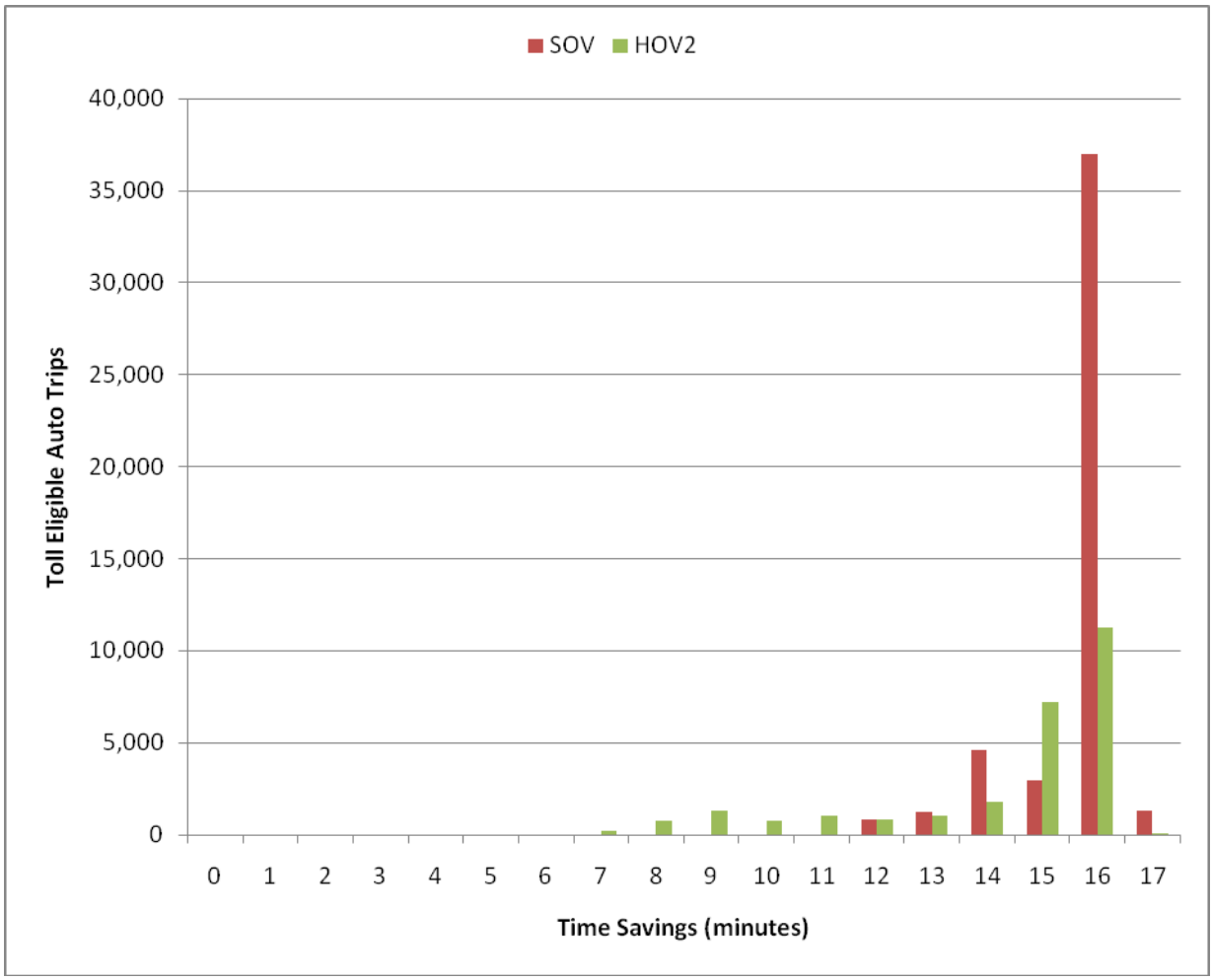


Figure 3-3 shows SOV and HOV toll demand curves by travel time saved for the $0.80-mile/$0.40-mile toll regime. The figure shows that at a toll time savings of 15 minutes, over 20 percent of SOV toll-eligible trips were estimated to pay the $0.80 a

mile toll rate, while about 45% of HOV 2-eligible trips estimated to pay the $0.40 a mile toll rate. However, this toll regime resulted in demand that would be higher than an LOS D capacity on the managed lanes, as shown in Table 3-2. Therefore, a higher toll is necessary to manage demand and ensure LOS D or better conditions.

Figure 3-3: Toll Demand Curves for Initial Toll Regime

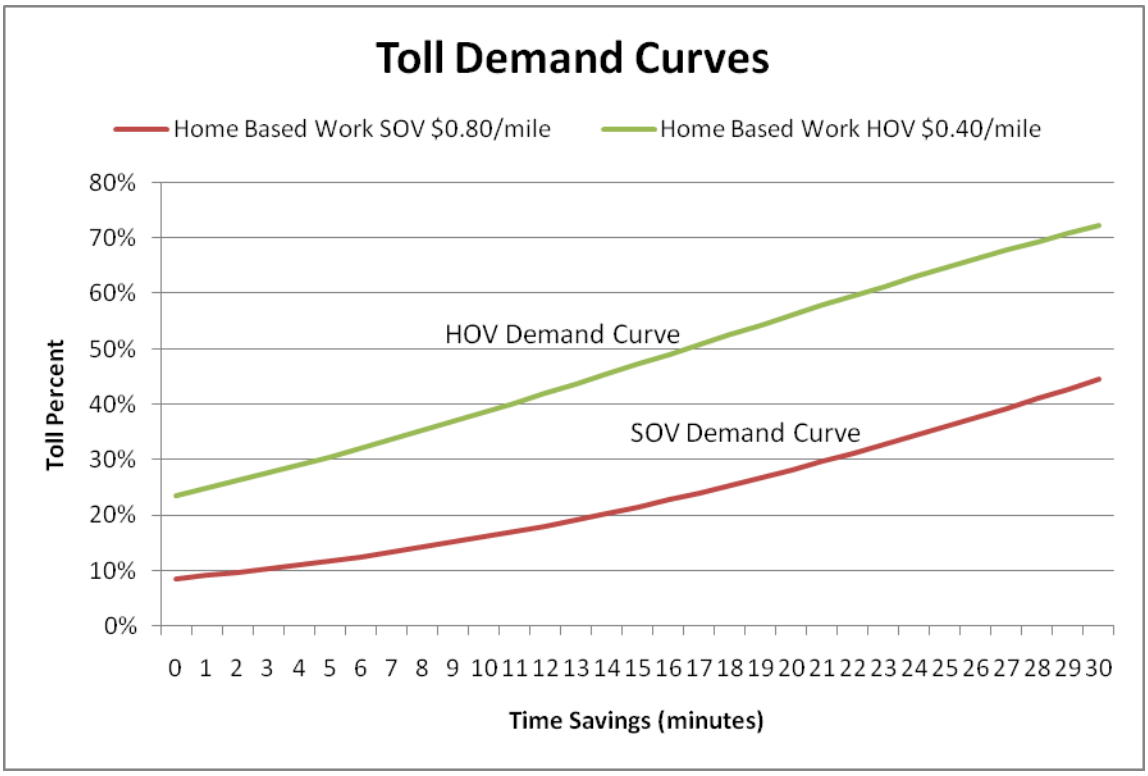


Table 3-2: 2035 AM 2-Hour Volumes on Pearl City Viaduct for Managed Lane with Initial Toll Regime ($0.80/mile SOV, $0.40/mile HOV2)

Facility	SOV Toll	HOV2 Toll	SOV Free	HOV 2 Free	HOV 3 Free	Truck Free	Total	v/c
H-1 General Purpose Lanes	0	0	16,187	3,442	512	753	20,894	1.19
HOT Lanes	2,962	1,692	0	0	3,356	0	8,010	0.91
Total HOT Demand	2,962	1,692	n/a	n/a	3,868	n/a	8,522	*0.98*

A higher toll was calculated based on the amount of demand from the initial toll regime and the amount of reduction necessary to achieve a LOS D or better on the managed lanes. This resulted in a toll of $1.00 a mile for SOVs and $0.50 a mile for two-occupant vehicles. Figure 3-4 shows that an increased toll shifted the willingness to pay the toll downward.

Table 3-3 shows that this regime resulted in a reasonable LOS for the managed lane (0.82 v/c).

Figure 3-4: Toll Demand Curves for New Toll Regime

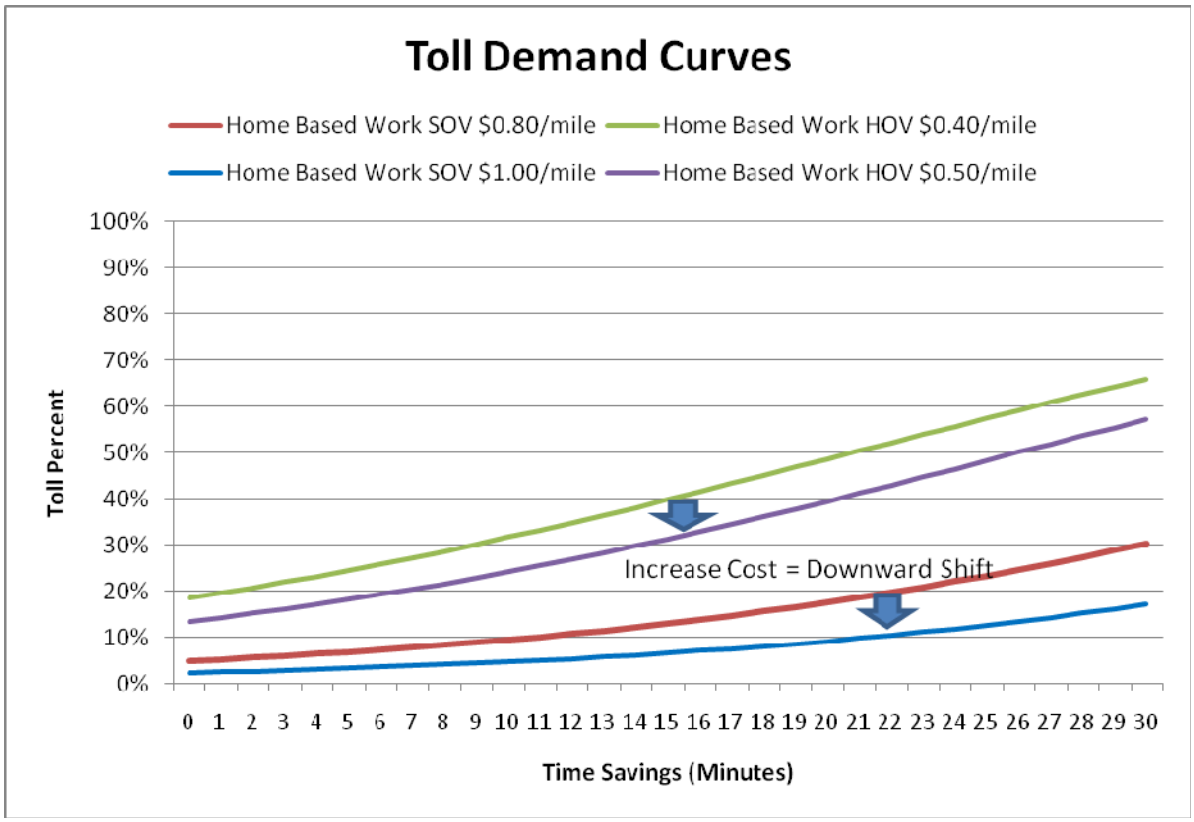


Table 3-3: 2035 AM 2-Hour Volumes on Pearl City Viaduct for Managed Lane with New Toll Regime ($1.00/mile SOV, $0.50/mile HOV2)

Facility	SOV Toll	HOV2 Toll	SOV Free	HOV 2 Free	HOV 3 Free	Truck Free	Total	v/c
H-1 GP Lanes	0	0	16,636	3,594	366	745	21,341	1.21
HOT Lanes	1,737	1,392	n/a	n/a	3,680	n/a	6,809	0.77
Total HOT Demand	1,737	1,392	n/a	n/a	4,046	n/a	7,175	0.82

3.3 Managed Lane Scenario Person Trips by Purpose and Mode

This section describes the basic travel demand forecasting model results such as person trips and mode choice associated with the 2035 Managed Lane scenario, comparing it to the 2035 Baseline scenario results. Note that all results are summarized for the $1.00-mile/$0.50-mile toll regime presented above.

