EVALUATION OF NCHRP 8-51 AND EPA MIXED USE DEVELOPMENT INTERNAL CAPTURE MODELS

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Introduction

- What is a Mixed Use Development?

  As discussed later, definitions vary even between the two models, but essentially a mixed use development combines two or more land uses, such as residential, office and commercial space.

- What is Internal Capture?

  Internal capture is what occurs when someone in a mixed use development makes a trip within the development instead of going to a similar place outside the development.

- Why does Internal Capture matter?

  Internal Capture reduces a development's impact on congestion, air quality and energy consumption.

Introduction

- Why are there two models?
  - Actually there are three: the ITE <u>Trip Generation Handbook</u> contains the only currently accepted model for estimating internal capture.
  - The ITE model has some limitations:
    - Based on a study of three developments in and near Boca Raton, FL
    - Addresses only midday and PM peak hours
    - Addresses only office, residential and retail land uses
    - No adjustments for site characteristics such as walkability or connectivity

Introduction

- TRB, through the NCHRP, created Project 8-51 to improve on the ITE model. They received two good proposals for how to do that. Their Project Panel selected the proposal from the Texas Transportation Institute, which has since developed the NCHRP 8-51 model discussed here.
- EPA, which is represented on the NCHRP Project Panel, found merit in the other proposal, this one from the consulting firm Fehr & Peers. They paid for its development as the EPA model discussed here.

Current Status of the Models

- The ITE Model remains the only one currently adopted.
- The NCHRP 8-51 report is largely complete but does not have final approval from its Project Panel.
- The EPA model is in beta testing but has not been approved for use in air quality modeling. The version addressed in this presentation is Version 4.

How the Models Were Developed

NCHRP 8-51

- Peak period travel surveys at 6 mixed-use developments (MXD), 3 in FL, 2 in TX, 1 in GA
- Model begins with the use of ITE-based peak hour traffic
- Model previously developed for ITE Trip Generation Handbook expanded to include new data (from TX and GA), from 3 land uses to 6 land uses, to include adjustments for proximity of uses within the development, and to address both AM and PM Peak Hours (Daily and Midday traffic not addressed)
- Mode split (auto, walk, transit) of external trips is not addressed
- Model validated using data from 7 sites

EPA

- Household travel survey data from 239 multi-use developments (MXD)
- Model begins with the use of ITE-based daily and peak hour traffic.
- Model sums the ITE results and factors those sums to get trips by purpose (HBW, HBO, NHB)
- Model estimates the probabilities of trips remaining internal to the site, being on foot, or being on transit for each trip purpose (Note that external walking and transit trips are different from internal capture.)
- Model validated using data from 16 sites. Validation was done only for daily traffic trips and only for overall trip reduction, not separately for internal trip capture, walking and transit.

Applicable Developments

NCHRP 8-51

- Land Use Mix – combination of at least three of the following uses: retail, restaurant, office, residential, hotel, and cinema
- Development Type - a single, physically and functionally integrated development on a single block or a group of contiguous blocks: with internal pedestrian and vehicular connectivity; and with shared parking among some or all uses.
- Parking supply is sufficient to meet demand
- Development Location - midtown or suburban; not in or adjacent to a CBD.
- Development Size –between 100,000 and 5 million square feet of building space within an overall acreage of up to about 300 acres; use caution if less than 500,000 square feet or 7 acres or more than 3 million square feet or 250 acres

EPA

- Land Use Mix - two or more land uses, possibly including residential, retail, office, and/or entertainment.
- Development Type – trips between land uses can be made using local streets, without having to use major streets. There may be walk trips between the uses.
- Parking supply is not addressed.
- Development Location is not addressed.
- Development Size – between 5 acres and 2,000 acres; less than 5,000 dwellings and less than 3 million square feet of commercial space.

Inputs

NCHRP 8-51

- Site plan of sufficient detail to quantify development for use of ITE Trip Generation report and to estimate walking distances between uses
- Peak hour vehicle occupancy rates
- Mode splits by land use

EPA

- Required: developed acreage; number of intersections within and along the development edge; presence of transit; location within a CBD or transit-oriented development; number of jobs within one mile of edge of site; number of jobs within a 30-minute transit commute; numbers of single-family, multi-family and high-rise condominium dwelling units; trip generation variables (most commonly floor area) for 8 types of commercial use, 2 types of office use, 3 types of industrial use, hotels, motels, movie theaters, and 4 types of schools; average auto ownership;
- Optional (defaults available if data is not available): average household size for each housing type; numbers of employees per trip generation variable on the above land uses; average internal and external trip lengths; trip purpose splits (HBW,HBO, NHB) by land use; and site-specific internalization percentages

Outputs

NCHRP 8-51

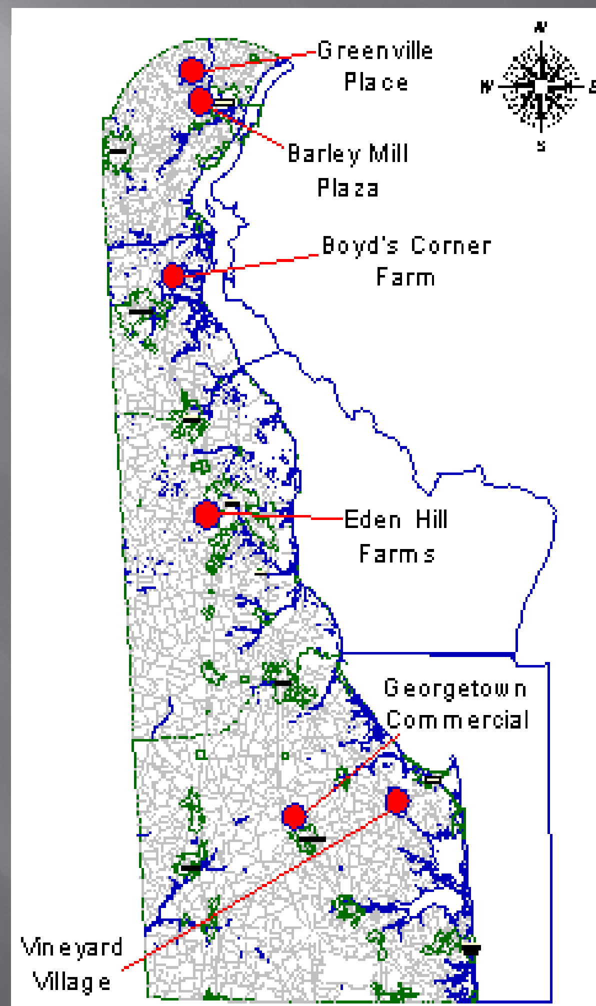
- AM peak hour and PM peak hour internal and external vehicle trips in and out of each land use in the development.
- If there are pedestrian facilities and destinations within walking distance or if transit is available, it may be appropriate to further reduce the external vehicle trips. The EPA model may be helpful in these regards. NCHRP 8-51 provides no guidance in this area.

EPA

- Daily, AM peak hour and PM peak hour internal trips, and external walking trips, transit trips and vehicle trips in and out of the development, classified by trip purpose (home-based work, home-based other and non-home-based).
- The external walking and transit trips reported are the <u>increases</u> over those that a comparable conventional development would generate.

Delaware Examples

Six Current and Proposed Mixed Use Developments



Delaware Examples

Comparison of Internal Capture Percentages*

Development	Status	Description	ITE Trip Generation Handbook			NCHRP 8-51				EPA			
			Daily	AM	PM	Daily	AM	PM	PM Δ from ITE	Daily	AM	PM	PM Δ from ITE
Vineyards at Nassau Valley	Partially Built	927 condominiums, 150-room hotel, 75,000 SF office, 317,000 SF retail, 33,000 SF restaurant	N/A	N/A	15.7	N/A	20.9	31.0	+15.3	5.1	4.7	5.1	-10.6
Greenville Place	Partially Built	27 multi-family DUs, 62,256 SF office, 94,703 SF retail	N/A	N/A	5.2	N/A	15.7	19.5	+14.3	1.8	1.4	1.9	-3.3
Boyds Corner Farm	Proposed	400 multi-family DUs, 40,000 SF office, 175,000 SF retail	N/A	N/A	16.6	N/A	4.4	20.0	+3.4	4.8	4.1	4.7	-11.9
Barley Mill Plaza	Proposed	700 multi-family DUs, 1,434,638 SF office, 488,000 SF retail, 200-room hotel	N/A	N/A	11.4	N/A	12.1	17.5	+6.1	2.4	1.9	2.4	-9.0
Georgetown Commercial	Proposed	105 single-family DUs, 317 multi-family DUs, 50,800 SF office, 64,496 SF retail, 10,800 SF restaurant, 72 hotel rooms	N/A	N/A	17.0	N/A	21.8	40.7	+23.7	7.7	6.6	7.5	-9.5
Eden Hill Farms	Partially Built	291 single-family DUs, 355 townhouses, 230,441 SF office, 154,500 SF retail	N/A	N/A	11.8	N/A	7.6	24.5	+12.7	9.7	6.4	9.4	-2.4

*Does not include external walk or transit trips.

Observations

- Both models yield PM Peak Hour results similar to the ITE procedure, except that when restaurants and hotels are identified as part of the development the NCHRP model shows much more internal capture. The proximity of the uses is also significant in the NCHRP model. Therefore it is important for the analyst using this model know the site layout and to identify these components of proposed commercial areas if they are planned.
- The EPA model consistently shows less, often much less, internal capture than the ITE and NCHRP models.
- Both models tend to show more internal capture in the PM peak hour than in the AM peak hour, but the NCHRP 8-51 model shows much greater differences between AM and PM. Possible explanations include the nature of the survey instrument (on-site exit interviews vs. household travel surveys) and the size of the developments considered (some of EPA's were much larger).

Sensitivity Analysis

- Sensitivity analyses have been done for both the NCHRP and EPA models to determine which variables have the most influence on model results.
- For each of the six example developments, each of the variables was increased in three to four increments of increasing magnitude. For example, in evaluating the EPA model, the number of single-family detached houses was increased first by 50, then by 100, then by 200.