As compared to the Baseline, total system-wide daily person trips remain the same for the 2035 Managed Lane scenario. Transit mode share for total daily trips also remains relatively the same for the 2035 Managed Lane scenario compared to Baseline (Table 3-4).

Table 3-4: Total Daily Person Trips by Mode—2035 Baseline vs. 2035 Managed Lane Scenario

Alternative	2035 Baseline		2035 Managed Lane Scenario		Percentage Change
	Number	Percent by Category	Number	Percent by Category	
Trips by Residents					
Private automobile	3,335,857	83%	3,335,171	82%	0%
Transit	245,727	6%	245,852	6%	0%
Bike/walk	461,617	11%	462,046	11%	0%
Total Trips by Residents	4,043,201	100%	4,043,069	100%	0%
Trips by Visitors					
Private Automobile	121,092	32%	121,103	32%	0%
Transit	30,235	8%	30,237	8%	0%
Taxi	9,540	3%	9,553	3%	0%
Tour Bus	57,953	16%	57,977	16%	0%
Bike/Walk	154,265	41%	154,267	41%	0%
Total Trips by Visitors	373,085	100%	373,137	100%	0%
Ground Access Trips by Air Passengers					
Private Automobile	28,841	26%	28,852	26%	0%
Transit	4,372	4%	4,356	4%	0%
Taxi	17,269	15%	17,285	15%	0%
Tour Bus	22,486	20%	22,486	20%	0%
Shuttle Bus	39,732	35%	39,720	35%	0%
Total Trips by Air Passengers	112,700	100%	112,699	100%	0%
Truck Trips					
Total Trips by Truck	237,306	100%	237,306	100%	0%
Total Daily Trips (All)	*4,766,292*	*100%*	*4,766,211*	*100%*	*0%*

Table 3-5 shows the comparison of the 2035 Managed Lane mode choice results by purpose to the 2035 Baseline alternative results. This table shows the change and the percent change between 2035 Baseline and the Managed Lane scenario. Overall the managed lane mode shares are almost identical to the Baseline mode shares.

Table 3-7 shows the toll mode choice results. The majority of toll trips are part of the journey-to-work/home-based-work-trip purpose, which is logical given the high commute demand on H-1 Koko Head-bound in the AM peak period, and the relatively higher value-of-time of work trips compared to non-work trips.

Table 3-5: 2035 Managed Lane Scenario Mode Choice Summary Results by Trip Purpose for Residents

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	536,595	81,197	161,976	29,245	115,857	2,954	8,222	35,682	112,439	264,126	142,229	1,490,522
	59%	*37%*	*66%*	*33%*	*53%*	*25%*	*3%*	*48%*	*29%*	*27%*	*23%*	*37%*
Double-occupant vehicle	151,599	73,744	42,190	33,720	29,913	1,707	65,685	8,405	131,899	300,618	221,526	1,061,006
	17%	*33%*	*17%*	*38%*	*14%*	*14%*	*23%*	*11%*	*34%*	*31%*	*35%*	*26%*
Three-or-more occupant vehicle	41,444	46,619	12,768	15,976	11,645	427	104,461	3,023	95,437	247,235	204,608	783,643
	5%	*21%*	*5%*	*18%*	*5%*	*4%*	*37%*	*4%*	*25%*	*25%*	*33%*	*19%*
Walk to express transit	3,459	221	2	527	0	0	237	209	0	0	0	4,655
	0%	*0%*	*0%*	*1%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Walk to local bus transit	55,732	4,259	7,118	5,146	4,474	4,546	16,057	9,525	9,921	26,159	3,675	146,612
	6%	*2%*	*3%*	*6%*	*2%*	*38%*	*6%*	*13%*	*3%*	*3%*	*1%*	*4%*
Walk to fixed guideway transit	27,171	1,839	5,023	1,827	1,677	1,114	3,195	5,740	1,322	10,534	1,852	61,294
	3%	*1%*	*2%*	*2%*	*1%*	*9%*	*1%*	*8%*	*0%*	*1%*	*0%*	*2%*
Informal Park-and-ride transit	1,130	48	0	7	0	0	260	96	139	215	0	1,895
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Formal Park-and-ride transit	12,506	0	0	0	0	0	3	1,598	12	538	0	14,657
	1%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*2%*	*0%*	*0%*	*0%*	*0%*
Kiss-and-ride transit	10,672	253	14	0	1	1	1,551	1,856	752	1,636	3	16,739
	1%	*0%*	*0%*	*0%*	*0%*	*0%*	*1%*	*3%*	*0%*	*0%*	*0%*	*0%*
Auxiliary walk	51,960	10,809	13,811	3,118	52,688	1,238	74,492	4,132	30,092	122,588	51,056	415,984
	6%	*5%*	*6%*	*3%*	*24%*	*10%*	*26%*	*6%*	*8%*	*12%*	*8%*	*10%*
Auxiliary bike	12,685	1,857	954	33	2,104	12	8,467	3,435	2,567	11,410	2,538	46,062
	1%	*1%*	*0%*	*0%*	*1%*	*0%*	*3%*	*5%*	*1%*	*1%*	*0%*	*1%*
Total	*904,953*	*220,846*	*243,856*	*89,599*	*218,359*	*11,999*	*282,630*	*73,701*	*384,580*	*985,059*	*627,487*	*4,043,069*

Table 3-6: Comparison of 2035 Managed Lane Scenario to 2035 Baseline Scenario Mode Choice Results by Purpose for Residents (Change and Percent Change)

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	-1,589	-206	-239	-3	20	-2	-26	-231	-16	-35	-2	-2,329
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*-1%*	*0%*	*0%*	*0%*	*0%*
Double-occupant vehicle	813	-7	97	-18	9	-1	311	-90	12	-16	15	1,125
	1%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*-1%*	*0%*	*0%*	*0%*	*0%*
Three-or-more occupant vehicle	428	167	95	3	2	0	-340	160	9	-15	9	518
	1%	*0%*	*1%*	*0%*	*0%*	*0%*	*0%*	*6%*	*0%*	*0%*	*0%*	*0%*
Walk to express transit	11	-1	0	0	0	0	-3	3	0	0	0	10
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*-1%*	*1%*	*0%*	*0%*	*0%*	*0%*
Walk to local bus transit	203	1	5	3	1	0	-20	48	12	36	4	293
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*1%*	*0%*	*0%*	*0%*	*0%*
Walk to fixed guideway transit	-178	-3	-10	-15	3	2	9	23	0	-43	-3	-215
	-1%	*0%*	*0%*	*-1%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Informal Park-and-ride transit	1	0	0	0	0	0	-1	0	0	0	0	0
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Formal Park-and-ride transit	-26	0	0	0	0	0	1	36	0	1	0	12
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*50%*	*2%*	*0%*	*0%*	*0%*	*0%*
Kiss-and-ride transit	8	0	-1	0	0	0	-1	18	1	0	0	25
	0%	*0%*	*-7%*	*0%*	*0%*	*0%*	*0%*	*1%*	*0%*	*0%*	*0%*	*0%*
Auxiliary walk	250	5	48	9	-75	-2	117	14	12	16	-56	338
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Auxiliary bike	76	0	4	0	-2	0	-2	10	0	7	-2	91
	1%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Total	-3	-44	-1	-21	-42	-3	45	-9	30	-49	-35	-132
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*

Table 3-7: 2035 Managed Lane Scenario Toll Mode Choice Summary Results by Trip Purpose for Residents

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle non-toll	531,205	81,013	161,332	29,263	115,933	2,957	8,217	35,630	112,476	264,284	142,309	1,484,619
Single-occupant vehicle toll	5,590	234	750	11	0	0	7	52	0	0	0	6,644
Double-occupant vehicle non-toll	145,225	72,672	41,042	33,667	29,931	1,709	65,267	8,295	131,937	300,795	221,642	1,052,182
Double-occupant vehicle toll	6,425	1,113	1,169	81	0	0	428	109	0	0	0	9,325
Three-or-more occupant vehicle non-toll	41,454	46,636	12,773	15,985	11,654	427	104,472	3,023	95,465	247,373	204,723	783,985

3.4 Managed Lane Scenario Assignment Results

This section describes the assignment results such as VMT, VHT, VHD, and transit boardings by mode associated with the 2035 Managed Lane sensitivity test scenario, comparing it to the 2035 Baseline results.

3.4.1 Managed Lane Scenario Highway Assignment

The highway assignment in the model produces summaries of the total islandwide daily VMT by motorized vehicles (automobiles, buses, and commercial vehicle) as estimated by the travel demand forecasting model. Table 3-8 shows the summary of the daily VMT by facility type and area type.[5] Of the more than 15.1 million daily VMT estimated, approximately 39 percent are estimated to occur on the Interstate freeway system (e.g., Interstate Routes H-1, H-2, H-3, and Moanalua Freeways), while the estimated percentages of VMT on the expressways (e.g., Likelike Highway and Pali Highway), ramps, arterials (e.g., Nimitz Highway, Dillingham Boulevard, and Moanalua Road) and collectors (e.g., Kaahumanu Street and Waipahu Street) would be 11 percent, five percent, 33 percent, and 12 percent, respectively.

Table 3-9 shows that the VMT is forecasted to remain similar to the 2035 Baseline scenario. This shows that incorporating a managed lane in an existing system keeps relatively the same number of vehicles on the roadways.

Table 3-10 shows Vehicle Hours of Travel (VHT) by facility type and area type in 2035, and Table 3-11 shows the percent change in VHT from 2035 Baseline scenario to 2035 managed lane scenario. The model forecasts 458,961 hours of travel in the 2035 managed lane scenario, a decrease of one percent from the 2035 Baseline scenario. Arterials are expected to carry the greatest share of VHT, with 39 percent of the total, followed by freeways (27 percent) and collectors (17 percent).

Table 3-12 shows 2035 managed lane scenario Vehicle Hours of Delay (VHD) forecasted by the travel demand forecasting model, and Table 3-13 shows the percent change in VHD between the 2035 Baseline and the 2035 managed lane scenario. VHD is projected to decrease by three percent in total and the majority of it likely occurs on the segments of H-1 within the limits of the managed lane facility.

[5] See Appendix Table A - 1 for area type definitions.

Table 3-8: 2035 Managed Lane Scenario VMT by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0	152,099	506,615	1,149,021	2,664,451	364,267	839,754	233,235	5,909,442
Expressways	0	0	37,579	170,515	448,516	372,280	515,580	160,150	1,704,620
Ramps	0	17,153	35,533	165,737	362,828	28,372	159,607	17,979	787,209
Arterials	127,498	252,989	619,447	716,515	1,518,749	261,258	1,053,826	400,276	4,950,558
Collectors	14,500	33,269	139,993	373,172	771,343	19,344	388,489	39,491	1,779,601
Total	141,998	455,510	1,339,167	2,574,960	5,765,887	1,045,521	2,957,256	851,131	15,131,430

Table 3-9: Percent Change from 2035 Baseline to 2035 Managed Lane Scenario VMT by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0%	0%	0%	-2%	-2%	-1%	3%	-1%	-1%
Expressways	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ramps	0%	0%	0%	0%	-1%	0%	-1%	-1%	-1%
Arterials	0%	0%	0%	-1%	0%	0%	0%	0%	0%
Collectors	-1%	0%	0%	0%	0%	0%	0%	0%	0%
Total	0%	0%	0%	-1%	-1%	0%	1%	0%	-1%

Table 3-10: 2035 Managed Lane Scenario VHT by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0	3,799	16,254	24,279	54,107	6,741	16,397	4,625	126,202
Expressways	0	0	865	5,191	10,507	9,073	10,762	3,135	39,533
Ramps	0	1,647	2,572	10,101	16,955	653	7,383	829	40,140
Arterials	5,791	12,676	28,817	27,940	54,655	7,519	30,225	9,352	176,975
Collectors	718	2,608	7,280	17,417	33,818	691	12,569	1,010	76,111
Total	6,509	20,730	55,788	84,928	170,042	24,677	77,336	18,951	458,961