Sensitivity Analysis Results NCHRP 8-51

Input / Increments	Vineyards		Greenville Place		Boyds Corner Farm		Barley Mill Plaza		Georgetown Commercial		Eden Hill Farms	
	AM Change	PM Change	AM Change	PM Change	AM Change	PM Change	AM Change	PM Change	AM Change	PM Change	AM Change	PM Change
Residential Size												
Increase of 50 units	-0.6	1.9	-0.8	6.3	-0.1	3.1	-0.2	1.2	-0.9	-0.8	-0.1	-0.7
Increase of 100 units	-1	3	-1.4	11	-0.3	4.5	-0.3	2.1	-1.3	-2.1	-0.2	-1.3
Increase of 200 units	-1.6	4.9	-2.4	17.2	-0.5	5.9	-0.5	3.9	-2.6	-4.3	-0.3	-2.3
Retail Size												
100,000 SF	-0.6	-5.7	-3	-2.7	-1.1	-6.6	0.2	-2.1	-0.3	-12.1	-1.1	-2.3
200,000 SF	-1.1	-8.3	-4.4	-3.5	-1.4	-8.8	-0.2	-3	-0.6	-16.6	-1.5	-5.2
400,000 SF	-1.8	-11.3	-6.1	-4.2	-1.9	-11.1	-0.7	-4.3	-1.8	-21.4	-2.1	-8.7
Office Size												
100,000 SF	4.6	-0.1	-2.4	1.7	2.8	0.2	-0.4	-0.1	7.1	-2.8	1.1	-0.6
200,000 SF	7.2	-0.6	-4.1	2.4	3.8	-0.1	-0.6	-0.2	8.1	-4.2	1.3	-0.9
400,000 SF	7.2	-1.5	-6.8	3.5	5.1	-0.7	-1	-0.3	5	-6.8	1	-1.8
Cinema Size												
10 screens	0	2.8	0	4.8	0	3.6	0	1.4	0	2.9	0	2.6
14 screens	0	3.2	0	4.2	0	3.4	0	1.9	0	0.9	0	2.3
18 screens	0	3.6	0	3.6	0	2.5	0	2.3	0	-0.5	0	1.9
Hotel Size												
50 rooms	-0.2	0	0.9	0.8	0.8	0.4	0	0.1	-0.1	-0.1	0.6	0.2
100 rooms	-0.4	0	0.9	1.7	0.5	0.9	-0.1	0.3	-0.6	-0.4	1.6	0.7
200 rooms	-0.8	0.3	-1.1	2.8	-0.1	1.3	-0.4	0.4	-1.3	-1.6	1	1
Restaurant Size												
5,000 SF	-2.1	4.6	15.1	13.1	16.5	10.4	9.8	4.2	-4.5	7.5	18.4	7.9
10,000 SF	-4.7	7.3	13.2	21.7	11.7	16.9	14.4	8	-7.9	10.7	18.9	14.3
20,000 SF	-8.2	11.6	4.6	30.2	6.2	22.8	18.3	13	-11.9	8.6	15.6	21.7
Distance to Residential												
1,000 Feet	-1.6	-1.9	0	-0.3	-0.2	-2.1	0	-1.1	-1.9	-2.9	-0.1	-2.2
2,000 Feet	-4.4	-7.7	0	-0.9	-0.5	-8	-0.2	-4.1	-5.5	-10.7	-0.5	-8.8
3,000 Feet	-5.9	-12.2	0	-1.4	-0.8	-12.6	-0.2	-6.5	-7.4	-16.9	-0.7	-14.3
Distance to Retail												
1,000 Feet	-0.4	-1.6	-2.9	-0.9	-0.5	-2.5	-1.1	-2.5	-0.4	-2.4	-0.8	-2.9
2,000 Feet	-0.9	-6.3	-8.3	-2.8	-1.4	-8.8	-3.2	-8.2	-1	-9	-2.3	-10.6
3,000 Feet	-1.2	-9.9	-11	-3.9	-1.9	-13.7	-4.2	-11.8	-1.4	-14.2	-3.1	-16.6
Distance to Office												
1,000 Feet	-0.7	-0.1	-2.9	-0.7	-0.3	-0.4	-1	-1.5	-0.7	-0.5	-0.6	-0.7
2,000 Feet	-1.7	-0.7	-8.2	-2	-0.9	-1.1	-3	-4.4	-2	-1.4	-1.8	-2.3
3,000 Feet	-2.2	-1.1	-10.9	-2.6	-1.1	-1.6	-3.9	-5.9	-2.7	-2	-2.4	-3.2
Distance to Cinema												
1,000 Feet	0	0	0	0	0	0	0	0	0	0	0	0
2,000 Feet	0	0	0	0	0	0	0	0	0	0	0	0
3,000 Feet	0	0	0	0	0	0	0	0	0	0	0	0
Distance to Hotel												
1,000 Feet	0	0	0	0	0	0	0	0	0	0	0	0
2,000 Feet	0	0	0	0	0	0	0	0	0	0	0	0
3,000 Feet	0	0	0	0	0	0	0	0	0	0	0	0
Distance to Restaurant												
1,000 Feet	-1.9	-0.5	0	-0.2	0	0	0	0	-2.3	-0.9	0	0
2,000 Feet	-5.2	-2	0	-0.5	0	0	0	0	-6.5	-2.9	0	0
3,000 Feet	-7	-3.1	0	-0.8	0	0	0	0	-8.7	-4.8	0	0

Sensitivity Analysis Results EPA (page 1 of 2)

Input / Increments	Vineyards			Greenville Place			Boyds Corner Farm			Barley Mill Plaza			Georgetown Commercial			Eden Hill Farms		
	Daily Change	AM Change	PM Change	Daily Change	AM Change	PM Change	Daily Change	AM Change	PM Change	Daily Change	AM Change	PM Change	Daily Change	AM Change	PM Change	Daily Change	AM Change	PM Change
SFDU																		
Increase of 50 SFDU	0	0.1	0	0.4	0.5	0.4	0	0.1	0.1	0	0	0	0.2	0.2	0.1	0.1	0.1	0.1
Increase of 100 SFDU	0.1	0.1	0	0.6	0.8	0.6	0.1	0.2	0.1	0	0.1	0.1	0.3	0.3	0.2	0.1	0.2	0.2
Increase of 200 SFDU	0.2	0.2	0.1	0.9	1.2	0.8	0.3	0.4	0.3	0.1	0.1	0.1	0.2	0.2	0.1	0.3	0.4	0.3
MFDU																		
Increase of 50 MFDU	0	0.1	0	0.4	0.5	0.4	0.1	0.1	0.1	0	0	0	0.2	0.2	0.1	0.1	0.1	0.1
Increase of 100 MFDU	0.1	0.1	0.1	0.6	0.8	0.6	0.1	0.2	0.2	0	0.1	0.1	0.3	0.3	0.2	0.2	0.2	0.2
Increase of 200 MFDU	0.2	0.2	0.1	0.9	1.2	0.9	0.3	0.4	0.3	0.1	0.1	0.1	0.4	0.4	0.3	0.3	0.4	0.3
High-Rise Condo																		
Increase of 50 Units	0.1	0.1	0	0.4	0.5	0.4	0	0.1	0.1	0	0	0.1	0.2	0.2	0.1	0.1	0.1	0.1
Increase of 100 Units	0.1	0.1	0.1	0.6	0.9	0.6	0.1	0.2	0.2	0	0.1	0.1	0.3	0.3	0.2	0.2	0.2	0.2
Increase of 200 Units	0.2	0.2	0.1	0.9	1.2	0.9	0.3	0.4	0.3	0.1	0.1	0.1	0.4	0.4	0.3	0.3	0.4	0.4
General Retail SF																		
100,000 SF	-0.1	-0.2	-0.1	0	-0.1	0	-0.2	-0.3	-0.1	-0.1	0	0	-0.2	-0.6	-0.2	-0.1	-0.2	0.1
200,000 SF	-0.2	-0.3	-0.2	0	-0.2	0	-0.4	-0.5	-0.2	-0.1	-0.1	0	-0.4	-1	-0.3	-0.1	-0.3	0.1
400,000 SF	-0.4	-0.6	-0.3	0	-0.3	0	-0.5	-0.8	-0.4	-0.1	-0.1	0	-0.7	-1.5	-0.5	-0.2	-0.5	0.1
Supermarket SF																		
25,000 SF	0	0	-0.1	0	0	0	-0.1	0	0	0	0	0	0	-0.1	0	0	0	0.1
50,000 SF	-0.1	-0.1	-0.1	0	-0.1	0	-0.1	-0.1	-0.1	0	0	0	0	-0.2	0	0.1	0.1	0.2
75,000 SF	-0.1	-0.1	-0.1	0	-0.1	0	-0.2	-0.2	-0.1	0	0	0	-0.1	-0.3	0	0.1	0.1	0.2
Bank SF																		
2,000 SF	0	0	0	0	0	0	-0.1	0	0	0	0	0	0	0	0	0	0	0
4,000 SF	0	0	0	0	0	0	-0.1	0	0	0	0	0	0.1	0	0	0	0	0.1
6,000 SF	0	0	0	0	0	0	-0.1	0	0	0	0	0	0.1	0	0	0	0.1	0.1
Health Club SF																		
2,000 SF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4,000 SF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6,000 SF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HTSD Restaurant SF																		
2,000 SF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4,000 SF	0	0	0	0	0	0	-0.1	0	0	0	0	0	0	0	0	0	0	0
6,000 SF	0	0	0	0	0	0	-0.1	0	0	0	0	0	0	0	0	0	0.1	0.1
FF Restaurant SF																		
2,000 SF	0	0	0	0	0	0	0	0.1	0	0	0	0	0.1	0.1	0	0	0.1	0.1
4,000 SF	0	0	0	0	0	0	0	0.1	0	0	0	0	0.1	0.1	0	0	0.2	0.1
6,000 SF	0	0	0	0	0	0	0	0.1	0	0	0	0	0.1	0.2	0	0.1	0.3	0.1
Gas Station SF																		
2,000 SF	0	0	0	0	0	0	0	0.1	0	0	0	0	0.1	0.1	0.1	0.1	0.2	0.1
4,000 SF	0	0	0	0	0	0	0	0.1	0	0	0	0	0.2	0.2	0.1	0.1	0.3	0.2
6,000 SF	0	0	0	0	0	0	0	0.1	0	0	0	0	0.2	0.2	0.2	0.2	0.5	0.3
Auto Repair SF																		
2,000 SF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4,000 SF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6,000 SF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Office SF																		
100,000 SF	-0.2	-0.3	-0.2	0	-0.2	0	-0.3	-0.5	-0.3	-0.1	-0.1	0	-0.6	-1	-0.6	-0.3	-0.5	-0.2
200,000 SF	-0.3	-0.5	-0.3	0	-0.3	0	-0.5	-0.8	-0.4	-0.1	-0.1	0	-0.9	-1.6	-0.9	-0.5	-0.8	-0.4
400,000 SF	-0.5	-0.8	-0.5	0	-0.4	0	-0.7	-1.2	-0.6	-0.1	-0.1	0	-1.3	-2.3	-1.2	-0.7	-1.3	-0.6
Med Office SF																		
20,000 SF	0	0	-0.1	0	0	0	-0.1	-0.1	-0.1	0	0	0	-0.1	-0.3	-0.2	-0.1	-0.1	-0.1
40,000 SF	-0.1	-0.1	-0.1	0	-0.1	0	-0.2	-0.2	-0.1	0	0	0	-0.3	-0.5	-0.3	-0.2	-0.2	-0.1
60,000 SF	-0.1	-0.2	-0.1	0	-0.1	0	-0.3	-0.3	-0.2	0	0	0	-0.4	-0.7	-0.4	-0.3	-0.3	-0.2
Light Industrial Jobs																		
50	0	0	-0.1	0	0	0	-0.1	-0.1	-0.1	0	0	0	-0.1	-0.2	-0.2	-0.1	-0.1	0
100	-0.1	-0.1	-0.1	0	0	0	-0.2	-0.2	-0.1	0	0	0	-0.2	-0.4	-0.3	-0.2	-0.2	-0.1
150	-0.1	-0.1	-0.1	0	0	0	-0.2	-0.3	-0.2	0	0	0	-0.4	-0.6	-0.4	-0.2	-0.3	-0.2
Manufacturing SF																		
50,000 SF	0	0	0	0	0	0	-0.1	-0.1	0	0	0	0	0	-0.2	-0.1	-0.1	-0.1	-0.1
100,000 SF	0	0	-0.1	0	0	0	-0.1	-0.2	-0.1	0	0	0	-0.1	-0.3	-0.2	-0.1	-0.2	-0.1
150,000 SF	-0.1	-0.1	-0.1	0	0	0	-0.2	-0.2	-0.1	0	0	0	-0.2	-0.5	-0.3	-0.2	-0.3	-0.2
Warehousing SF																		
50,000 SF	-0.1	0.2	-0.1	0	-0.1	0	-0.2	-0.2	-0.1	0	0	0	-0.2	-0.4	-0.2	-0.1	-0.2	-0.1
100,000 SF	-0.1	-0.2	-0.1	0	-0.1	0	-0.3	-0.3	-0.2	-0.1	0	0	-0.4	-0.7	-0.4	-0.2	-0.3	-0.1
150,000 SF	-0.2	-0.2	-0.2	0	-0.2	0	-0.3	-0.5	-0.3	-0.1	-0.1	0	-0.6	-0.9	-0.6	-0.3	-0.4	-0.2
Hotel Rooms																		
50	0	0	0	0	0	0	-0.1	-0.1	0	0	0	0	-0.1	-0.1	-0.1	-0.1	-0.1	0
100	0	0	-0.1	0	0	0	-0.1	-0.1	-0.1	0	0	0	-0.2	-0.3	-0.2	-0.2	-0.2	-0.1
150	-0.1	-0.1	-0.1	0	0	0	-0.2	-0.2	-0.1	0	0	0	-0.3	-0.4	-0.3	-0.3	-0.3	-0.2
Motel Rooms																		
50	0	0	0	0	0	0	-0.1	-0.1	0	0	0	0	-0.1	-0.1	-0.1	-0.1	-0.1	0
100	0	0	0	0	0	0	-0.1	-0.1	-0.1	0	0	0	-0.2	-0.3	-0.2	-0.2	-0.2	-0.1
150	0	0	0	0	0	0	-0.2	-0.2	-0.1	0	0	0	-0.3	-0.4	-0.3	-0.2	-0.3	-0.1
Movie Screens																		
8	0	0.1	0	0	0	0	-0.2	0	-0.1	-0.1	0	0	-0.2	-0.1	-0.3	-0.3	-0.1	-0.2
12	0	0.1	0	0	0	0	-0.2	-0.1	-0.1	-0.1	0	0	-0.3	-0.2	-0.4	-0.4	-0.1	-0.3
16	0	0.1	0	0	0	0	-0.2	-0.1	-0.2	-0.1	0	0	-0.4	-0.2	-0.5	-0.5	-0.1	-0.4

SENSITIVITY ANALYSIS RESULTS EPA (PAGE 2 OF 2)

Input / Increments	Vineyards			Greenville Place			Boyds Corner Farm			Barley Mill Plaza			Georgetown Commercial			Eden Hill Farms		
	Daily Change	AM Change	PM Change	Daily Change	AM Change	PM Change	Daily Change	AM Change	PM Change	Daily Change	AM Change	PM Change	Daily Change	AM Change	PM Change	Daily Change	AM Change	PM Change
SFDU																		
University Students																		
2,000	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.7	-0.6	-0.5	-0.1	-0.1	-0.1	-2.1	-2	-1.9	-1	-0.3	-0.8
6,000	-0.7	-0.9	-0.7	-0.6	-0.5	-0.6	-1.4	-1.2	-1.2	-0.3	-0.2	-0.2	-2.6	-2.3	-2.4	-2.2	-0.8	-1.8
10,000	-1.1	-1.2	-1.1	-0.7	-0.6	-0.8	-1.8	-1.5	-1.6	-0.4	-0.2	-0.3	-3	-2.6	-2.7	-3	-1.2	-2.5
High School Students																		
500	0	0.1	0	-0.1	-0.1	-0.1	-0.1	0	-0.1	-0.1	0	0	-0.1	-0.1	-0.2	-0.2	0.1	-0.1
1,000	0	0	0	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	-0.1	0	0	-0.3	-0.2	-0.3	-0.4	0.1	-0.2
1,500	-0.1	0	-0.1	-0.1	-0.2	-0.2	-0.3	-0.2	-0.2	-0.1	0	0	-0.5	-0.4	-0.4	-0.5	0.1	-0.3
Middle School Students																		
500	0	0.1	0	-0.1	-0.1	-0.1	-0.1	0	-0.1	-0.1	0	0	-0.1	-0.1	-0.2	-0.2	0.1	-0.1
1,000	0	0	0	-0.1	-0.1	-0.1	-0.2	-0.1	-0.2	-0.1	0	0	-0.3	-0.2	-0.3	-0.3	0.1	-0.2
1,500	-0.1	0	-0.1	-0.1	-0.2	-0.2	-0.3	-0.2	-0.2	-0.1	0	0	-0.5	-0.4	-0.4	-0.5	0.1	-0.4
Elementary Students																		
500	0	0.1	0	-0.1	-0.1	-0.1	-0.1	0	-0.1	-0.1	0	0	-0.1	-0.1	-0.2	-0.2	0.1	-0.1
1,000	0	0	0	-0.1	-0.1	-0.1	-0.2	-0.1	-0.2	-0.1	0	0	-0.3	-0.2	-0.3	-0.3	0.1	-0.2
1,500	-0.1	0	-0.1	-0.1	-0.2	-0.2	-0.3	-0.2	-0.2	-0.1	0	0	-0.5	-0.4	-0.4	-0.4	0.1	-0.3
Site Acreage																		
20	0.1	0.2	0	-0.1	0	-0.1	0	0.1	0	-0.1	0	0	0.1	0.1	0	0	0	0
40	0.1	0.2	0	-0.1	0	-0.2	0	0.1	0	-0.1	0	0	0.1	0.1	0	0	0	0
60	0.1	0.3	0	-0.1	0	-0.2	0	0.2	0	-0.1	0	0	0.1	0.1	0	0	0	0
Intersections																		
10	2.1	1.4	2	1.9	0.7	1.9	1.5	0.9	1.5	2.1	0.8	2.2	0.9	0.6	0.8	0.6	0.3	0.6
20	3.5	2.3	3.4	3	1.2	3.2	2.7	1.5	2.7	3.5	1.2	3.6	1.7	1.1	1.6	1.2	0.6	1.2
30	4.6	3	4.5	4	1.5	4.1	3.6	2	3.6	4.6	1.6	4.6	2.4	1.5	2.2	1.7	0.8	1.7
Transit?																		
Yes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CBD?																		
Yes	-0.2	-0.2	-0.2	0.1	0	0	-0.3	-0.2	-0.3	0	0	0	-0.5	-0.8	-0.6	-0.8	-0.7	-0.9
No	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EMP 1 Mile																		
1,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EMP 30 min transit																		
5,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles Owned																		
1	-1	-1.1	-1	-0.2	-0.3	-0.3	-0.9	-0.9	-0.8	-0.4	-0.5	-0.4	-1.4	-1.5	-1.4	-1.4	-1.3	-1.3
2	-1.5	-1.8	-1.6	-0.4	-0.5	-0.4	-1.3	-1.5	-1.3	-0.6	-0.7	-0.6	-2.2	-2.4	-2.2	-2.3	-2.1	-2.1
3	-1.9	-2.2	-1.9	-0.5	-0.6	-0.5	-1.6	-1.8	-1.6	-0.8	-0.9	-0.7	-2.7	-2.9	-2.7	-2.9	-2.6	-2.7

Sensitivity Analysis Variables Ranked by Sensitivity

NCHRP 8-51

- Size of restaurant use
- Proximity of retail use
- Sizes of retail, office and residential uses, and proximity of office and residential uses
- Sizes of cinema and hotel uses
- Proximity of restaurant, hotel and cinema uses

EPA

- Number of Internal intersections
- Auto ownership
- Size of university (if any)
- Acreage, location within a CBD or TOD, numbers of dwellings and sizes of non-residential uses other than university
- Presence of transit, jobs within one mile of the site and jobs within a 30-minute transit trip

Sensitivity Analysis Findings

NCHRP 8-51

- Of 12 independent variables, the size of the restaurant use has by far the greatest effect. The proximity of the retail use is also significant.
- The sizes of the of retail, office and residential uses, and the proximity of office and residential uses all had lesser effects.
- The sizes of the cinema and hotel uses and the proximity of the restaurant, cinema and hotel uses had relatively small effects .
- The size of any one land use can be optimized relative to the others.
- The optimum land use mix for internal capture differs with the peak hour.
- The proximity of the uses relative to each other is a complex set of variables in that of 30 possible origin-destination pairs, there are proximity adjustments for nine of them. For this analysis, we assumed all uses were contiguous and moved one use away from the rest at a time. In reality, moving one use changes between one and seven proximity adjustments.

EPA

- Of 30 independent variables, only 27 affected the internal capture percentage.
- Of the 27, the number of internal intersections has by far the greatest effect. Two other variables, automobile ownership and university size, if a university is present, were also particularly significant.
- The total acreage, location within a CBD or TOD, and the sizes of the other land uses all had lesser effects. Two uses, health clubs and auto repair facilities, never changed internal capture by as much as 0.05 percent in this analysis.
- The presence of transit, employment within one mile of the site and employment within a 30-minute transit trip affect other model outputs but not the internal capture percentage.
- The relative sensitivity of the site characteristic variables varied from site to site, apparently due to the starting values of those variables. For example, for Greenville Center, site acreage and the numbers of dwellings were particularly significant but the site is relatively small compared to the other examples and has only 27 dwellings.

Recommended Uses

NCHRP 8-51

- Site Traffic Impact Analysis (TIS, TOA, etc.)
- Environmental Impact Analyses other than emissions and energy if sensitive to intersection or peak hour operation
- Other applications where peak hour estimates are important and/or the site plan is known

EPA

- Regional travel model
- Vehicle emissions
- Energy consumption
- Environmental Impact Analyses other than emissions and energy if analyzing large areas or corridors or on a daily basis
- Other applications where site plan is unknown but population and employment estimates are available

THANK YOU!

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Appendix G: Other Material and misc. Reports

- **TCRP Report 128, "Effects of TOD on Housing, Parking and Travel**
- **Paper: "*Vehicle Trip Reduction Impacts of Transit-Oriented Housing:-* Robert Cervero, University of California, Berkeley**
- **TCRP Report 95: *"Transit Oriented DevelopmentTraveler Response to Transportation System Changes"***

In the interest of reducing document size, below are the links to documents that were part of the literature review for this project.

TCRP Report 128, *"Effects of TOD on Housing, Parking and Travel"*
www.gulliver.trb.org/publications/tcrp/tcrp_rpt_128.pdf

Paper: *"Vehicle Trip Reduction Impacts of Transit-Oriented Housing"-* Robert Cervero, University of California, Berkeley
www.nctr.usf.edu/jpt/pdf/JPT11-3Cervero.pdf

TCRP Report 95: *"Transit Oriented Development Traveler Response to Transportation System Changes"*
www.gulliver.trb.org/publications/tcrp/tcrp_rpt_95c17.pdf

Community Capture Methodology

Accepted by the FDOT Executive Board February 18, 2009

The Florida Department of Transportation (FDOT), in partnership with the Florida Department of Community Affairs (DCA), Regional Planning Councils (RPCs), local governments, transportation and land use professionals, and representatives of the development community, has initiated the process of identifying unique trip making characteristics of large, self-standing development with a balanced mix of uses, such as a new community or town. . These communities will be subject to regulation under F.S. 380.06 – Developments of Regional Impact (DRI). Most DRIs will not need to utilize the Community Capture methods because they will not meet the identified community criteria. To recognize the unique characteristics of the developments meeting this type of scenario, we have introduced the term "**Community Capture**".

Recommendations for Estimating Community Capture

A Definition of Community Capture

Community Capture is the reduction in the number of external vehicle trips generated by a large, mixed-use development reducing the overall impact of the proposed community on the transportation system outside of the development. Community Capture occurs due to the combined land-use, location, design, and multimodal characteristics of the development. Internal Capture, as accepted by the professional transportation community, recognizes that a portion of the total trips for a multi-use development may be satisfied within the development. The concept of Community Capture extends the application of internal capture to include potential trip interactions and reductions within the boundaries of large scale, multi-use developments. In these large-scale cases, internal capture trips would be a wholly contained subset of community capture trips. While "Community Capture" and "Internal Capture" are somewhat different, some of the research and applications associated with Internal Capture can apply to Community Capture.

Where May Community Capture be Applied?