Table 3-11: Percent Change from 2035 Baseline to 2035 Managed Lane Scenario VHT by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0%	0%	0%	-4%	-3%	-2%	1%	-2%	-2%
Expressways	0%	0%	0%	-1%	0%	-1%	0%	0%	-1%
Ramps	0%	0%	0%	-1%	-1%	0%	-3%	-5%	-1%
Arterials	0%	0%	0%	-2%	-1%	0%	0%	0%	-1%
Collectors	-1%	-1%	0%	0%	0%	0%	0%	0%	0%
Total	0%	0%	0%	-2%	-2%	-1%	0%	-1%	-1%

Table 3-12: 2035 Managed Lane Scenario VHD by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0	1,305	7,949	5,745	11,814	958	3,068	922	31,761
Expressways	0	0	216	2,300	3,032	2,869	2,310	510	11,237
Ramps	0	1,085	1,550	5,535	8,492	81	3,802	450	20,995
Arterials	691	2,555	4,036	7,699	11,732	983	5,853	833	34,382
Collectors	138	1,278	1,680	4,664	6,953	112	2,429	132	17,386
Total	829	6,223	15,431	25,943	42,023	5,003	17,462	2,847	115,761

Table 3-13: Percent Change from 2035 Baseline to 2035 Managed Lane Scenario VHD by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0%	1%	-1%	-9%	-8%	-9%	-8%	-5%	-6%
Expressways	0%	0%	-1%	-1%	-1%	-4%	-2%	-1%	-2%
Ramps	0%	0%	0%	-1%	-2%	0%	-4%	-7%	-2%
Arterials	-1%	-1%	0%	-4%	-3%	0%	-1%	-1%	-2%
Collectors	-2%	-1%	0%	0%	0%	1%	0%	1%	0%
Total	-1%	0%	0%	-4%	-4%	-4%	-3%	-3%	-3%

3.4.2 Managed Lane Scenario Transit Assignment

Table 3-14 shows 2035 managed lane scenario transit boardings by period (peak versus off-peak) and mode for residents, visitors, and ground access air passengers. Table 3-15 shows the percent change in transit boardings from 2035 Baseline to the 2035 managed lane scenario. Total boardings remain almost identical.

Table 3-14: 2035 Managed Lane Scenario Transit Boardings By Period and Mode

	Boardings By Mode					
Period/Mode	Local	Express	Limited	Guideway	Ferry	Total
Peak	174,028	7,537	6,834	72,735	0	261,134
Off-Peak	93,451	0	5,115	27,441	0	126,007
Total	267,479	7,537	11,949	100,176	0	387,141

Table 3-15: Percent Change in Transit Boardings, Baseline to Managed Lane Scenario

	Boardings By Mode					
Period/Mode	Local	Express	Limited	Guideway	Ferry	Total
Peak	0%	0%	0%	0%	0%	0%
Off-Peak	0%	0%	1%	0%	0%	0%
Total	0%	0%	0%	0%	0%	0%

3.5 Summary of Managed Lane Scenario Findings

These are the key findings of the managed lane scenario:

- The significant HOV demand in the 2035 Baseline showed there will be no excess capacity to sell in the AM zipper lane or the HOV 2+ lane due to forecasted 2035 HOV demand, so both the AM zipper lane and the HOV 2+ occupant lane were tolled for this scenario, essentially pricing out some HOV 2-occupant demand to provide capacity for the SOV demand. A relatively high toll regime of $1.00/mile for SOVs, and $0.50/mile for HOV 2-occupant was required to ensure an adequate LOS of D or better on the managed lanes in the peak periods.
- There was relatively no change in mode share between auto, transit, bicycle, and walking between the Baseline and managed lane scenarios. The only change was some non-toll auto trips shifted into the tolled auto trips.
- There were very small changes in VMT, VHT and VHD between the Baseline and managed lane scenarios.
- And there was almost no change in transit boardings by time-of-day and mode between the Baseline and managed lane scenarios.

4 Cordon Pricing Scenario

This chapter provides the results of the Cordon Pricing sensitivity scenario.

4.1 Cordon Pricing Scenario Definition

Cordon pricing is a congestion management strategy that involves charging for vehicle access to a particular location (e.g., central business district). Tolls are assessed when vehicles cross a boundary, or cordon line, encircling the pricing area.

For this scenario, the project team set a cordon line (illustrated by the purple line in Figure 4-1) bounding the Honolulu central business district (CBD). All vehicles that enter the CBD by passing this line would be charged a toll, regardless of the time of day. The pricing area and tolled network links are shown in Figure 4-2. Residents of the pricing area would be allowed to travel into and out of the pricing area toll-free. Also, through trips made along the edge of the cordon (e.g., Ala Moana Boulevard / Nimitz Highway) would not be charged a toll. The following three toll rates[6] were tested in the OahuMPO regional travel demand forecasting model to assess the effects of different pricing levels:

1) $5.00
2) $7.50
3) $10.00

[6] In 1995 dollars. Dollars are reflected in 1995 dollars as the OahuMPO travel demand model cost components are calibrated to year 1995 conditions.

Figure 4-1. Cordon Pricing Boundary

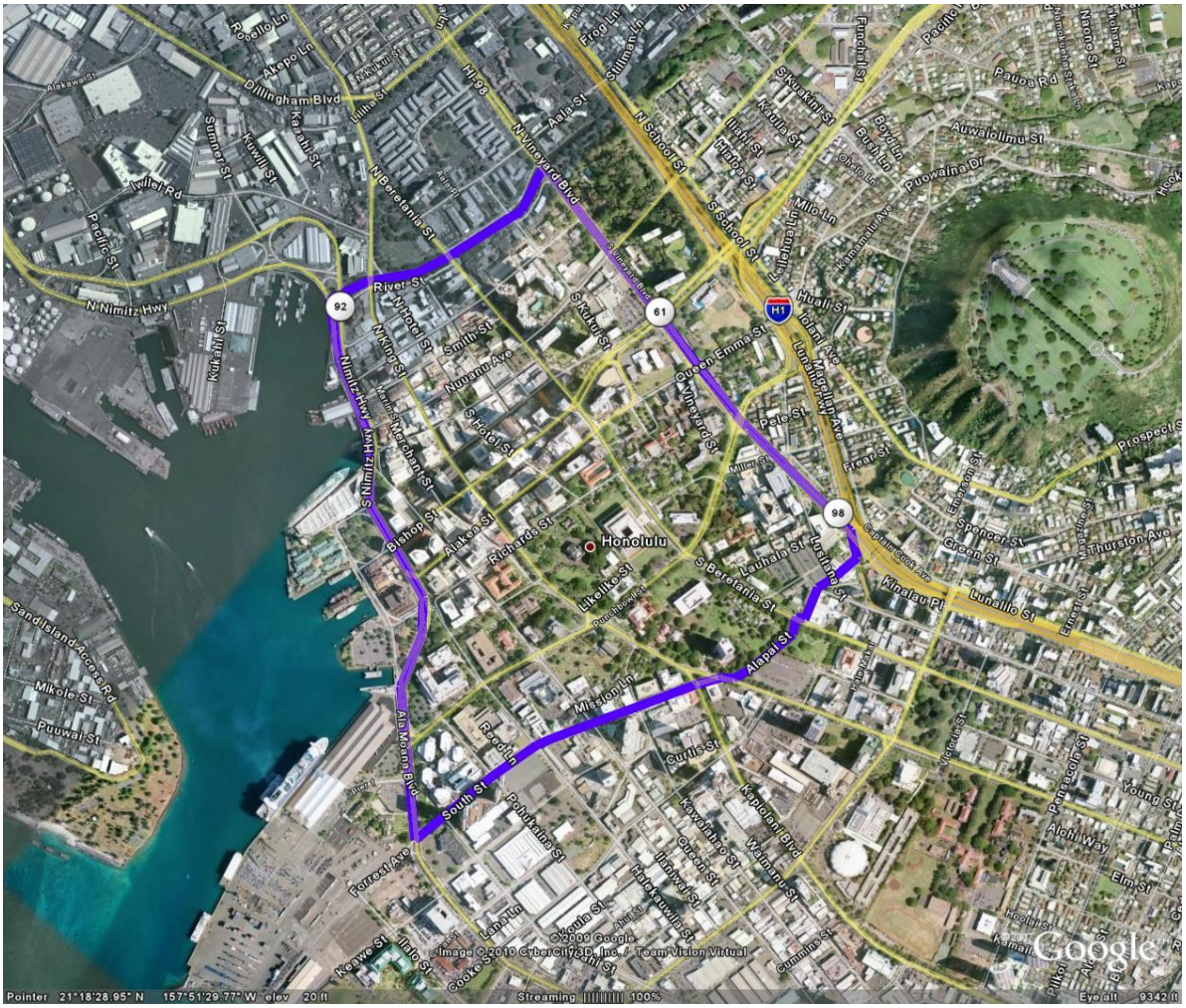
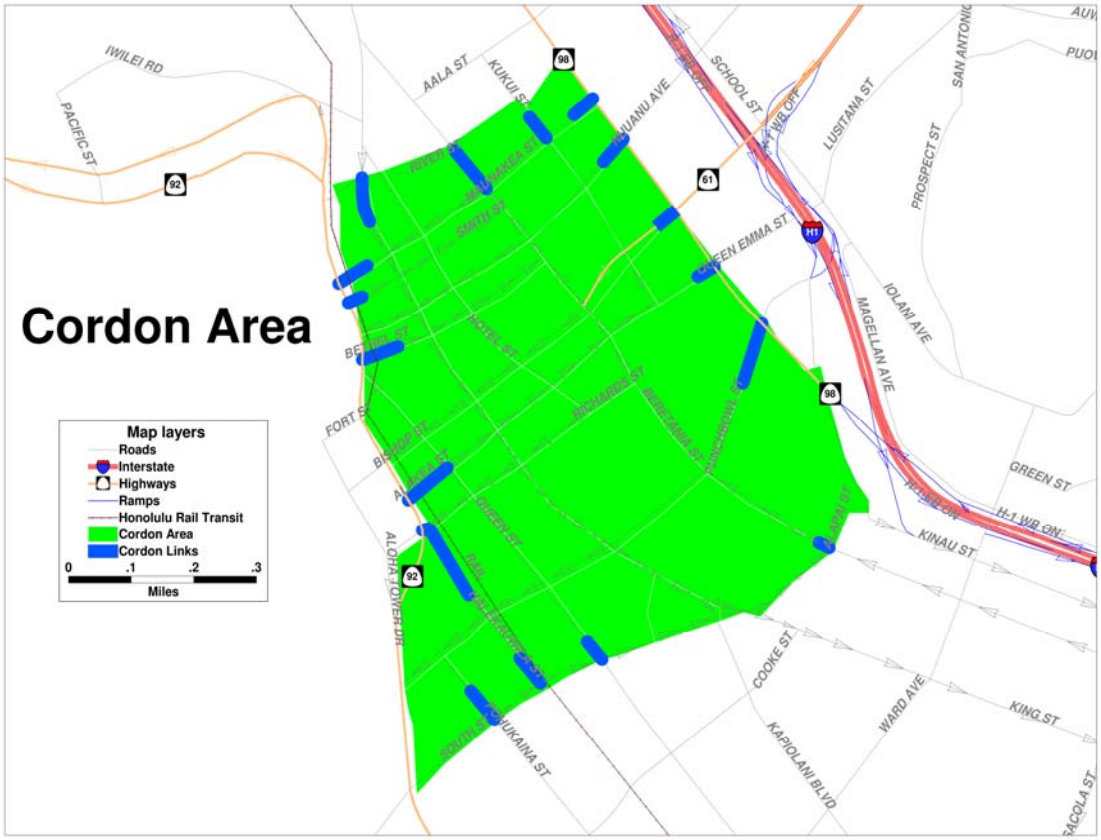

Honolulu
N Nimitz Hwy
Nimitz Hwy
Ala Moana Blvd
Dillingham Blvd
N Vineyard Blvd
Queen Emma St
Beretania St
Alapai St
Mission Ln
Reed Ln
South St
Bishop St
Richards St
Alakea St
Punchbowl St
Kapiolani Blvd
Kalakaua Ave
Kuhio Ave
Kinau St
Lunalilo St
Green St
Thurston Ave
Pauoa Rd
Auwaiolimu St
Puowaina Dr
Pacific St
Kuwili St
Kaahumanu St
Sand Island Access Rd
Mikole St
Puuwai St
Forrest Ave
Keawe St
Ilalo St
Cooke St
Curtis St
Cummins St
Aiea St
Aala St
Frog Ln
Stillman Ln
N School St
S School St
Liliha St
Kukui St
Smith St
Nuuanu Ave
Maunakea St
Merchant St
Hotel St
Likelike St
Lauhala St
Lusitana St
Pele St
Frear St
Prospect St
Spencer St
Thurston Ave
Elm St
Young St
Aloha Way
Pensacola St
Victoria St
Keeaumoku St
Kamani St
Wilder Ave
Makiki St
Piikoi St
Ala Moana Blvd
Kaheuwili St
Hauwai St
Ouwehi St
Kawananakoa St
Wyllie St
Kaiulani St
Kuhio Ave
Kalakaua Ave
Kapahulu Ave
Kaiolani St
Kaiolani Ave
Lunalilo Ave
Kinalau Pl
Cathedral Ln
Beretania St
Hotel St
Nuuanu Ave
Smith St
Kukui St
Vineyard Blvd
Aala St
Frog Ln
Stillman Ln
N School St
S School St
Liliha St
Kuwili St
Kaahumanu St
Summer St
Akepo Ln
Rogello Ln
Aiea St
Kaiolani St
Kaiolani Ave
Lunalilo Ave
Kinau St
Lunalilo St
Green St
Thurston Ave
Spencer St
Prospect St
Frear St
Pele St
Lusitana St
Lauhala St
Alapai St
Mission Ln
Reed Ln
South St
Curtis St
Kapiolani Blvd
Wilder Ave
Makiki St
Piikoi St
Ala Moana Blvd
Kaheuwili St
Hauwai St
Ouwehi St
Kawananakoa St
Wyllie St
Keeaumoku St
Kamani St
Aloha Way
Elm St
Young St
Pensacola St
Victoria St
Cummins St
Cooke St
Ilalo St
Keawe St
Forrest Ave
Lane Ln
Schools St
Pohukaina St
Punchbowl St
Alakea St
Richards St
Bishop St
Merchant St
Maunakea St
Nimitz Hwy
Kuwili St
Kaahumanu St
Summer St
Akepo Ln
Dillingham Blvd
Rogello Ln
Aiea St
Aala St
Vineyard Blvd
Beretania St
Pacific St
Iwilei Rd
Sand Island Access Rd
Mikole St
Puuwai St
Pauoa Rd
Auwaiolimu St
Puowaina Dr
Naone St
Pacific

Figure 4-2. Map of Network Links Charged When Entering Cordon Area



4.2 Cordon Pricing Scenario Person Trips by Purpose and Mode

This section describes the basic travel demand forecasting model results such as person trips and mode choice associated with the 2035 Cordon Pricing scenarios, comparing it to the 2035 Baseline scenario results.

4.2.1 Cordon Toll $5.00

As compared to the Baseline, total system-wide daily person trips remain the same for the 2035 Cordon $5.00 toll scenario. Transit mode share for total daily trips is also projected to remain similar to the Baseline for the 2035 Cordon $5.00 toll scenario (Table 4-1).

Table 4-1: Total Daily Person Trips by Mode—2035 Baseline vs. 2035 Cordon $5.00 Toll

Alternative	2035 Baseline		2035 Cordon $5 Toll		Percentage Change
	Number	Percent by Category	Number	Percent by Category	
Trips by Residents					
Private automobile	3,335,857	83%	3,325,390	82%	0%
Transit	245,727	6%	252,134	6%	3%
Bike/walk	461,617	11%	465,643	12%	1%
Total Trips by Residents	4,043,201	100%	4,043,167	100%	0%
Trips by Visitors					
Private Automobile	121,092	32%	120,971	32%	0%
Transit	30,235	8%	30,454	8%	1%
Taxi	9,540	3%	9,500	3%	0%
Tour Bus	57,953	16%	57,940	16%	0%
Bike/Walk	154,265	41%	153,797	41%	0%
Total Trips by Visitors	373,085	100%	372,662	100%	0%
Ground Access Trips by Air Passengers					
Private Automobile	28,841	26%	28,847	26%	0%
Transit	4,372	4%	4,378	4%	0%
Taxi	17,269	15%	17,275	15%	0%
Tour Bus	22,486	20%	22,486	20%	0%
Shuttle Bus	39,732	35%	39,714	35%	0%
Total Trips by Air Passengers	112,700	100%	112,700	100%	0%
Truck Trips					
Total Trips by Truck	237,306	100%	237,306	100%	0%
Total Daily Trips (All)	4,766,292	*100%*	4,765,835	*100%*	*0%*

Table 4-2 shows the mode choice results by purpose for residents in the 2035 Cordon $5.00 Toll scenario model run. This table shows that overall islandwide mode choice is similar to the 2035 Baseline.

Table 4-3 shows the comparison of the 2035 Cordon $5.00 Toll mode choice results by purpose to the 2035 Baseline alternative results. This table also shows that the overall regional change and the percent change between 2035 Baseline and the Cordon $5.00 Toll scenario is small.

Table 4-4 shows the mode choice results by trip purpose for the trips to the cordon area only, with Table 4-5 revealing that there is a significant mode share shift to transit and out of the auto modes when looking at only trips to the cordon area. Overall auto trips to the cordon area decreased by 8%, 7%, and 6% respectively for single occupant vehicles, two occupant vehicles, and three-plus occupant vehicles, while transit trips to the cordon area increased between 17% and 26% for the transit modes. In total, there would be 10,500 less auto-person trips entering the pricing area under the $5.00 cordon price scenario than in the 2035 Baseline. Under this scenario, there would be 6,400 more transit trips and 2,000 more non-motorized trips to the pricing area than in the 2035 Baseline.

Table 4-2: 2035 Cordon $5 Toll Scenario Mode Choice Summary Results by Trip Purpose for Residents

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	535,273	81,354	161,544	29,189	115,138	2,943	8,252	35,353	112,416	263,590	142,104	1,487,156
	59%	*37%*	*66%*	*33%*	*53%*	*25%*	*3%*	*48%*	*29%*	*27%*	*23%*	*37%*
Double-occupant vehicle	149,704	73,698	41,897	33,657	29,705	1,689	65,389	8,339	131,827	299,952	221,268	1,057,125
	17%	*33%*	*17%*	*38%*	*14%*	*14%*	*23%*	*11%*	*34%*	*30%*	*35%*	*26%*
Three-or-more occupant vehicle	40,359	46,310	12,528	15,918	11,568	422	104,745	2,778	95,383	246,710	204,388	781,109
	4%	*21%*	*5%*	*18%*	*5%*	*4%*	*37%*	*4%*	*25%*	*25%*	*33%*	*19%*
Walk to express transit	3,704	237	2	540	0	0	239	207	0	0	0	4,929
	0%	*0%*	*0%*	*1%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Walk to local bus transit	57,169	4,333	7,496	5,234	4,572	4,573	16,117	9,814	9,933	26,650	3,712	149,603
	6%	*2%*	*3%*	*6%*	*2%*	*38%*	*6%*	*13%*	*3%*	*3%*	*1%*	*4%*
Walk to fixed guideway transit	28,225	1,879	5,324	1,889	1,710	1,106	3,185	5,902	1,312	10,688	1,867	63,087
	3%	*1%*	*2%*	*2%*	*1%*	*9%*	*1%*	*8%*	*0%*	*1%*	*0%*	*2%*
Informal Park-and-ride transit	1,183	50	0	7	0	0	261	100	140	224	0	1,965
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Formal Park-and-ride transit	13,045	-1	0	0	0	0	3	1,642	12	557	0	15,258
	1%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*2%*	*0%*	*0%*	*0%*	*0%*
Kiss-and-ride transit	11,131	258	15	0	1	1	1,550	1,907	753	1,673	3	17,292
	1%	*0%*	*0%*	*0%*	*0%*	*0%*	*1%*	*3%*	*0%*	*0%*	*0%*	*0%*
Walk	52,378	10,901	14,069	3,150	53,555	1,255	74,370	4,180	30,211	123,567	51,621	419,257
	6%	*5%*	*6%*	*4%*	*25%*	*10%*	*26%*	*6%*	*8%*	*13%*	*8%*	*10%*
Bike	12,782	1,865	979	33	2,141	12	8,472	3,487	2,571	11,489	2,555	46,386
	1%	*1%*	*0%*	*0%*	*1%*	*0%*	*3%*	*5%*	*1%*	*1%*	*0%*	*1%*
Total	*904,953*	*220,884*	*243,854*	*89,617*	*218,390*	*12,001*	*282,583*	*73,709*	*384,558*	*985,100*	*627,518*	*4,043,167*

Table 4-3: Comparison of 2035 Cordon $5 Toll Scenario to 2035 Baseline Mode Choice Results by Purpose for Residents (Change and Percent Change)

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	-2,911	-49	-671	-59	-699	-13	4	-560	-39	-571	-127	-5,695
	-1%	*0%*	*0%*	*0%*	*-1%*	*0%*	*0%*	*-2%*	*0%*	*0%*	*0%*	*0%*
Double-occupant vehicle	-1,082	-53	-196	-81	-199	-19	15	-156	-60	-682	-243	-2,756
	-1%	*0%*	*0%*	*0%*	*-1%*	*-1%*	*0%*	*-2%*	*0%*	*0%*	*0%*	*0%*
Three-or-more occupant vehicle	-657	-142	-145	-55	-75	-5	-56	-85	-45	-540	-211	-2,016
	-2%	*0%*	*-1%*	*0%*	*-1%*	*-1%*	*0%*	*-3%*	*0%*	*0%*	*0%*	*0%*
Walk to express transit	256	15	0	13	0	0	-1	1	0	0	0	284
	7%	*7%*	*0%*	*2%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*6%*
Walk to local bus transit	1,640	75	383	91	99	27	40	337	24	527	41	3,284
	3%	*2%*	*5%*	*2%*	*2%*	*1%*	*0%*	*4%*	*0%*	*2%*	*1%*	*2%*
Walk to fixed guideway transit	876	37	291	47	36	-6	-1	185	-10	111	12	1,578
	3%	*2%*	*6%*	*3%*	*2%*	*-1%*	*0%*	*3%*	*-1%*	*1%*	*1%*	*3%*
Informal Park-and-ride transit	54	2	0	0	0	0	0	4	1	9	0	70
	5%	*4%*	*0%*	*0%*	*0%*	*0%*	*0%*	*4%*	*1%*	*4%*	*0%*	*4%*
Formal Park-and-ride transit	513	-1	0	0	0	0	1	80	0	20	0	613
	4%	*0%*	*0%*	*0%*	*0%*	*0%*	*50%*	*5%*	*0%*	*4%*	*0%*	*4%*
Kiss-and-ride transit	467	5	0	0	0	0	-2	69	2	37	0	578
	4%	*2%*	*0%*	*0%*	*0%*	*0%*	*0%*	*4%*	*0%*	*2%*	*0%*	*3%*
Walk	668	97	306	41	792	15	-5	62	131	995	509	3,611
	1%	*1%*	*2%*	*1%*	*2%*	*1%*	*0%*	*2%*	*0%*	*1%*	*1%*	*1%*
Bike	173	8	29	0	35	0	3	62	4	86	15	415
	1%	*0%*	*3%*	*0%*	*2%*	*0%*	*0%*	*2%*	*0%*	*1%*	*1%*	*1%*
Total	-3	-6	-3	-3	-11	-1	-2	-1	8	-8	-4	-34
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*

Table 4-4: Comparison of 2035 Cordon $5 Toll Scenario to 2035 Baseline Mode Choice to <u>Cordon Area</u> Results by Purpose for Residents (Difference in Trips)