Community Capture can be applied to a large, self-standing development, such as a new community or town, with a balanced mix of uses that may fulfill a significant portion of the community's needs within the development. These communities may be separated by travel-time, design, or distance from other major land use concentrations. They provide a wide range of internal services, which may satisfy a significant portion of their needs within the community.

The community would make many off-site trips unnecessary by being of sufficient size to provide a balance of land uses, including a range of housing types and values, neighborhood and community retail centers, entertainment facilities, offices, and employment. The community would also provide a range of support services such as schools, civic institutions, houses of worship, public parks, and government facilities. Larger communities may have several town centers or villages, which embrace connectivity within, and between, each center and village with a transportation system of all modes, including pedestrian paths, bicycle facilities, and shuttles.

Numerical Factors for Community Capture

Because each site will have unique characteristics, no minimum or maximum values for Community Capture will be recommended by FDOT. Reasonable analysis of proposed developments will be used and will be verified by substantial and ongoing monitoring programs. Ideally, over time, agreement may occur on some ranges and measurement criteria. However, because this is an emerging topic, many of the early estimates will be negotiated, based on best professional judgment and verified with monitoring agreements.

Justification of Community Capture Values

The justification will need to include summaries showing the numbers and percentages of trips served within the proposed development. For example, depending on the development, it might look like this,

> ***"X % of the entering shopping trips expected in the PM peak hour makes up Y% of the total exiting shopping trips from homes within the community".***

As a Development of Regional Impact (DRI), the proposed community will include the standard "Map H", development program summary, and build-out schedule. Additionally, there must be information provided in sufficient detail to clearly support and explain the process used to determine a proposed Community Capture value.

This analysis should be done for each phase, with an agreed upon monitoring program.

Using the Right Tools for Determining Community Capture

No single tool for determining Community Capture currently exists. While refinements to existing tools, such as the modeling methodology described below, are currently under development, no one procedure has been demonstrated to provide a final Community Capture value. Until there is more experience and knowledge regarding Community Capture, reasonable analysis and negotiations, supported by substantial and detailed monitoring requirements will be used.

Commitment to Traffic Monitoring

Expanded traffic monitoring beyond the current basic requirements of the DRI annual/biennial report will be a required provision in accepting Community Capture rates. While the detailed needs of the traffic monitoring program will be determined through the traffic study process, elements such as origin and destination studies, trip generation studies, and an evaluation of land use mixes in the community and surrounding the community will usually be included in the monitoring program. At a minimum, monitoring will be necessary before the development enters a new phase. If appropriate, trip characteristic assumptions and impact mitigation requirements will be revised, based on the monitoring.

Traffic monitoring at a frequency greater than by phase may be required for more aggressive development programs or if significant changes are made to the planned development program.

The Role of Pre-Application and Methodology Meetings

During the pre-application and transportation methodology meetings it will be important to have discussions among the experts in development and transportation (DCA, FDOT, RPCs, local governments, transportation professionals and representatives of the development community), to agree on factors needed to determine Community Capture and external impacts. All requests for utilizing Community Capture rates require more detailed information and specific commitments for justification. If sufficient information is not available at the time of the methodology meeting to make the commitments necessary to justify a Community Capture rate, final agreements on a rate will not be made until such information is available.

The Factors Impacting Community Capture

Community Capture will go beyond Internal Capture, accounting for the unique trip making aspects of a large, self-standing development with a balanced mix of uses such as a new community or town. The Community Capture concept focuses on:

Land Use Characteristics: A balance of land uses where form and function result in trips being satisfied within the development must exist for significant Community Capture to occur. Some of these factors are:

- "**Income Compatible" Uses**: Residence and employment centers should be "income compatible" so residents have ample employment opportunities in the community. Employment centers should attract a reasonable amount of the workforce from within the community.

- **Type of Community:** Is this a community planned for all age groups with job opportunities, or is it a retirement community? Is the new community primarily recreational? These issues can have an important impact on Community Capture.

- **Community Design:** The design features of the community can affect both the number of external vehicle trips, as well as the internal trips using major roadways. For example, a well-designed development with good internal connectivity will make it more convenient for trips to stay on site. By providing alternative connections internal to the site, the number of vehicle trips needing to use a major roadway to traverse the site can be reduced. Internal capture is facilitated by a high level of connectivity and short travel distances between complimentary land uses.

- **Development Maturity**: The project's fullest Community Capture may not occur until the complementary land uses mature. This may occur late in the development program. This will depend on the quantity and balance between complementary land uses. However, each phase or increment must mitigate the cumulative impacts to the regional network resulting from the current phase or increment and previously approved phases or increments.

Location Context: The location context of large, mixed-use developments may impact Community Capture in the following ways:

- **Remote Locations**: For a remote location with a balance of complementary land uses, high trip capture may occur. For the trips not captured on site, longer external trip lengths will result because there would be few opportunities for trips to end near the site.

- **Competing External Opportunities**: If there were ample nearby destinations (shopping, jobs, or entertainment) outside of the community, the Community Capture rate would likely be lower. For example, if a mixed-use development is located near other large developments, the Community Capture rate may be reduced.

- **Trip Generation of Isolated Communities**: Discussion is ongoing regarding the trip generation characteristics of isolated communities. One assumption proposed is if a community is isolated, and a trip cannot be satisfied on site, some discretionary trips are less likely to occur. While not making a trip can be an option for some trips, such as shopping, it is not an option for work-based trips, which have the highest impact during the peak hours.

- **Multimodal Elements** (Encouragement of transit, walking and cycling): The provisions of on-site transit circulators and integrated systems of bicycle, golf cart, and pedestrian paths may have an impact on vehicle trip generation and vehicle trip capture. Such amenities make it easier for trips to remain on site and may reduce the need for vehicle trips to occur.

Some Guidance on Analysis Tools

Travel Demand Models

Currently, large-scale transportation models, such as FSUTMS, which are not specifically modified for Community Capture purposes, may be insensitive to some of the factors expected to affect Community Capture. To address some of the limitations associated with using travel demand models to estimate capture, a methodology is proposed based on the following modifications:

- Consider land use categories in place of or in addition to traditional trip purposes. Within the model, use an increased selection of housing types (single-family, multifamily, rental apartments) and categories (high cost employed, retired, seasonal, medium cost employed, and low cost employed) and a trip purpose table for the expanded housing categories which can be used to create a residential trip generation and trip purpose profile to better match the development plan;

- Consider land use categories at trip attraction ends, such as retail/restaurant price levels to better match with residential income/price category. Also, consider for income/price category. Summarize the potential attractions within the community, based on the marketing plan, to better account for income differences;

- Create transportation analysis zones (TAZs) for each land use along with more detailed coded networks; and

- Carefully use K-factors (travel-time friction factors) within the model to make reasonable adjustments to the trip distribution patterns within the community and to the trip lengths external to the community.

While this methodology appears to be a positive step in addressing some of the traditional limitations of travel demand models in determining capture rates, the methodology needs to be tested to gain a better understanding of the sensitivity of the model to the proposed variables. The use of additional or modified variables must be documented and discussed with reviewing agencies early in the methodology development phase.

Currently, most standard large-scale travel demand models are not sufficiently detailed to predict internal capture. Unmodified models and their "raw" output are not appropriate tools to be used alone to justify Community Capture values. When the model is part of the justification for Community Capture values, clear documentation of the model process, including the submittal of all model files, must be provided, so a professional reviewer with reasonable competence in travel demand models can replicate the analysis and conclusions.

Institute of Transportation Engineers (ITE) Multi-Use Development Methodology

The ITE multi-use development methodology has been the primary tool used to estimate internal capture since 2000. While the ITE multi-use development methodology does not account for variables such as proximity of on-site land uses and location context, the methodology does provide an organized and professionally accepted manner to evaluate internal capture. If the data needed to support a Community Capture assessment is not available, an internal capture value determined using the ITE methodology could be used. A new National Project to update the ITE method is expected to be complete in 2009. This project is expanding the database and refining the method employed in the ITE methodology.

FLITE

Institute of Transportation Engineers
FLORIDA SECTION

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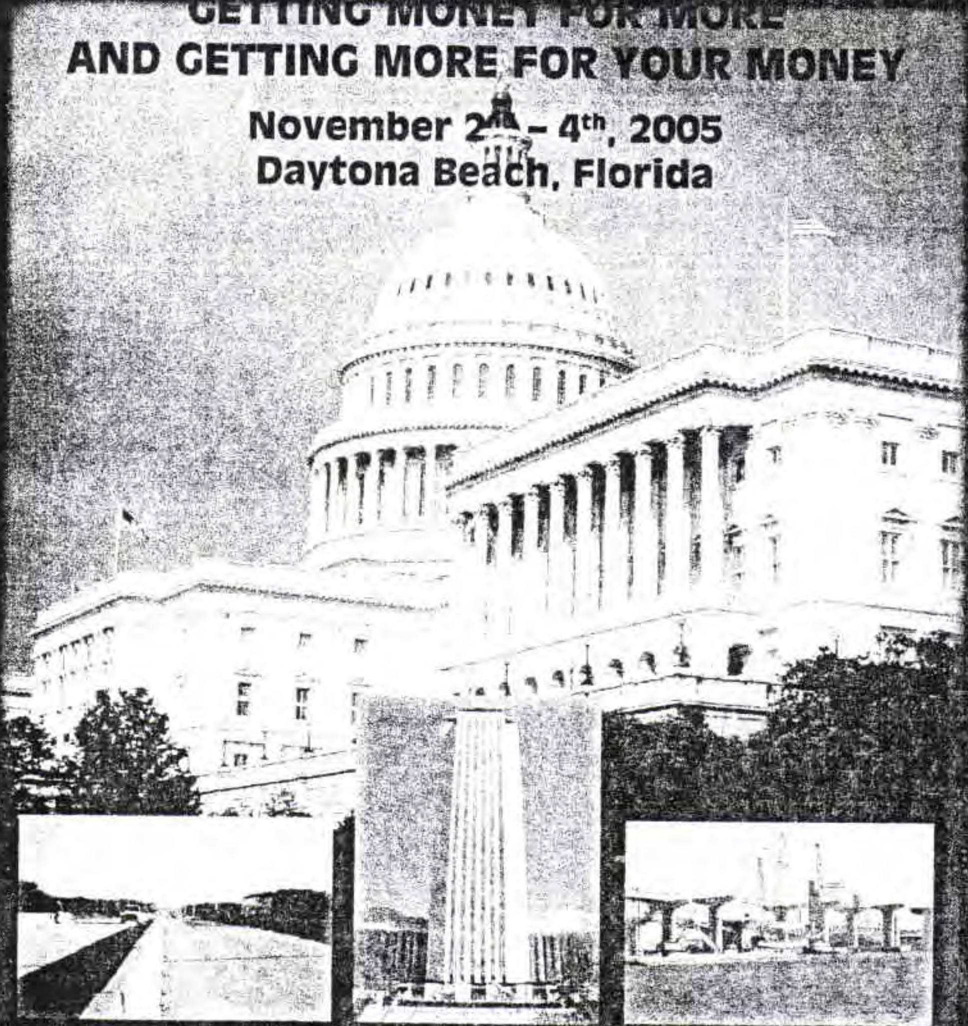

INSIDE

- PREDICTING FUTURE TRAVEL PATTERNS IN FLORIDA MPO AREAS
- TRADITIONAL DEVELOPMENT TRIP GENERATION CHARACTERISTICS
- FSITE STRATEGIC PLAN
- FSITE CHAPTER NEWS
- AND MORE

Traditional Development Trip Generation Characteristics

I. Introduction

Planned communities today are widely employing a New Urbanism approach in design. These concepts are hailed as one of the remedies to the rapid utilization of resources due to suburban sprawl. Traditional neighborhood developments incorporate a varied mixture of land uses usually within walking distance of one another. The proximity of these easily accessible facilities is intended to promote pedestrian, bicycle, and shorter internal auto trips. A large percentage of internal trips should be the result and lessen the impact of the community on the surrounding roadway network. Internal trips are defined as those that have both trip ends within the development project. Although they often utilize one or more segments of a public roadway, there is no net increase in traffic volume on the external roadway system outside the boundary of the project.