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	-2,799	-75	-726	-72	-673	-24	-1	-447	-5	-464	-254	-5,540
Double-occupant vehicle	-1,213	-101	-226	-105	-182	-22	-22	-166	-63	-612	-415	-3,127
Three-or-more occupant vehicle	-449	-58	-93	-57	-70	-5	-59	-86	-45	-495	-377	-1,794
Walk to express transit	257	16	0	13	0	0	1	0	0	0	0	287
Walk to local bus transit	1,382	66	357	78	97	13	23	210	14	547	39	2,826
Walk to fixed guideway transit	978	47	328	57	57	7	10	183	1	203	21	1,892
Informal Park-and-ride transit	53	2	0	1	0	0	0	5	1	8	0	70
Formal Park-and-ride transit	577	0	0	0	0	0	0	80	0	23	0	680
Kiss-and-ride transit	519	6	0	0	0	0	3	73	3	42	0	646
Walk	429	46	259	32	290	2	18	54	-12	323	203	1,644
Bike	163	7	29	0	35	0	6	60	2	69	15	386
Total	-103	-44	-72	-53	-446	-29	-21	-34	-104	-356	-768	-2,030

Table 4-5: Comparison of 2035 Cordon $5 Toll Scenario to 2035 Baseline Mode Choice to <u>Cordon Area</u> Results by Purpose for Residents (Percent Change)

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	-8%	-3%	-6%	-9%	-12%	-27%	-7%	-28%	0%	-4%	-7%	-8%
Double-occupant vehicle	-11%	-4%	-6%	-9%	-12%	-28%	-10%	-29%	-4%	-4%	-7%	-7%
Three-or-more occupant vehicle	-11%	-3%	-5%	-9%	-12%	-25%	-9%	-30%	-4%	-4%	-7%	-6%
Walk to express transit	21%	25%	0%	22%	n/a	n/a	20%	0%	n/a	n/a	n/a	21%
Walk to local bus transit	16%	18%	31%	27%	28%	4%	14%	14%	6%	17%	30%	17%
Walk to fixed guideway transit	17%	21%	29%	26%	31%	5%	16%	17%	3%	16%	33%	19%
Informal Park-and-ride transit	25%	33%	n/a	n/a	n/a	n/a	0%	45%	33%	27%	n/a	26%
Formal Park-and-ride transit	25%	n/a	n/a	n/a	n/a	n/a	n/a	31%	n/a	24%	n/a	25%
Kiss-and-ride transit	22%	24%	0%	n/a	n/a	n/a	16%	31%	18%	20%	n/a	23%
Walk	8%	7%	21%	22%	9%	2%	3%	13%	-2%	6%	13%	8%
Bike	13%	7%	27%	0%	23%	0%	9%	21%	9%	13%	21%	15%
Total	0%	-1%	0%	-2%	-4%	-4%	-1%	-1%	-2%	-1%	-4%	-1%

4.2.2 Cordon Toll $7.50

As compared to the Baseline, total system-wide daily person trips remain the same for the 2035 Cordon $7.50 toll scenario. Transit mode share for total daily trips is projected to increase very slightly for the 2035 Cordon $7.50 toll scenario (Table 4-6).

Table 4-6. Total Daily Person Trips by Mode—2035 Baseline vs. 2035 Cordon $7.50 Toll

Alternative	2035 Baseline		2035 Cordon $7.50 Toll		Percentage Change
	Number	Percent by Category	Number	Percent by Category	
Trips by Residents					
Private automobile	3,335,857	83%	3,320,499	82%	0%
Transit	245,727	6%	255,543	6%	4%
Bike/walk	461,617	11%	467,144	12%	1%
Total Trips by Residents	4,043,201	100%	4,043,186	100%	0%
Trips by Visitors					
Private Automobile	121,092	32%	120,907	32%	0%
Transit	30,235	8%	30,343	8%	0%
Taxi	9,540	3%	9,449	3%	-1%
Tour Bus	57,953	16%	57,884	16%	0%
Bike/Walk	154,265	41%	154,155	41%	0%
Total Trips by Visitors	373,085	100%	372,738	100%	0%
Ground Access Trips by Air Passengers					
Private Automobile	28,841	26%	28,816	26%	0%
Transit	4,372	4%	4,388	4%	0%
Taxi	17,269	15%	17,247	15%	0%
Tour Bus	22,486	20%	22,486	20%	0%
Shuttle Bus	39,732	35%	39,762	35%	0%
Total Trips by Air Passengers	112,700	100%	112,700	100%	0%
Truck Trips					
Total Trips by Truck	237,306	100%	237,306	100%	
Total Daily Trips (All)	*4,766,292*	*100%*	*4,765,930*	*100%*	*0%*

Table 4-7 shows the mode choice results by purpose for residents in the 2035 Cordon $7.50 Toll scenario model run. As with the Cordon $5.00 Toll scenario, this table shows that overall islandwide mode choice is similar to the 2035 Baseline.

Table 4-8 shows the comparison of the 2035 Cordon $7.50 Toll mode choice results by purpose to the 2035 Baseline alternative results. This table shows the change and the percent change between 2035 Baseline and the Cordon $7.50 Toll scenario. Like the Cordon $5.00 Toll scenario, the regional mode choice Cordon $7.50 Toll Scenario results showed small decreases in auto trips and small increases in transit trips, and the percentage change was also small, yet a little higher than the Cordon $5.00 Toll changes.

Table 4-9 shows the mode choice results by trip purpose for the trips to the cordon area only, with Table 4-10 revealing that there is a significant mode share shift to transit and out of the auto modes when looking at only trips to the cordon area. Overall auto trips to the cordon area decreased by 11%, 10%, and 9% respectively for single-occupant vehicles, two-occupant vehicles, and three-plus-occupant vehicles, while transit trips to the cordon area increased between 28% and 43% for the transit modes. In total, there would be 15,600 less auto-person trips entering the pricing area under the $7.50 cordon price scenario than in the 2035 Baseline. Under this scenario, there would be 9,900 more transit trips and 3,700 more non-motorized trips to the pricing area than in the 2035 Baseline. The changes for paying a $7.50 toll into the cordon area were slightly more pronounced than the $5.00 toll.

Table 4-7. 2035 Cordon $7.50 Toll Scenario Mode Choice Summary Results by Trip Purpose for Residents

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	533,929	81,335	161,197	29,156	114,889	2,934	8,255	35,193	112,407	263,312	142,052	1,484,659
	59%	*37%*	*66%*	*33%*	*53%*	*24%*	*3%*	*48%*	*29%*	*27%*	*23%*	*37%*
Double-occupant vehicle	149,098	73,668	41,777	33,611	29,638	1,681	65,387	8,257	131,801	299,616	221,185	1,055,719
	16%	*33%*	*17%*	*38%*	*14%*	*14%*	*23%*	*11%*	*34%*	*30%*	*35%*	*26%*
Three-or-more occupant vehicle	40,004	46,237	12,446	15,889	11,542	420	104,746	2,725	95,364	246,437	204,311	780,121
	4%	*21%*	*5%*	*18%*	*5%*	*4%*	*37%*	*4%*	*25%*	*25%*	*33%*	*19%*
Walk to express transit	3,883	248	2	552	0	0	241	213	0	0	0	5,139
	0%	*0%*	*0%*	*1%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Walk to local bus transit	58,029	4,385	7,718	5,284	4,633	4,584	16,136	9,955	9,947	26,937	3,731	151,339
	6%	*2%*	*3%*	*6%*	*2%*	*38%*	*6%*	*14%*	*3%*	*3%*	*1%*	*4%*
Walk to fixed guideway transit	28,657	1,903	5,491	1,921	1,744	1,110	3,185	5,947	1,314	10,790	1,878	63,940
	3%	*1%*	*2%*	*2%*	*1%*	*9%*	*1%*	*8%*	*0%*	*1%*	*0%*	*2%*
Informal Park-and-ride transit	1,217	51	0	7	0	0	262	103	140	228	0	2,008
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Formal Park-and-ride transit	13,267	0	0	0	0	0	2	1,658	12	570	0	15,509
	1%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*2%*	*0%*	*0%*	*0%*	*0%*
Kiss-and-ride transit	11,388	261	16	0	1	1	1,552	1,935	756	1,695	3	17,608
	1%	*0%*	*0%*	*0%*	*0%*	*0%*	*1%*	*3%*	*0%*	*0%*	*0%*	*0%*
Walk	52,603	10,931	14,213	3,167	53,782	1,258	74,330	4,205	30,241	123,978	51,797	420,505
	6%	*5%*	*6%*	*4%*	*25%*	*10%*	*26%*	*6%*	*8%*	*13%*	*8%*	*10%*
Bike	12,882	1,872	997	33	2,166	12	8,480	3,520	2,572	11,540	2,565	46,639
	1%	*1%*	*0%*	*0%*	*1%*	*0%*	*3%*	*5%*	*1%*	*1%*	*0%*	*1%*
Total	*904,957*	*220,891*	*243,857*	*89,620*	*218,395*	*12,000*	*282,576*	*73,711*	*384,554*	*985,103*	*627,522*	*4,043,186*

Table 4-8. Comparison of 2035 Cordon $7.50 Toll Scenario to 2035 Baseline Mode Choice Results by Purpose for Residents (Change and Percent Change)

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	-4,255	-68	-1,018	-92	-948	-22	7	-720	-48	-849	-179	-8,192
	-1%	*0%*	*-1%*	*0%*	*-1%*	*-1%*	*0%*	*-2%*	*0%*	*0%*	*0%*	*-1%*
Double-occupant vehicle	-1,688	-83	-316	-127	-266	-27	13	-238	-86	-1,018	-326	-4,162
	-1%	*0%*	*-1%*	*0%*	*-1%*	*-2%*	*0%*	*-3%*	*0%*	*0%*	*0%*	*0%*
Three-or-more occupant vehicle	-1,012	-215	-227	-84	-101	-7	-55	-138	-64	-813	-288	-3,004
	-2%	*0%*	*-2%*	*-1%*	*-1%*	*-2%*	*0%*	*-5%*	*0%*	*0%*	*0%*	*0%*
Walk to express transit	435	26	0	25	0	0	1	7	0	0	0	494
	13%	*12%*	*0%*	*5%*	*0%*	*0%*	*0%*	*3%*	*0%*	*0%*	*0%*	*11%*
Walk to local bus transit	2,500	127	605	141	160	38	59	478	38	814	60	5,020
	5%	*3%*	*9%*	*3%*	*4%*	*1%*	*0%*	*5%*	*0%*	*3%*	*2%*	*3%*
Walk to fixed guideway transit	1,308	61	458	79	70	-2	-1	230	-8	213	23	2,431
	5%	*3%*	*9%*	*4%*	*4%*	*0%*	*0%*	*4%*	*-1%*	*2%*	*1%*	*4%*
Informal Park-and-ride transit	88	3	0	0	0	0	1	7	1	13	0	113
	8%	*6%*	*0%*	*0%*	*0%*	*0%*	*0%*	*7%*	*1%*	*6%*	*0%*	*6%*
Formal Park-and-ride transit	735	0	0	0	0	0	0	96	0	33	0	864
	6%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*6%*	*0%*	*6%*	*0%*	*6%*
Kiss-and-ride transit	724	8	1	0	0	0	0	97	5	59	0	894
	7%	*3%*	*7%*	*0%*	*0%*	*0%*	*0%*	*5%*	*1%*	*4%*	*0%*	*5%*
Walk	893	127	450	58	1,019	18	-45	87	161	1,406	685	4,859
	2%	*1%*	*3%*	*2%*	*2%*	*1%*	*0%*	*2%*	*1%*	*1%*	*1%*	*1%*
Bike	273	15	47	0	60	0	11	95	5	137	25	668
	2%	*1%*	*5%*	*0%*	*3%*	*0%*	*0%*	*3%*	*0%*	*1%*	*1%*	*1%*
Total	1	1	0	0	-6	-2	-9	1	4	-5	0	-15
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*

Table 4-9. Comparison of 2035 Cordon $7.50 Toll Scenario to 2035 Baseline Mode Choice to <u>Cordon Area</u> Results by Purpose for Residents (Difference in Trips)

Mode	Purpose											*Total*
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	-4,337	-109	-1,092	-103	-929	-32	-2	-657	-18	-746	-308	-8,333
Double-occupant vehicle	-1,829	-148	-353	-152	-252	-29	-32	-240	-90	-948	-503	-4,576
Three-or-more occupant vehicle	-710	-102	-157	-84	-97	-7	-90	-127	-65	-768	-458	-2,665
Walk to express transit	427	26	0	23	0	0	1	6	0	0	0	483
Walk to local bus transit	2,232	110	573	124	159	24	34	346	31	837	60	4,530
Walk to fixed guideway transit	1,449	72	501	88	90	11	15	248	3	302	31	2,810
Informal Park-and-ride transit	87	3	0	1	0	0	1	8	2	13	0	115
Formal Park-and-ride transit	830	0	0	0	0	0	0	103	0	36	0	969
Kiss-and-ride transit	794	9	1	0	0	0	5	102	5	64	0	980
Walk	702	83	418	53	525	5	39	86	23	743	388	3,065
Bike	268	14	47	1	60	0	10	92	4	120	25	641
Total	-87	-42	-62	-49	-444	-28	-19	-33	-105	-347	-765	-1,981

Table 4-10. Comparison of 2035 Cordon $7.50 Toll Scenario to 2035 Baseline Mode Choice to <u>Cordon Area</u> Results by Purpose for Residents (Percent Change)

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	-13%	-5%	-9%	-13%	-17%	-36%	-13%	-41%	-2%	-6%	-8%	-11%
Double-occupant vehicle	-16%	-6%	-9%	-13%	-17%	-36%	-15%	-42%	-6%	-7%	-8%	-10%
Three-or-more occupant vehicle	-17%	-5%	-9%	-13%	-17%	-35%	-13%	-44%	-6%	-7%	-8%	-9%
Walk to express transit	35%	41%	0%	39%	n/a	n/a	20%	19%	n/a	n/a	n/a	35%
Walk to local bus transit	26%	30%	50%	42%	46%	8%	21%	22%	14%	26%	45%	28%
Walk to fixed guideway transit	25%	33%	45%	41%	49%	8%	23%	23%	10%	24%	49%	28%
Informal Park-and-ride transit	40%	50%	n/a	n/a	n/a	n/a	33%	73%	67%	43%	n/a	43%
Formal Park-and-ride transit	35%	n/a	n/a	n/a	n/a	n/a	n/a	40%	n/a	38%	n/a	36%
Kiss-and-ride transit	34%	36%	33%	n/a	n/a	n/a	26%	43%	29%	30%	n/a	35%
Walk	14%	13%	34%	37%	17%	6%	6%	21%	4%	13%	25%	16%
Bike	21%	14%	43%	50%	40%	0%	16%	33%	18%	23%	35%	25%
Total	0%	0%	0%	-1%	-4%	-4%	-1%	-1%	-2%	-1%	-4%	-1%

4.2.3 Cordon Toll $10.00

As compared to the Baseline, total system-wide daily person trips remain the same for the 2035 Cordon $10 toll scenario. Transit mode share for total daily trips is projected to increase very slightly for the 2035 Cordon $10 toll scenario (Table 4-11).

Table 4-11. Total Daily Person Trips by Mode—2035 Baseline vs. 2035 Cordon $10 Toll

Alternative	2035 Baseline		2035 Cordon $10 Toll		Percentage Change
	Number	Percent by Category	Number	Percent by Category	
Trips by Residents					
Private automobile	3,335,857	83%	3,315,358	82%	-1%
Transit	245,727	6%	259,162	6%	5%
Bike/walk	461,617	11%	468,678	12%	2%
Total Trips by Residents	4,043,201	100%	4,043,198	100%	0%
Trips by Visitors					
Private Automobile	121,092	32%	120,858	32%	0%
Transit	30,235	8%	30,348	8%	0%
Taxi	9,540	3%	9,440	3%	-1%
Tour Bus	57,953	16%	57,908	16%	0%
Bike/Walk	154,265	41%	154,153	41%	0%
Total Trips by Visitors	373,085	100%	372,707	100%	0%
Ground Access Trips by Air Passengers					
Private Automobile	28,841	26%	28,989	26%	1%
Transit	4,372	4%	4,379	4%	0%
Taxi	17,269	15%	17,429	15%	1%
Tour Bus	22,486	20%	22,486	20%	0%
Shuttle Bus	39,732	35%	39,416	35%	-1%
Total Trips by Air Passengers	112,700	100%	112,700	100%	0%
Truck Trips					
Total Trips by Truck	237,306	100%	237,306	100%	
Total Daily Trips (All)	*4,766,292*	*100%*	*4,765,911*	*100%*	*0%*

Table 4-12 shows the mode choice results by purpose for residents in the 2035 Cordon $10.00 Toll scenario model run. As with the Cordon $5.00 and $7.50 Toll scenarios, this table shows that overall islandwide mode choice is similar to the 2035 Baseline.

Table 4-13 shows the comparison of the 2035 Cordon $10.00 Toll mode choice results by purpose to the 2035 Baseline alternative results. This table shows the change and the percent change between 2035 Baseline and the Cordon $10.00 Toll scenario. Compared to the Cordon $5.00 and $7.50 Toll scenarios, the regional mode choice Cordon $10.00 Toll results showed a higher decrease in auto trips and higher increase in transit trips.

Table 4-14 shows the mode choice results by trip purpose for the trips to the cordon area only, with Table 4-15 revealing that there is a significant mode share shift to transit and out of the auto modes when looking at only trips to the cordon area. Overall auto trips to the cordon area decreased by 15%, 14%, and 12% respectively for single occupant vehicles, two occupant vehicles, and three-plus occupant vehicles, while transit trips to the cordon area increased between 37% and 57% for the transit modes. In total, there would be 20,900 less auto person trips entering the pricing area under the $10.00 cordon price scenario than in the 2035 Baseline. Under this scenario, there would be 13,600 more transit trips and 5,400 more non-motorized trips to the pricing area than in the 2035 Baseline. The changes for paying a $10.00 toll into the cordon area was more pronounced than the $5.00 and $7.50 toll scenarios.

Table 4-12. 2035 Cordon $10 Toll Scenario Mode Choice Summary Results by Trip Purpose for Residents

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	532,292	81,303	160,791	29,122	114,631	2,926	8,254	34,960	112,397	263,020	141,994	1,481,690
	59%	*37%*	*66%*	*32%*	*52%*	*24%*	*3%*	*47%*	*29%*	*27%*	*23%*	*37%*
Double-occupant vehicle	148,620	73,648	41,666	33,566	29,567	1,674	65,418	8,207	131,776	299,273	221,090	1,054,505
	16%	*33%*	*17%*	*37%*	*14%*	*14%*	*23%*	*11%*	*34%*	*30%*	*35%*	*26%*
Three-or-more occupant vehicle	39,696	46,160	12,370	15,860	11,515	419	104,724	2,693	95,346	246,156	204,224	779,163
	4%	*21%*	*5%*	*18%*	*5%*	*3%*	*37%*	*4%*	*25%*	*25%*	*33%*	*19%*
Walk to express transit	4,022	258	2	558	0	0	241	213	0	0	0	5,294
	0%	*0%*	*0%*	*1%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Walk to local bus transit	58,917	4,439	7,951	5,335	4,703	4,594	16,157	10,059	9,966	27,241	3,754	153,116
	7%	*2%*	*3%*	*6%*	*2%*	*38%*	*6%*	*14%*	*3%*	*3%*	*1%*	*4%*
Walk to fixed guideway transit	29,138	1,926	5,687	1,956	1,780	1,114	3,182	6,040	1,316	10,871	1,883	64,893
	3%	*1%*	*2%*	*2%*	*1%*	*9%*	*1%*	*8%*	*0%*	*1%*	*0%*	*2%*
Informal Park-and-ride transit	1,245	51	0	7	0	0	263	105	141	233	0	2,045
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Formal Park-and-ride transit	13,563	1	0	0	0	0	1	1,691	11	582	0	15,849
	1%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*2%*	*0%*	*0%*	*0%*	*0%*
Kiss-and-ride transit	11,684	266	16	0	1	1	1,554	1,966	757	1,717	3	17,965
	1%	*0%*	*0%*	*0%*	*0%*	*0%*	*1%*	*3%*	*0%*	*0%*	*0%*	*0%*
Walk	52,799	10,964	14,358	3,185	54,008	1,261	74,289	4,236	30,266	124,429	52,000	421,795
	6%	*5%*	*6%*	*4%*	*25%*	*11%*	*26%*	*6%*	*8%*	*13%*	*8%*	*10%*
Bike	12,975	1,880	1,015	34	2,194	12	8,487	3,544	2,574	11,591	2,577	46,883
	1%	*1%*	*0%*	*0%*	*1%*	*0%*	*3%*	*5%*	*1%*	*1%*	*0%*	*1%*
Total	*904,951*	*220,896*	*243,856*	*89,623*	*218,399*	*12,001*	*282,570*	*73,714*	*384,550*	*985,113*	*627,525*	*4,043,198*

Table 4-13. Comparison of 2035 Cordon $10 Toll Scenario to 2035 Baseline Mode Choice Results by Purpose for Residents (Change and Percent Change)

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	-5,892	-100	-1,424	-126	-1,206	-30	6	-953	-58	-1,141	-237	-11,161
	-1%	*0%*	*-1%*	*0%*	*-1%*	*-1%*	*0%*	*-3%*	*0%*	*0%*	*0%*	*-1%*
Double-occupant vehicle	-2,166	-103	-427	-172	-337	-34	44	-288	-111	-1,361	-421	-5,376
	-1%	*0%*	*-1%*	*-1%*	*-1%*	*-2%*	*0%*	*-3%*	*0%*	*0%*	*0%*	*-1%*
Three-or-more occupant vehicle	-1,320	-292	-303	-113	-128	-8	-77	-170	-82	-1,094	-375	-3,962
	-3%	*-1%*	*-2%*	*-1%*	*-1%*	*-2%*	*0%*	*-6%*	*0%*	*0%*	*0%*	*-1%*
Walk to express transit	574	36	0	31	0	0	1	7	0	0	0	649
	17%	*16%*	*0%*	*6%*	*0%*	*0%*	*0%*	*3%*	*0%*	*0%*	*0%*	*14%*
Walk to local bus transit	3,388	181	838	192	230	48	80	582	57	1,118	83	6,797
	6%	*4%*	*12%*	*4%*	*5%*	*1%*	*0%*	*6%*	*1%*	*4%*	*2%*	*5%*
Walk to fixed guideway transit	1,789	84	654	114	106	2	-4	323	-6	294	28	3,384
	7%	*5%*	*13%*	*6%*	*6%*	*0%*	*0%*	*6%*	*0%*	*3%*	*2%*	*6%*
Informal Park-and-ride transit	116	3	0	0	0	0	2	9	2	18	0	150
	10%	*6%*	*0%*	*0%*	*0%*	*0%*	*1%*	*9%*	*1%*	*8%*	*0%*	*8%*
Formal Park-and-ride transit	1,031	1	0	0	0	0	-1	129	-1	45	0	1,204
	8%	*0%*	*0%*	*0%*	*0%*	*0%*	*-50%*	*8%*	*-8%*	*8%*	*0%*	*8%*
Kiss-and-ride transit	1,020	13	1	0	0	0	2	128	6	81	0	1,251
	10%	*5%*	*7%*	*0%*	*0%*	*0%*	*0%*	*7%*	*1%*	*5%*	*0%*	*7%*
Walk	1,089	160	595	76	1,245	21	-86	118	186	1,857	888	6,149
	2%	*1%*	*4%*	*2%*	*2%*	*2%*	*0%*	*3%*	*1%*	*2%*	*2%*	*1%*
Bike	366	23	65	1	88	0	18	119	7	188	37	912
	3%	*1%*	*7%*	*3%*	*4%*	*0%*	*0%*	*3%*	*0%*	*2%*	*1%*	*2%*
Total	-5	6	-1	3	-2	-1	-15	4	0	5	3	-3
	0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*

Table 4-14. Comparison of 2035 Cordon $10.00 Toll Scenario to 2035 Baseline Mode Choice to <u>Cordon Area</u> Results by Purpose for Residents (Difference in Trips)