These benefits of internal capture and the level of trip reduction associated with traditional land use development, however, are supported by a minimal amount of documented research. Estimations for traffic characteristics such as trip generation and internal capture are sometimes challenged due to this lack of information. This report presents available information from the research conducted for traditional neighborhood developments and provides sources for greater inquiry.

II. Study Review

A. Celebration Monitoring & Modeling Study

Published in September 2003, the Celebration Monitoring & Modeling Study provides a quantified insight into an established traditional community. The report was mandated by the Third Amended and Restated Development Order of the Celebration Development of Regional Impact (DRI). The report contributes information on many aspects of the community. Relevant information includes the development program, traffic counts, trip generation, and internal capture percentages.

Celebration is located in Osceola County, Florida. Interstate 4 (I-4) and US 192 form the community's north and west borders, respectively. Other communities in the area include Lake Buena Vista at approximately 7 miles, and Kissimmee at approximately 10 miles away.

B. Traditional Neighborhood Development Trip Generation Study

Traditional Neighborhood Development Trip Generation Study was prepared by Dr. Asad J. Khattak, Dr. John R. Stone, William E. Letchworth, Ben K. Rasmussen and Bastian J. Schroeder in February 2005. The report was completed for the North Carolina Department of Transportation by the Department of City and Regional Planning of the University of North Carolina in Chapel Hill and the Department of Civil, Construction, and Environmental Engineering at North Carolina State. The report uses local traffic impact analysis methods to estimate trip generation rates. These estimated trip generation rates were compared with actual traffic counts produced by the existing developments.

The Traditional Neighborhood Development surveyed for this study is Southern Village, which is located within the city limits of the City of Chapel Hill. The other suburban development surveyed is located within the Northern Carrboro area. The developments are approximately 7 miles apart. The nearest commercial district is Franklin Street of Chapel Hill and the University of North Carolina and both developments are located equal distances away.

C. Haile Plantation Traffic Study

The Haile Plantation Traffic Study was prepared in November 15, 1996 by Buckholz Traffic. The study was completed to monitor the effect of changes to the Haile Plantation Master Plan and to document the actual project traffic characteristics. Both machine and manual intersection turning movement counts were conducted for the study. The manual counts were conducted at the intersection of SW 46th Boulevard and SW 75th Street, and SW 91st Street and Archer Road. The machine counts were taken at SW 46th Boulevard and SW 91st Street. These locations were determined sufficient to record all traffic movements from the traditional project elements.

Haile Plantation Village is located in Alachua County, FL. The development is approximately 7 miles from the commercial district of the City of Gainesville.

Continued on page 17

D. Internalizing Travel by Mixing Land Uses: A Study of Master-Planned Communities in South Florida

Internalizing Travel by Mixing Land Uses: A Study of Master-Planned Communities in South Florida, a study completed by Reid Ewing, Eric Dumbaugh, and Mike Brown, was presented at the 80th Transportation Research Board Conference in Washington D.C. The travel data originated form the Southeast Florida Travel 2000 Survey conducted by the Florida Department of Transportation. The land use data originated from metropolitan planning organizations and the Florida Department of Transportation. The information for Palm Beach and Broward counties was updated in 1999; the information for Dade County in 1996. Land use measures employed in the study were size, density, entropy, balance and accessibility.

Twenty different neighborhood developments from Palm Beach, Broward and Dade counties are included in this study. These communities were built over the last 40 years, and were both family and retirement oriented. The land uses included in each development included "housing, shopping, services, and recreational facilities."

E. Other Traditional Neighborhood Development Resources

Using the New Urban News' list of traditional neighborhood communities as a starting point, a list of additional nearly or recently completed developments was compiled. Local jurisdictions and development companies were contacted in reference to traffic studies for each of these projects but no usable information was available. These communities could provide opportunities for study in the future.

- Seaside, Walton County, FL. 350 Single Family (SF), 60 ksf commercial, charter school, chapel
- Kentlands, Gaithersburg, MD. 520 SF, 1539 Multi Family (MF), 1,000 ksf commercial & office, elementary school, convenience store/gas station/car wash
- Birkdale Village, Huntersville, NC. 230 SF, 360 MF, 234,921 sf Specialty Retail, 52,202 sf Office
- Daniel Island, Charleston, SC. 10,000 seat Tennis Stadium, 16 tennis courts, 5,100 seat Soccer Stadium, Private High School, K-8 Public, Preschool/Daycare
- I'ON, Mt. Pleasant, SC. 762 SF, 30,000 sf Commercial
- Harbor Town, Memphis, TN. 550 SF, 345 MF, 43 ksf commercial
- Middleton Hills, Middleton, WI. 327 SF, 87 MF, 150 ksf commercial

III. Traffic Generation & Internal Capture

A. Celebration, Osceola County, FL

The land use composition at the time of the Monitoring & Modeling (M&M) study is listed below. In keeping with the traditional community philosophy, the development program is quite diverse. Since Celebration development is still under way, this mixture of uses will change with time.

- Single Family 2,232 DU
- Retail 65,687 square feet
- Multi-Family 1,868 DU
- Hospital 100 beds
- Hotel 90 rooms
- Medical Office 204,940 square feet
- Office 922,857 square feet
- Golf Course 18 holes

Data was collected for the Celebration M&M during 72-hour machine cordon line counts. These counts revealed a significant difference from the internal trip values predicted by the ITE Trip Generation Handbook 6th Edition. This difference was evident in both the peak hour and daily trips and created significant internal capture percentages.

- Total Peak Hour Project Trips (actual counts): 3,458
- Total Peak Hour Project Trips (ITE, 6th Edition): 5,044
- Total Daily Project Trips (actual counts): 40,912
- Total Daily Project Trips (ITE, 6th Edition): 56,544
- Calculated Peak Hour Internal Capture: 31.8%
- Calculated Daily Internal Capture: 27.7%

B. Southern Village, Chapel Hill, NC

The study of Southern Village compares the development to a similar conventional neighborhood. Both development programs are depicted below and the multi-use housing is included for Southern Village.

Southern Village:

- Single Family 611 DU
- Church 27,000 square feet
- Multi-family 309 DU
- Retail 30,000 square feet
- School 90,000 square feet
- Office 95,000 square feet
- Day Care Center 6,000 square feet

Northern Carrboro:

- Single Family 891 DU

Continued on page 18

Traditional Development Trip Generation Characteristics, *continued from page 17*

Traffic counts for Southern Village single-family households recorded a value of 1,336 for the PM peak-hour and a value of 12,609 for the daily period. Using ITE trip generation methods, estimated trip generation values were calculated at 1,363 for the PM peak and 12,250 for the daily. The percent difference between actual and estimated is negligible. Thus, the findings confirm that the ITE trip generation methods were very reasonable for Southern Village.

The authors concluded that the residents of Southern Village did not make significantly fewer trips than residents of the conventional neighborhood. However, the trips by residents of Southern Village were shorter in time and distances, used different modes, and were less frequently external. For instance, each household in Southern Village was responsible for 7.7 auto trips per day. A single-family household in the conventional neighborhood created approximately 10 auto trips per day. The study also found that Southern Village residents traveled 28 fewer miles per day. In Southern Village, 78.4% of all trips were made by automobile. This compares favorably with an average of 89.9% for the Northern Carrboro suburbs, a 92.4% regional average, and a national average of 87%. The internal capture percentage for Southern Village was calculated to be 20.2 %. Southern Village residents also produced 25.8% fewer external trips and 30.3% fewer regional trips.

The intent of this study was to produce a comparison of traffic studies for traditional neighborhood development and conventional communities. The report suggests that no matter the type of residential use, tradition neighborhood developments produce different traffic behaviors than the conventional community and that those behaviors include fewer external and long distance trips.

C. Haile Village Plantation Center, Alachua County, FL

The development program for Haile Plantation is listed below. The community was not complete when the study was conducted, however, a variety of land uses were represented to a large extent.

- Single Family 1,070 DU
- Multi Family 2,460 DU
- Retail 175,000 square feet
- Office 175,000 square feet
- Church 18,000 square feet
- Church/School 12,000 square feet & 600 Students
- School Elementary/Middle 1,650 Students

The traffic study conducted in 1996 concluded that Haile Village Plantation Center is exhibiting an internal capture rate of 24% of the daily trips, and 28% during the PM peak hour. The ITE trip generation manual estimated that a traditional neighborhood project like Haile Plantation would have an internal capture rate of approximately 32% of daily trips and 36% of PM peak hour trips. Based upon the comparison of these two sets of internal capture percentages, it was determined that due to the existing mixture and density of development , the percentages of 24% for the daily and 28% of the PM peak hour were an appropriate expectation for the project at its current state of completion.

D. Southern Florida – Palm Beach, Broward, and Dade Counties

The 20 Traditional Neighborhood Developments for this study were chosen based upon the mix of land uses. Each development was required to have housing, shopping, services, and recreational facilities. All were constructed after 1965. The size of the developments, in population and acreage, ranged significantly. Each of the developments was analyzed according to its gross acreage, population, and employment.

Community	Gross Acreage	Population	Employment
Aventura	692	8,303	5,965
California Club	1,234	13,649	1,869
Century Village	934	12,781	534
Century Village North	716	10,246	331
The Crossings	662	6,036	965
The Hammocks	863	13,801	1,338
Jonathan's Landing	1,205	4,211	3,127
Kendale Lakes	985	12,207	2,588
Kings Point	845	12,523	771
Miami Lakes	2,541	12,918	17,862
Mission Bay	3,851	10,598	7,869
Pembroke Meadows	1,687	5,638	1,032
PGA National	2,421	9,178	2,324
Sabel Chase	325	4,984	1,120
Silver Lakes	3,210	11,329	1,593
The Township	715	4,267	556
Village of Palm Beach Lakes	1,475	8,215	1,818
Wellington	10,727	34,267	5,220
Weston	15,517	44,199	9,206
Winston Park	1,464	8,017	440

The focus of this paper was to evaluate and report internal capture rates from a multitude of traditional neighborhood developments. The land use measures considered in calculations were size, density, entropy, balance, and accessibility. The scale of the development was directly related to capture levels and regional accessibility was inversely related to internal capture rates.

The internal capture percentages for the twenty "traditional" neighborhood developments varied greatly. However, the authors highlighted the trend of the largest traditional neighborhood developments also employing the largest internal capture percentages.

- Wellington, Palm Beach County 57 %
- Weston, Broward County 52 %
- Century Village Broward, Broward County 43 %
- The Township, Broward County 41 %
- Century Village North, Palm Beach County 40 %
- Village of Palm Beach Lakes, Palm Beach County 34 %
- Winston Park, Broward County 30 %
- The Hammocks, Dade County 28 %
- Silver Lakes, Broward County 27 %
- Miami Lakes, Dade County 25 %
- Mission Bay, Palm Beach County 18 %
- PGA National, Palm Beach County 17 %
- Aventura, Dade County 17 %
- Jonathan's Landing, Palm Beach County 13 %
- Sabel Chase, Dade County 13 %
- Kendale Lakes, Dade County 12 %
- Kings Point, Palm Beach County 10 %
- Pembroke Meadows, Broward County 9 %
- The Crossings, Dade County 6 %
- California Club, Dade County 0 %

The mean internal capture percentage was 25% and the median was 22%. The authors concluded that the traditional neighborhood developments most successful in obtaining increased internal capture were large in size and distant from similar regional trip attractions.

IV. Summary

Most of the studies reviewed in this report indicated support for more research into the effect of traditional neighborhood developments. The studies confirm that while traditional neighborhood developments lower trip distances and encourage other modes, the actual number of total trips produced does not decrease but the net number that reach the external roadway network are reduced by up to over 50% with an average of between 25% and 30%. Each of the studies supports the trend of increasing internal capture with increasing size and diversity of land uses. Many questions still remain regarding the effects on trip length and geographic effect on trip production, but the majority of researchers agree that the ITE trip generation estimates and the results produced using the methodologies are reasonably accurate for these communities.

In conclusion, the data available for use in the development of this paper supports the use of internal capture estimates produced using the ITE Trip Generation Handbook methodologies and that results ranging between 25% and 50% should not be questioned if the land use composition is favorable in size and diversity to supporting the estimated capture rate. Therefore, placing a cap on the level of internal capture that can be assumed for purposes of development planning, a common approach in some jurisdictions due to limited documented data, is not a practice that can be supported by this research.

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Case Study – From ITE Website

ITE Journal - Surface Transportation Security Lessons Learned from 9/11

The terrorist attacks of Sept. 11, 2001 exacted a terrible toll on the United States and fundamentally changed the way of life in America. Surface transportation has changed and continues to change in response to the attack. Agencies that own and operate surface transportation systems must understand the relevant lessons from the 9/11 experience and respond accordingly so that we as a nation are well prepared should we be attacked again. The U.S. Federal Highway Administration (FHWA) commissioned the John A. Volpe National Transportation Systems Center (Cambridge, MA, USA) and Science Applications International Corporation (SAIC) to prepare detailed case studies of surface transportation in the New York City (NYC) and Washington, DC metro areas on the day of and in the days and weeks following the attacks. Published material was reviewed, participants were interviewed and internal agency working documents were analyzed. Extensive chronologies of actions were prepared for each study and impacts of the actions were identified whenever possible. The final two case studies total more than 150 pages. A panel of participants in the actual events have reviewed and approved the studies. The following material summarizes the lessons learned, exploring what did and did not work. This article synthesizes the findings from both studies and presents lessons that can be made available to the transportation profession as a whole. http://www.ite.org/membersonly/itejournal/itejournal/pdf/2002/JB02IA38.pdf

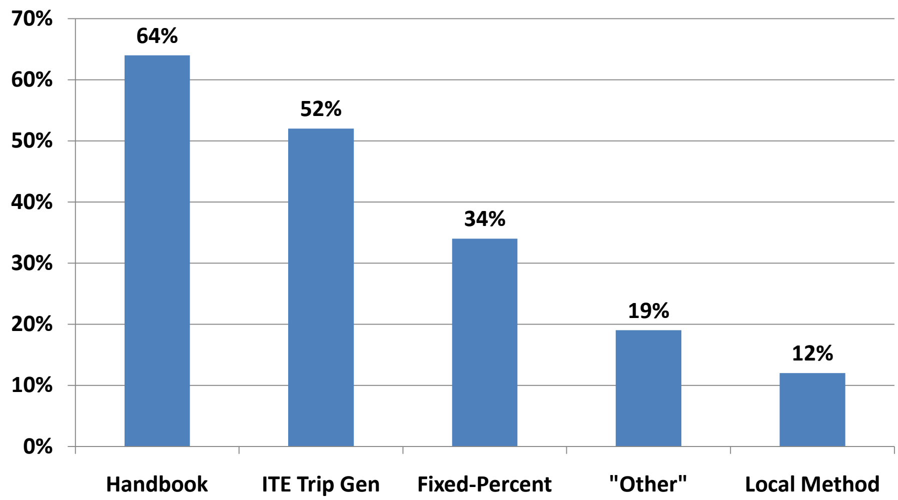
Comparing Methodologies to Estimate Internal Trip Capture at Mixed-Use Developments

Ben Sperry
Texas Transportation Institute
2010 ITE Annual Meeting - Session #32
August 11, 2010

Introduction

- Mixed-Use Developments (MXD)
  - Multiple Land Uses On-Site
  - Popular Development Style
  - Often Pedestrian or Transit-Oriented
- Estimating Trip Generation @ MXD
  - Important Step in Preparing TIA Reports
  - Complex at Mixed-Use Developments
  - Internal Travel Results in Fewer Off-Site Trips
  - Accurate Estimation Benefits All Parties

Survey of Methods in Practice



Source: ITE July 2004 *Multiuse Trip Generation and Internal Capture Rates Questionnaire*

Proposed New Estimation Method

- Issues with *Trip Generation Handbook* Method:
  - Developed from FDOT Studies in Early 90s
  - Limited to PM/Daily, Three Land Uses
- Proposed NCHRP 8-51 Method:
  - Includes Capture Data for AM Peak Period
  - Adds Capture Data for Three New Uses
  - Data From Newer MXD Sites
  - Adjustment for Proximity Between Land Uses

Research Problems

- Several Methods Available in Practice
- New NCHRP 8-51 Method Forthcoming
- Research Questions:
  1. Which method accurately replicates actual trips?
  2. Use of LUC 820 Combined or Separate
  3. More Detailed Method Better Than Fixed Percentage?
  4. NCHRP 8-51 Method Improve Over Current ITE Method?
  5. Effects of Land-Use Proximity at Site?
- Compare to Actual Counts at Five MXD Sites

Analysis Scenarios

Analysis Scenario	Case #	Description
Base Case: No Reduction	0a	Separate Retail/Restaurant
	0b	Combined Retail/Restaurant (LUC 820)
Case 1: Fixed-Percent Reduction	1	10 Percent Based on "Optimal" Base Case
Case 2: *Trip Generation Handbook* Method	2a	Combined Estimate; Assume Retail Capture
	2b	Separate Estimate; Retail Capture Only
	2c	Separate Estimate; Capture on Aggregate Estimate
Case 3: Proposed NCHRP 8-51 Method	3a	No Adjustment for Land Use Proximity
	3b	Adjustment for Land Use Proximity

Study MXD Sites

Site	Location	Site Size[1]	PM Peak Hour Traffic[2]	Count Date
Site 1	Atlanta, Georgia USA	140	2,026	July 2006
Site 2	Plano, Texas USA	75	1,819	May 2007
Site 3	Dallas, Texas USA	9	728	May 2006
Site 4	Chapel Hill, NC USA	310	1,336	March 2003
Site 5	Southlake, Texas USA	125	2,843	May 2008
[1]Acres				
[2]Bi-Directional Peak Hour Total Vehicle Trips (Entering plus Exiting)				

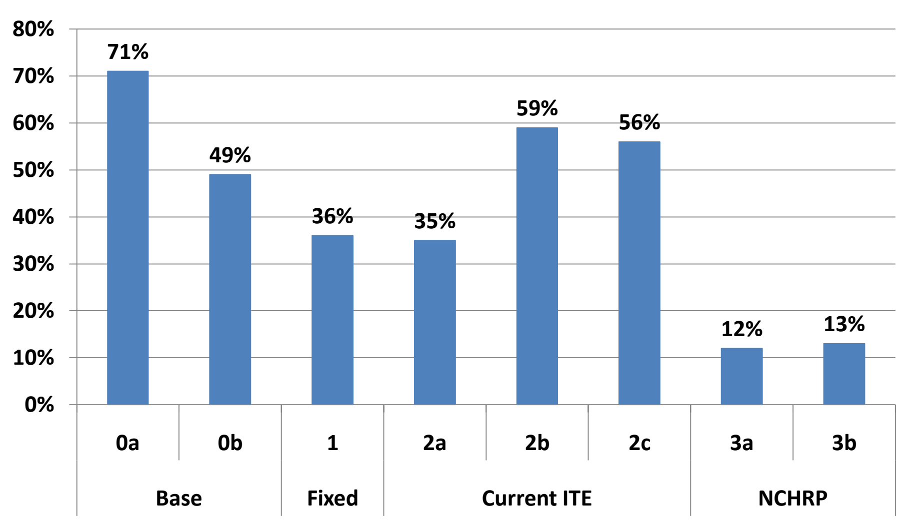
Methodology Details

- ITE *Trip Generation* 8th Edition
- PM Peak Period Only
- Adjustment for Transit, Vehicle Occupancy
- Land Uses Considered in Analysis:
  - Office
  - Retail
  - Restaurant
  - Residential
  - Cinema
  - Hotel

Analysis Results: Percent Error

Method	Case	Site 1	Site 2	Site 3	Site 4	Site 5
Observed Traffic	-	2,026	1,819	728	1,336	2,843
Base	0a	96%	84%	124%	17%	35%
	0b	66%	54%	100%	17%	6%
Fixed-Percent	1	50%	39%	80%	5%	-5%
Current ITE	2a	44%	36%	80%	13%	**2%**
	2b	75%	69%	105%	14%	31%
	2c	72%	59%	104%	13%	30%
NCHRP 8-51	3a	**10%**	-3%	**29%**	-5%	-14%
	3b	16%	**1%**	30%	**-4%**	-14%

Analysis Results: Average Absolute Error



Summary

- Base Case: Overestimated Traffic
- Current ITE Method Overestimated Traffic
- No Method Consistently Underestimated
- Most Accurate Method: NCHRP 8-51 Method
  - Average Absolute Error: 12 Percent
  - Error One-Fifth to One-Third of Other Methods
  - Proximity Adjustment Inconsequential

Conclusions

- Recommend Use of NCHRP 8-51 Method
- More Counts/Data Needed for Comparison

8

RESEARCH AND RECOMMENDATIONS ON INTERNAL TRIP CAPTURE RATES FOR OLOWALU NEW TOWN

PREPARED BY

JOHN D. EDWARDS, P.E.
TRANSPORTATION CONSULTANT

November 7, 2014

BACKGROUND
"A LITTLE HISTORY"

THE IMPACT OF THE 1956 HIGHWAY ACT ON URBAN DEVELOPMENT

URBAN DEVELODPMENT PATTERNS – 2000

THE RISE OF "MIXED USE DEVELOPMENT"