Mode	Purpose											*Total*
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	-6,000	-146	-1,505	-136	-1,183	-40	-3	-857	-29	-1,047	-365	-11,311
Double-occupant vehicle	-2,457	-201	-490	-201	-321	-36	-41	-308	-114	-1,303	-597	-6,069
Three-or-more occupant vehicle	-955	-152	-218	-113	-123	-9	-121	-161	-82	-1,055	-543	-3,532
Walk to express transit	564	35	0	30	0	0	2	7	0	0	0	638
Walk to local bus transit	3,117	161	805	176	227	33	46	444	49	1,145	82	6,285
Walk to fixed guideway transit	1,946	98	701	121	127	16	20	339	5	399	42	3,814
Informal Park-and-ride transit	118	4	0	1	0	0	1	9	2	17	0	152
Formal Park-and-ride transit	1,133	0	0	0	0	0	0	136	0	50	0	1,319
Kiss-and-ride transit	1,104	13	1	0	0	0	7	133	7	87	0	1,352
Walk	974	127	584	75	749	7	57	109	59	1,196	588	4,525
Bike	376	21	66	1	88	0	15	115	6	172	37	897
Total	-80	-40	-56	-46	-436	-29	-17	-34	-97	-339	-756	-1,930

Table 4-15. Comparison of 2035 Cordon $10.00 Toll Scenario to 2035 Baseline Mode Choice to <u>Cordon Area</u> Results by Purpose for Residents (Percent Change)

Mode	Purpose											Total
	Journey-to-Work / Home-Based-Work	Journey-to-Work / Home-Based-Other	Journey-to-Work / Work-Based	Journey-to-Work / Non-Home-Based	Journey-at-Work / Work-Based	Journey-at-Work / Non-Home-Based	Non-Work-Related / Home-Based-School (K-12)	Non-Work-Related / Home-Based-College	Non-Work-Related / Home-Based-Shopping	Non-Work-Related / Home-Based-Other	Non-Work-Related / Non-Home-Based	
Single-occupant vehicle	-18%	-7%	-13%	-18%	-21%	-45%	-20%	-54%	-2%	-8%	-9%	-15%
Double-occupant vehicle	-22%	-8%	-12%	-17%	-21%	-45%	-19%	-55%	-8%	-9%	-9%	-14%
Three-or-more occupant vehicle	-22%	-7%	-12%	-17%	-21%	-45%	-17%	-56%	-8%	-9%	-9%	-12%
Walk to express transit	47%	55%	0%	51%	n/a	n/a	40%	23%	n/a	n/a	n/a	47%
Walk to local bus transit	36%	44%	70%	60%	66%	11%	29%	29%	22%	36%	62%	39%
Walk to fixed guideway transit	33%	45%	62%	56%	70%	11%	31%	32%	17%	32%	67%	37%
Informal Park-and-ride transit	55%	67%	n/a	n/a	n/a	n/a	33%	82%	67%	57%	n/a	57%
Formal Park-and-ride transit	48%	n/a	n/a	n/a	n/a	n/a	n/a	53%	n/a	53%	n/a	49%
Kiss-and-ride transit	48%	52%	33%	n/a	n/a	n/a	37%	56%	41%	41%	n/a	48%
Walk	19%	20%	47%	52%	24%	8%	8%	26%	10%	21%	38%	23%
Bike	30%	21%	61%	50%	59%	0%	23%	41%	27%	33%	51%	35%
Total	0%	0%	0%	-1%	-4%	-4%	-1%	-1%	-2%	-1%	-4%	-1%

4.3 Cordon Pricing Scenario Assignment Results

This section describes the assignment results such as VMT, VHT, VHD, and transit boardings by mode associated with the 2035 Cordon Pricing sensitivity test scenario, comparing it to the 2035 Baseline results. The previous mode choice section showed that the overall differences differed slightly between the $5, $7.50, and $10 toll, with an approximately linear mode shift effect across the three alternatives, thus showing no clear differentiation among the three. For these reasons, the remainder of this document describes results obtained for the $7.50 toll alternative.

4.3.1 Cordon Pricing Scenario Highway Assignment

The highway assignment in the model produces summaries of the total islandwide daily VMT by motorized vehicles (automobiles, buses, and commercial vehicle) as estimated by the travel demand forecasting model for the 2035 sensitivity test scenarios. Table 4-16 shows the summary of the daily VMT by facility type and area type.[7]

Table 4-17 shows that the overall VMT is forecasted to remain similar to the 2035 Baseline scenario. However, the collectors in area type 1 (Downtown area) showed a 12% increase over the Baseline, as some autos were shifting to collector roadways to avoid the cordon pricing area.

Table 4-18 shows VHT by facility type and area type in 2035, and Table 4-19 shows the percent change in VHT from 2035 Baseline scenario to 2035 Cordon Pricing scenario. The model forecasts 463,130 hours of travel in the 2035 Cordon Pricing scenario, similar to the 2035 Baseline scenario. The collectors in area type 1 show a 40% increase in VHT over the Baseline as autos shift to avoid the cordon pricing area.

Table 4-20 shows 2035 Cordon Pricing scenario VHD forecasted by the travel demand forecasting model, and Table 4-21 shows the percent change in VHD between the 2035 Baseline and the 2035 Cordon Pricing scenarios. Overall VHD is projected to remain similar to the Baseline, but the collectors in area type 1 (Downtown area) and area type 3 (areas surrounding the Downtown area) increased 157% and 27% respectively as vehicles used these roadways to avoid being charged.

Figure 4-3 shows differences in AM 2-hour volumes between the Baseline and Cordon $7.50 Toll scenario in the cordon pricing area. Clearly, South King Street and Beretania Street had less volume in the Cordon $7.50 Toll scenario compared to the Baseline, while Vineyard Boulevard and Nimitz Highway/Ala Moana Boulevard

[7] See Appendix Table A - 1 for area type definitions.

had increased volumes in the Cordon $7.50 Toll scenario to go around the cordon area.

Figure 4-4 shows the auto travel time to Downtown for the 2035 Cordon $7.50 Toll scenario from the static equilibrium two-hour AM peak period highway assignment. Figure 4-5 shows that the difference in auto time to Downtown between the Baseline and cordon $7.50 toll scenario is minimal as can be seen by the ranges in the legend. The largest negative difference was 9 minutes while the largest positive difference was 0.7 minutes.

Table 4-16. 2035 Cordon $7.50 Toll Scenario VMT by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0	153,755	507,973	1,174,775	2,703,192	367,382	812,792	234,459	5,954,328
Expressways	0	0	36,336	170,188	447,050	371,101	513,451	159,584	1,697,710
Ramps	0	17,154	36,207	165,975	366,351	28,305	161,534	18,027	793,553
Arterials	119,014	250,035	598,521	722,049	1,520,471	260,788	1,052,879	399,338	4,923,095
Collectors	16,355	35,011	144,448	372,598	773,793	19,240	388,134	39,464	1,789,043
Total	135,369	455,955	1,323,485	2,605,585	5,810,857	1,046,816	2,928,790	850,872	15,157,729

Table 4-17. Percent Change from 2035 Baseline to 2035 Cordon $7.50 Toll Scenario VMT by Facility Type and Area Type

	Area Type								
Facility Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**All Areas**
Freeways	0%	1%	0%	0%	0%	0%	0%	0%	0%
Expressways	0%	0%	-3%	0%	0%	0%	0%	0%	0%
Ramps	0%	0%	2%	0%	0%	-1%	0%	0%	0%
Arterials	-7%	-1%	-3%	0%	0%	0%	0%	0%	-1%
Collectors	12%	5%	3%	0%	0%	-1%	0%	0%	0%
Total	-5%	0%	-1%	0%	0%	0%	0%	0%	0%

Table 4-18. 2035 Cordon $7.50 Toll Scenario VHT by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0	4,154	16,920	25,162	55,544	6,895	16,178	4,686	129,539
Expressways	0	0	811	5,176	10,471	9,073	10,703	3,108	39,342
Ramps	0	1,699	2,767	10,141	17,198	649	7,578	860	40,892
Arterials	5,520	12,407	27,716	28,302	54,858	7,508	30,200	9,332	175,843
Collectors	1,015	2,810	7,908	17,403	34,132	683	12,553	1,010	77,514
Total	6,535	21,070	56,122	86,184	172,203	24,808	77,212	18,996	463,130

Table 4-19. Percent Change from 2035 Baseline to 2035 Cordon $7.50 Toll Scenario VHT by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0%	10%	4%	-1%	-1%	0%	-1%	0%	0%
Expressways	0%	0%	-6%	-1%	0%	-1%	-1%	-1%	-1%
Ramps	0%	4%	8%	-1%	0%	-1%	0%	-1%	0%
Arterials	-5%	-2%	-4%	0%	-1%	0%	0%	0%	-1%
Collectors	40%	7%	9%	0%	1%	-1%	0%	0%	2%
Total	0%	1%	0%	0%	0%	-1%	0%	0%	0%

Table 4-20. 2035 Cordon $7.50 Toll Scenario VHD by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0	1,633	8,592	6,214	12,635	1,063	3,277	965	34,379
Expressways	0	0	185	2,293	3,020	2,888	2,285	492	11,163
Ramps	0	1,139	1,724	5,564	8,664	79	3,963	477	21,610
Arterials	760	2,406	3,772	7,912	11,888	983	5,848	833	34,402
Collectors	362	1,410	2,129	4,669	7,180	108	2,424	133	18,415
Total	1,122	6,588	16,402	26,652	43,387	5,121	17,797	2,900	119,969

Table 4-21. Percent Change from 2035 Baseline to 2035 Cordon $7.50 Toll Scenario VHD by Facility Type and Area Type

	Area Type								
Facility Type	1	2	3	4	5	6	7	8	All Areas
Freeways	0%	26%	7%	-1%	-2%	1%	-2%	-1%	2%
Expressways	0%	0%	-15%	-2%	-1%	-3%	-3%	-4%	-2%
Ramps	0%	5%	12%	-1%	0%	-2%	0%	-2%	1%
Arterials	9%	-6%	-7%	-1%	-1%	0%	-1%	-1%	-2%
Collectors	157%	9%	27%	0%	3%	-3%	0%	2%	6%
Total	34%	6%	6%	-1%	-1%	-2%	-1%	-1%	1%

Figure 4-3. Map of AM 2-Hour Flow Differences Between Baseline and Cordon $7.50 Toll Scenarios

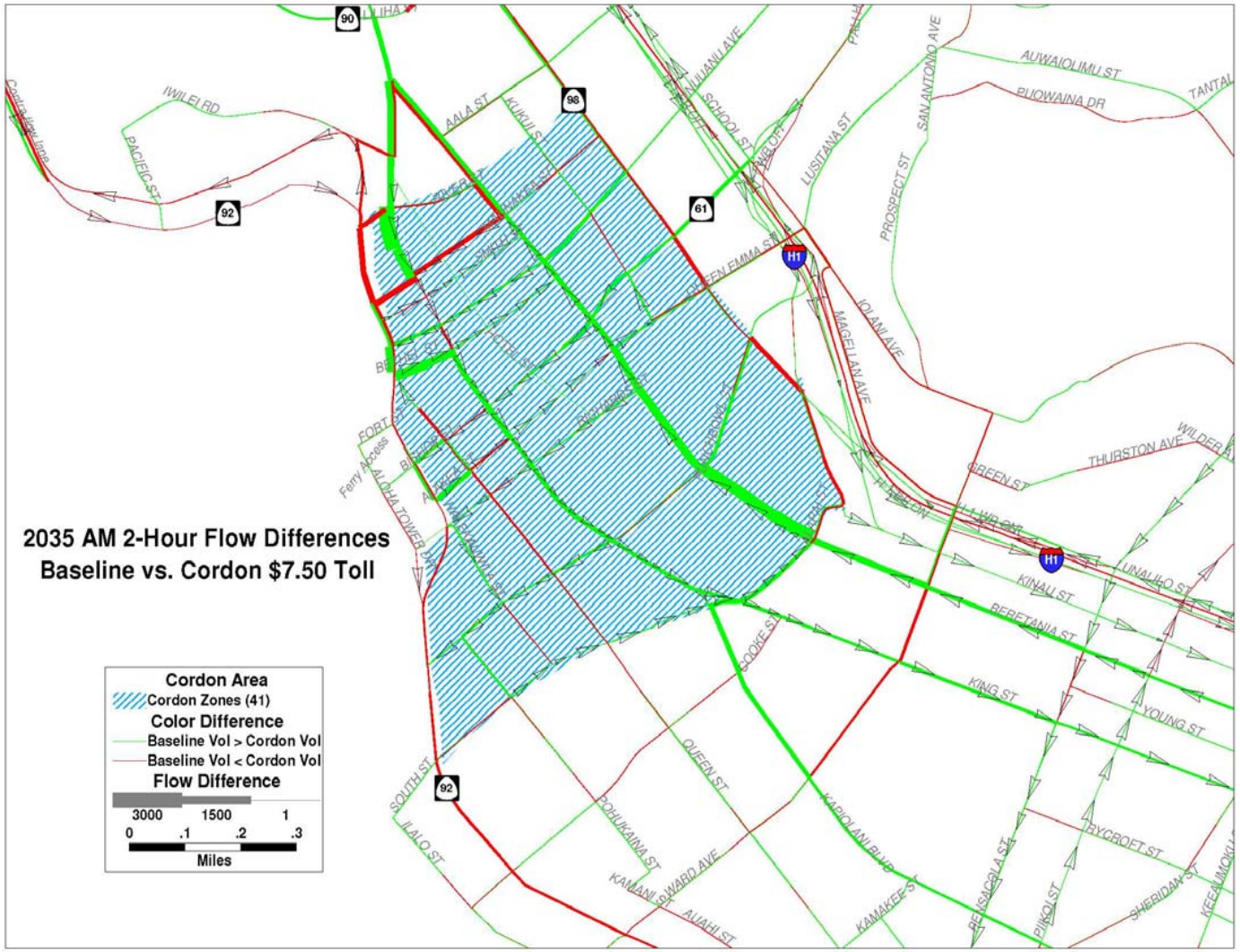


Figure 4-4. 2035 Cordon $7.50 Toll Scenario AM 2-Hour Static Assignment Auto Time to Downtown