THE IMPACT ON TRANSPORTATION PLANNING

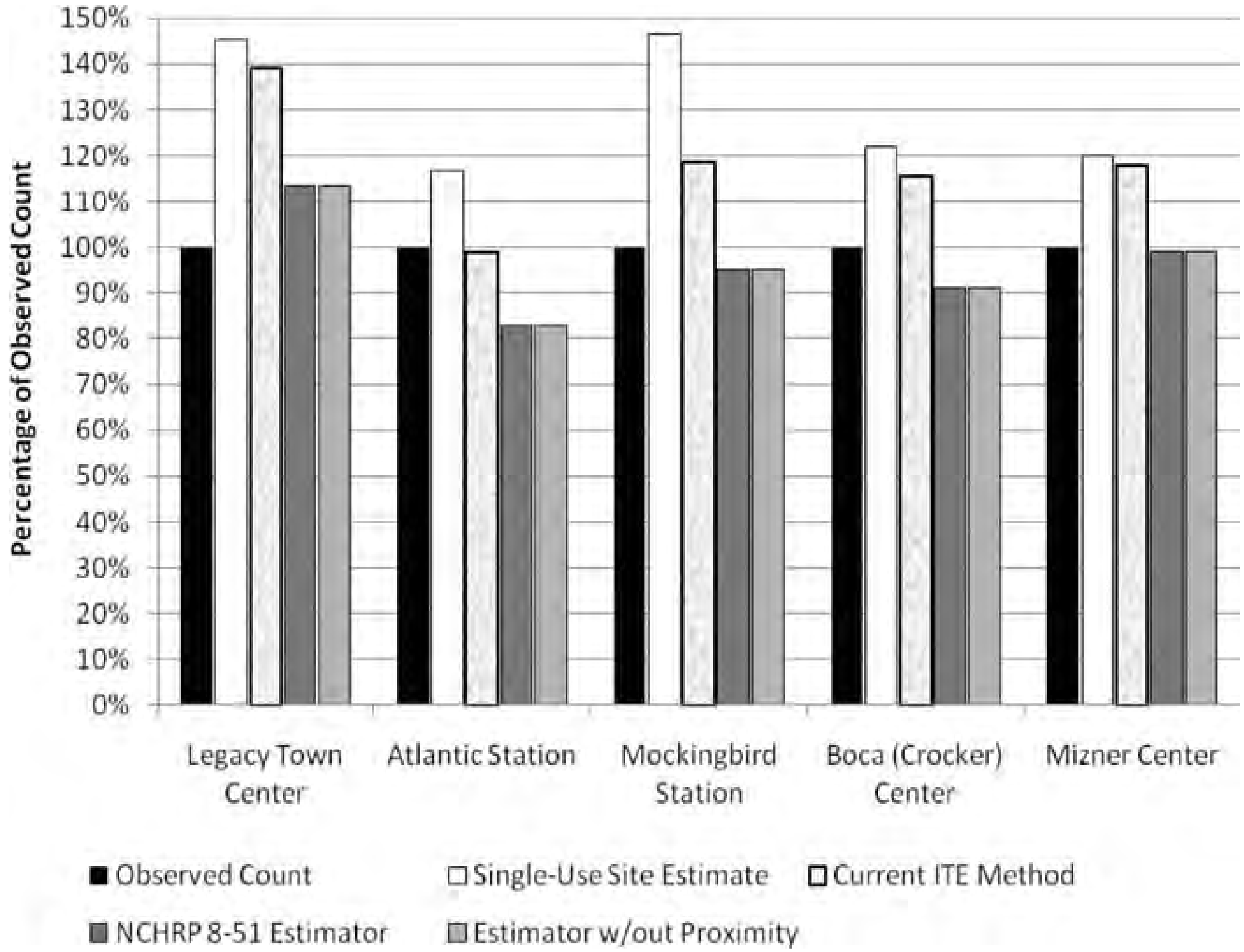
PRESENTATION CONTENT

A REVIEW OF RELEVANT RESEARCH

- Relevant Research Sources

  - ITE Trip Generation Handbook – 2014 Edition
  - NCHRP Report 684 Mixed Use Traffic Estimation
  - Productions and Attractions Analysis
  - Preliminary Traffic Impact Analysis Report (TIAR)
  - Florida DOT Internal Capture Rates
  - Florida DOT Policy on Mixed Use,
  - FLITE Newsletter Mixed Use Articles, and
  - the Maui Long Range Transportation Plan.

COMPARISON OF TRAFFIC ESTIMATE METHODS



Source: NCHRP Report 684 Enhancing Internal Trip Capture Estimation for Mixed Use Developments

COMMENT S ON ESTIMATE METHODS

- The Black Bars Represent Actual Ground Counts.
- The White Bars represent a simplified “single site use method”.
- The Light Gray Bars represent the Current ITE Method (productions/attractions approach) and range **between 0-10% high.**
- The NCHRP Estimator and the Estimator w/o Proximity is generally **5-10% low.**
- Conclusion: The Consultants believe the Current ITE Method best represents the “ most likely” real conditions.

RESEARCH RESULTS

Maui Regional Transportation Plan (trip ends)	**ITE Productions and Attractions Analysis**

Maui Regional Transportation Plan (trip ends)

- Productions 23,598 trip ends
- Attractions 14,787 trip ends
- Productions minus Attractions = 8,810 trip ends
- External trips 37.3%
- Internal Capture 62.7%

ITE Productions and Attractions Analysis

- Productions 5,762 trips
- Attractions 8,230 trips
- Total Trips 13,992
- External trips = 8230 - 5762 = 2468
- External Trip % = 2468 / 13,992
- External trips = 17.6%
- Internal Capture = 82.4%

COMPARISON OF RESULTS

Traffic Analysis	Trip Product.	Trip Attract	Total Trips	Percent Internal	Percent External
Maui Regional Transportation Plan	23,598 (trip ends)	7,394 (trip ends)	19,193	62.7%	37.3%
ITE Trip Generation	5,762	8,230	13,992	58.8%	41.2%
ITE Product./ Attractions Analysis	5,762	8,230	13,992	82.4%	17.6%
TIAR Traffic Analysis			16,400	61.0%	39.0%

TIAR - Table 1: Assumed Internal Capture Rates by Land Use Type

ITE Land Use Code	Land Use Description	Percentage of Trips Internal to Olowalu Town	Percentage of Trips External to Olowalu Town
730	Government Office Building	85%	15%
110	General Light Industrial	30%	70%
590	Library	90%	10%
520	Elementary School	90%	10%
415/417	Regional Park with Beach	50%	50%
310	Hotel	10%	90%
732	United States Post Office	95%	5%
230	Condominium/Townhouse	45%	55%
944	Gasoline/Service Station	95%	5%
220	Apartments	45%	55%
210	Single-Family Detached Housing	45%	55%
820	Commercial Retail	75%	25%
710	General Office	30%	70%

TIAR - Table 2: Pass by and Diverted External Trips on Honoapi'ilani Highway

ITE Land Use Code	Land Use Description	Percentage of Trips to/from Olowalu Town Already On Honoapi'ilani Hwy	Percentage of Trips to/from Olowalu Town Not Already On Honoapi'ilani Hwy
730	Government Office Building	50%	50%
110	General Light Industrial	20%	80%
590	Library	20%	80%
520	Elementary School	80%	20%
415/417	Regional Park with Beach	20%	80%
310	Boutique Hotel	20%	80%
732	United States Post Office	80%	20%
230	Condominium/Townhouse	20%	80%
944	Gasoline/Service Station	90%	10%
220	Apartments	20%	80%
210	Single-Family Detached Housing	20%	80%
820	Commercial Retail	80%	20%
710	General Office	20%	80%

CONCLUSIONS AND RECOMMENDATIONS

- RESEARCH HAS FOUND THAT MIXED USE DEVELOPMENT IS A WELL ESTABLISHED LAND USE PATTERN IN MANY U. S. URBAN AREAS.
- MANY DEPARTMENTS OF TRANSPORTATION RECOGNIZE THE REDUCTION OF EXTERNAL TRAFFIC WITH MIXED USE DEVELOPMENT
- IN FACT, MIXED USE DEVELOPMENT IS THE PREFERRED DEVELOPMENT TYPE IN MANY URBAN AREAS
- THE OLOWALU NEW TOWN LAND USE RECOMMENDATIONS FIT WELL INTO THE PATTERN OF REDUCED EXTERNAL TRIP GENERATION
- IT IS RECOMMENDED THAT THE HAWAII DOT RECOGNIZE THE INTERNAL CAPTURE RATES AND THE RESULTING REDUCED EXTERNAL TRAFFIC ON THE ROADWAY NETWORK

9

TECHBRIEF

Publication Number: FHWA-HRT-07-033

Synthesis of the Median U-Turn Intersection Treatment

FHWA Contact: Joe Bared, HRDS-05, (202) 493-3314, or
Wei Zhang, HRDS-05, (202) 493-3317

PDF Version (919 KB)

PDF files can be viewed with the Acrobat® Reader®

Objective

In the United States, congestion at intersections throughout urban and suburban areas continues to worsen. Crashes reported at intersections have continued to increase. One potential treatment to combat congestion and safety problems at intersections is the Median U-Turn Intersection Treatment (MUTIT), which has been used extensively in Michigan for many years and has been implemented successfully in Florida, Maryland, New Jersey, and Louisiana in recent years (Figure 1).

Figure 1. Example of MUTIT on Michigan corridors (Source: AAA, Michigan).

The treatment involves the elimination of direct left turns at signal-controlled intersections from major and/or minor approaches. Drivers desiring to turn left from the major road onto an intersecting cross street must first travel through the at-grade, signal-controlled intersection and then execute a U turn at the median opening downstream of the intersection. These drivers then can turn right at the crossstreet. For drivers on the sidestreet desiring to turn left onto the major road, they must first turn right at the signal-controlled intersection and then execute a U turn at the downstream median opening and proceed back through the signalized intersection. The MUTIT can be implemented with and without signal control at the median openings on the major road.

This synthesis summarizes the advantages and disadvantages of the MUTIT compared to conventional, at-grade signal-controlled intersections with left turns permitted from all approaches. The synthesis presents design guidelines including the location and design of the median crossovers on the major roads. Many of the guidelines presented in the synthesis are from the Michigan Department of Transportation (MDOT), and address directional and bidirectional crossovers and widened areas called "loons" that facilitate the U-turn maneuver by larger vehicles and at roads with narrow medians. The synthesis also discusses application criteria for the MUTIT, and presents information on the capacity and crash experience at these intersections relative to traditional intersections. Special considerations related to signal phasing at the median openings and signal phasing at the at-grade intersection also are discussed. Empirical evidence supports the practice that the reduction in signal phases at intersections can have higher vehicle-processing capacity and better level-of-service. In terms of safety, past research has shown that the reported numbers of crashes at MUTITs are 20 to 50 percent lower than comparable conventional intersections. The major safety benefit is a reduction in the probability of head-on and angle crashes that typically have high percentages of injury severity. Although the MUTIT typically is considered a corridor-wide treatment, the concept has been used successfully at isolated intersections to improve traffic flow and enhance safety.

Introduction

The MUTIT eliminates left turns at intersections and allows the maneuver to be made via median crossovers beyond the intersection. Drivers desiring to turn left at the subject intersection from the major road first must travel through the intersection, execute a U turn at the median crossover, and then make a right turn at the crossroad. Drivers on the minor road desiring to make a left at the subject intersection first make a right turn at the intersection onto the major road, and then make a U turn at the median crossover, and subsequently go straight through the intersection. Figure 1 shows an illustrative photograph of the MUTIT implementation in Michigan, and figure 2 shows the schematic for a typical MUTIT. The MUTIT is typically a corridor treatment. However, the concept is used at isolated intersections to alleviate specific traffic operational and safety problems. Levinson et al. (1) recommended that the application of MUTIT along the corridor should not be mixed with other indirect left-turn treatments or conventional left-turn treatments, thereby meeting driver expectancy. Figure 3 shows the MUTIT movements corresponding to left turns at conventional at-grade intersections.

The MUTIT has been used widely in the State of Michigan. Several highways in Michigan, particularly in the Detroit Metropolitan area, were constructed with wide medians on wide rights-of-way. Many of these medians are 18.3 to 30.5 meters (m) (60 to 100 feet (ft)) wide and were built decades ago in semirural areas to separate opposing directions of traffic and to provide an adequate median width for landscaping and beautification. The wide rights-of-way were originally established for "super highways," as they were called in the 1920s. By the early 1960s, many of these highways had capacity problems, generally because of interlocking left turns at the conventional intersections. To address this capacity problem, MUTITs replaced conventional intersections on various corridors. Today, there are more than 684 kilometers (km) (425 miles (mi)) of "boulevards" with over 700 directional crossovers on the Michigan State highway system. Partial implementations or designs with similar concepts have appeared in Florida, Maryland, New Mexico, and New Orleans. Hummer and Reid (2) and Levinson et al. (1) compared the MUTITs to conventional intersections. Hummer and Reid recommended that agencies consider the median U-turn alternative for junctions on high design arterials where relatively high through volumes conflict with moderate or low left-turn volumes, regardless of the cross-street through volumes.

Some of the advantages cited include:

- Reduced delay and better progression for through traffic on the major arterial.
- Increased capacity at the main intersection.
- Fewer stops for through traffic, especially where there are STOP-controlled directional crossovers.
- Reduced risk to crossing pedestrians.
- Fewer and more separated conflict points.
- Two-phase signal control allows shorter cycle lengths, thereby permitting more flexibility in traffic signal progression.