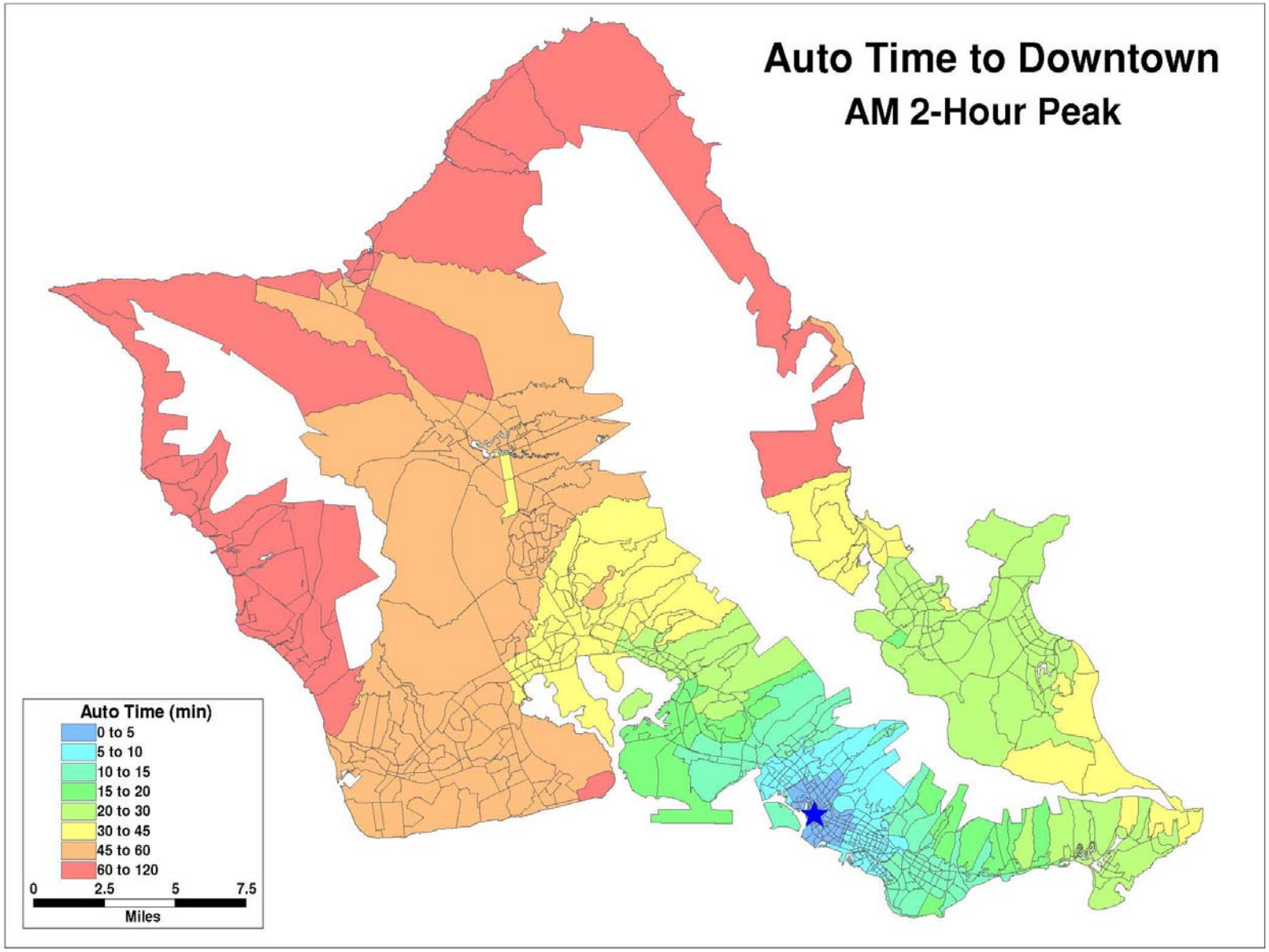
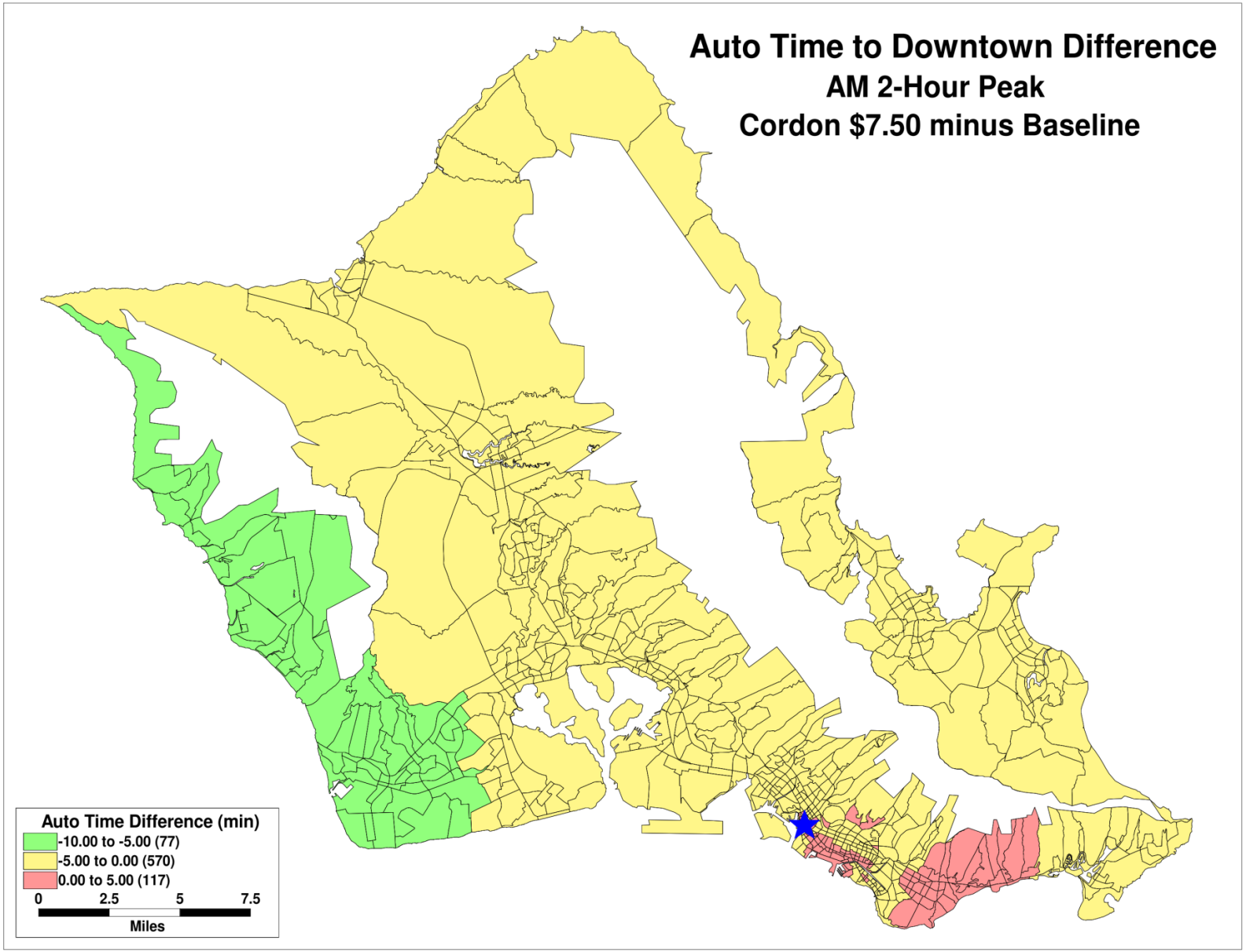


Figure 4-5. Difference in AM 2-Hour Static Assignment Auto Time to Downtown – Cordon $7.50 Toll vs. Baseline



4.3.2 Cordon Pricing Scenario Transit Assignment

Table 4-22 shows 2035 Cordon $7.50 Toll scenario transit boardings by period (peak versus off-peak) and mode for residents, visitors, and ground access air passengers. Table 4-23 shows the percent change in transit boardings from 2035 Baseline to the Cordon $7.50 Toll scenario. Total boardings increase by three percent.

Table 4-22. Cordon $7.50 Toll Scenario 2035 Transit Boardings By Period and Mode

	Boardings By Mode					
Period/Mode	Local	Express	Limited	Guideway	Ferry	Total
Peak	179,557	8,291	7,142	76,333	0	271,323
Off-Peak	94,468	0	5,414	27,863	0	127,745
Total	274,025	8,291	12,556	104,196	0	399,068

Table 4-23. Percent Change in Transit Boardings, 2035 Baseline to Cordon $7.50 Toll Scenario

	Boardings By Mode					
Period/Mode	Local	Express	Limited	Guideway	Ferry	Total
Peak	3%	10%	5%	5%	0%	4%
Off-Peak	1%	0%	7%	1%	0%	1%
Total	2%	10%	6%	4%	0%	3%

4.4 Summary of Cordon Pricing Scenario Findings

These are the key findings of the Cordon Pricing scenario:

- Pricing auto trips to the Downtown area causes significant modal shifts; fewer auto trips and increased transit and non-motorized trips.
- Increasing the cordon toll causes a higher shift to transit and motorized and a shift away from auto.
- Overall VMT, VHT, and VHD did not change, but VMT and VHT changed slightly for the cordon area (area type 1) for collectors, while the VHD increased substantially. This indicates that autos were shifting to other roads to avoid the cordon area. Nimitz Highway/Ala Moana Boulevard showed increased volumes to avoid the cordon area, but H-1 showed minimal change from the Baseline.
- The cordon pricing analysis examined specifically artificial cost thresholds to determine impact on transportation system performance. Further analyses are required to test alternative pricing policy options such as pricing to reduce congestion, maximizing revenue, or a combination of both.

Table A - 1. Area-Type Definitions Based on Population and Employment Densities

Employment Category (Employees per Square Mile)		1 ≤12	2 ≤93	3 ≤397	4 ≤1,615	5 ≤6,202	6 ≤22,630	7 ≤78,500	8 >78,500
Population Category (Population per Square Mile)									
1	0	8	8	7	6	4	4	2	1
2	≤192	8	8	6	6	4	4	2	1
3	≤1,623	7	7	7	6	4	4	2	1
4	≤4,975	7	7	7	7	4	4	2	1
5	≤11,588	5	5	5	5	5	4	2	1
6	≤24,000	5	5	5	5	5	5	2	1
7	≤42,866	3	3	3	3	3	3	3	1
8	>42,866	3	3	3	3	3	3	3	1

Bibliography

Oahu Metropolitan Planning Organization (OahuMPO). 2010. *Sensitivity Test Scenarios Definition Technical Memorandum.*

Oahu Metropolitan Planning Organization (OahuMPO). 2007. *Oahu Regional Transportation Plan 2030 with Amendment #1.*