Figure 2. Typical schematics of MUTIT.

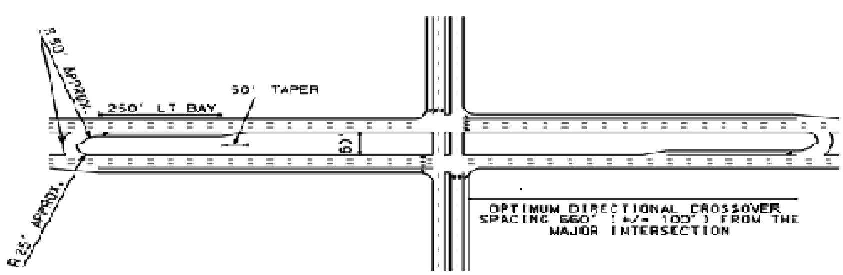
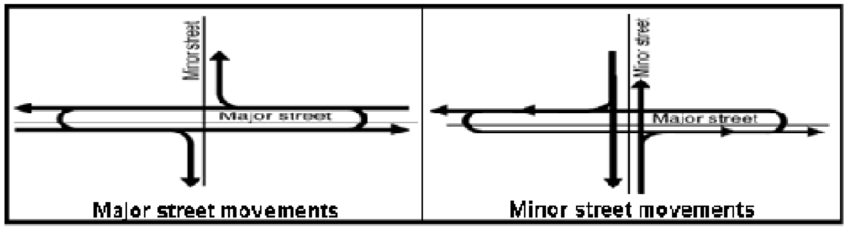


Figure 3. Vehicular movements at a MUTIT
(Source: Signalized Intersections Information Guide, FHWA-HRT-04-091, pg. 243).



Some disadvantages include:

- Possible driver confusion and disregard of left-turn prohibition at the main intersection.
- Possible increased delay, travel distances, and stops for left-turning traffic.
- Larger rights-of-way required for the arterial, although this potentially could be mitigated by the provision of loons (discussed later in this document) on roads with narrow medians.
- Higher operation and maintenance costs attributable to additional traffic signal control equipment if the directional crossovers are signalized.
- Longer minimum green times for cross-street phases or two-cycle pedestrian crossing.

MUTIT Design Guidelines

The 2004 AASHTO Green Book (3) recommends a distance of 122 to 183 m (400 to 600 ft) for the minimum spacing between the median crossover and the MUTIT intersection. The Michigan Department of Transportation (MDOT) recommends a distance of 201 m (660 ft) (+/- 30.5 m (100 ft)) for the median crossover from the MUTIT intersection. The distances recommended by the MDOT were established to accommodate drivers desiring to turn left from the crossroad. The longer distance facilitates the completion of the U-turn maneuver at the median crossover and subsequent right turn maneuver at the intersection of the major road and cross street for a 72 km/hour (h) (45 mi/h) posted speed limit on the major road. The selection of the spacing from the median crossover to the intersection is also a tradeoff between preventing spillback from the main intersection and the adverse impacts of additional travel for the left-turning vehicles. The Access Management Manual recommends an access spacing of 201 m (660 ft) on minor arterials and 402.3 m (1320 ft) on principal arterials between consecutive directional median openings on divided highways. Figures 4a, 4b, and 4c below show typical U-turn maneuvers. Table 1 gives the minimum median widths required for U turns from the major road as suggested by the MDOT.

Figure 4a. Left lane to inner lane maneuver.

Figure 4b. Left lane to second lane maneuver.

Figure 4c. Left lane to third lane maneuver.

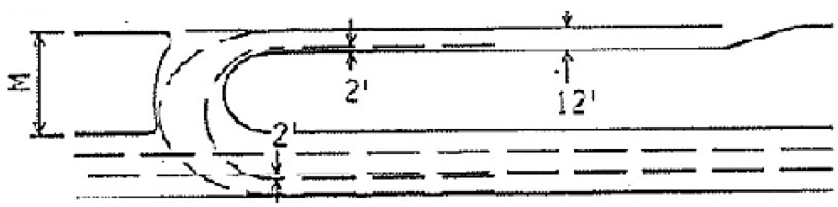


Table 1. Minimum median widths M for U-turn maneuvers suggested by MDOT.

Type of Maneuver	P	SU	BUS	WB-50	WB-60
	Length of Design Vehicle, m (ft)				
	5.8 (19)	9.1 (30)	12.2 (40)	16.8 (55)	21.3 (70)
Left Lane to Inner Lane	13.4 (44)	23.2 (76)	24.4 (80)	25 (82)	25 (82)
Left Lane to 2nd Lane	9.8 (32)	19.5 (64)	20.7 (68)	21.3 (70)	21.3 (70)
Left Lane to 3rd Lane	6.7 (22)	16.5 (54)	17.7 (58)	18.3 (60)	18.3 (60)

Where:
P = passenger car
SU = Single-unit truck
WB-50 = Semitruc medium size
WB-60 = Semitruck large size

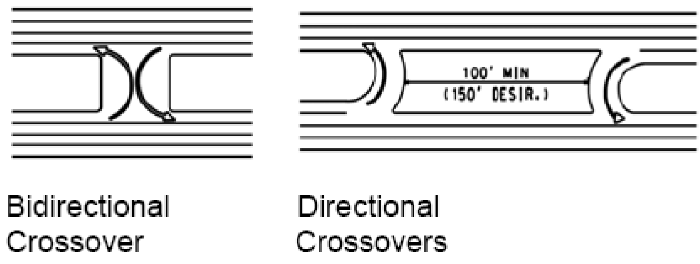
Location and Design of Median Crossovers

Figure 5 shows the two types of median crossovers, the "bidirectional" and the "directional." A bidirectional crossover is simply an opening in the median for vehicles to make U turns from either direction. Cars may enter from either direction. Bidirectional crossovers are sometimes installed without any deceleration or storage lanes. Most bidirectional median crossovers without deceleration/storage lanes can only store one or two vehicles. With high turning volumes, an interlocking effect is sometimes created. The vehicles queued to enter the crossover cannot do so until the vehicles in the crossover move out of the opening and merge into the travel lanes. A directional crossover is a one-way crossover with a deceleration/storage lane. This type of median crossover allows vehicles traveling in one direction of the boulevard to enter. As a result, motorists at a properly designed directional crossover should never experience the interlocking effect found at medians with a bidirectional crossover.

Taylor et al. (4) studied the effects of replacing existing bidirectional crossovers with directional crossovers on eight roadway sections in Michigan between 1991 and 1997. The study investigated crash frequency on roadway segments for two datasets. The study did not adjust for regression to the mean using control sites. One dataset included all the intersection crashes in the study segment, and the other dataset excluded intersection crashes from the study segment. The important findings of this study were:

- In total crash frequencies, 4 percent to 60 percent reductions were observed for the eight sections examined. The average reduction in total crash frequencies was 31 percent.
- In injury crash frequencies, 3 percent to 71 percent reductions were observed for the eight sections examined. The average reduction in injury crash frequencies was 32 percent.
- The crash types that experienced the largest decreases in crash frequency were rear-end and angle crashes. This effect was attributed to the lack of storage space and restricted visibility associated with bidirectional crossovers. There was an average 37 percent reduction in rear-end crashes when the bidirectional median crossovers were converted to directional median crossovers.
- Replacing bidirectional median crossovers at four-legged intersections and three-legged intersections produced reductions in total crash frequencies of 58 percent and 34 percent, respectively.

Figure 5. Directional and bidirectional crossovers.



Scheuer and Kunde (5) studied the effects of replacing existing bidirectional crossovers with directional crossovers on two segments of Grand River Avenue in Wayne County, MI, totaling 6.78 km (4.21 mi). The study segment was an eight-lane boulevard in a commercialized area with many driveways and minor crossroads. Three years of "before" crash data and approximately 2 years of "after" crash data were used in the analysis. The project achieved a total crash reduction of 24 percent. When the intersections where the crossovers were in-line with a crossroad are omitted, the crash reduction was 29 percent. Head-on and angle crashes showed the greatest reduction. The sideswipe crashes did increase, but the decrease in the heads-on and angle crashes far outweighed the increase of sideswipe crashes.

Castronovo et al. (6) studied the safety performance of divided highways with directional median crossovers versus bidirectional median crossovers. The key findings were:

- Divided highways with exclusive directional median crossovers have approximately the same crash rates as divided highways with exclusive bidirectional median crossovers for those sections without traffic signals.
- As the traffic signal density increases, divided highways with exclusive directional crossovers had 50 percent lower crash rates than crashes rates for divided highways with exclusive bidirectional median crossovers.

Figure 6a. Cured section of directional crossover (Source: MDOT Geometric Design Guide 670).

CREST OF MOUND, FOR DRAINAGE AND AETHETICS, SHOULD SHOULD NOT EXCEED 1' ABOVE TOP OF CURB. IF NOT PAVED, VEGETATION MUST NOT OBSTRUCT DRIVER SIGHT DISTANCE (TYP.)

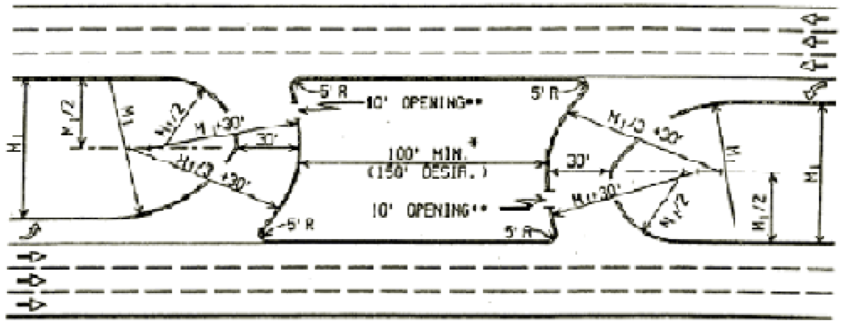
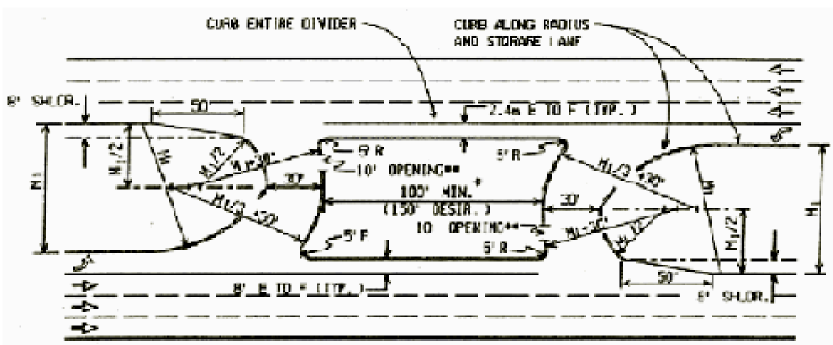


Figure 6b. Uncured section of directional median crossovers (Source: MDOT Geometric Design Guide 670).



Based on the studies cited, directional median crossovers likely provide better traffic operations and safety performance than bidirectional median crossovers. Figures 6a and 6b illustrate MDOT guidelines for designing directional median crossovers.

Location and Design of Loons

The design vehicle and the number of opposing lanes directly govern the required median width at the MUTIT median crossover junction. If the available median width is not sufficient, then agencies add additional pavement outside the travel lane to allow the design vehicle to complete the U-turn maneuver and merge back into the traffic stream. The additional pavements are typically referred to as "loons." Sisiopiku and Aylsworth-Bonzelet (7) defined loons as expanded paved aprons opposite a median crossover. Figure 7 shows a schematic diagram of a loon design, and figure 8 is a photo of an actual loon implementation in Wilmington, NC. The design width for loons will be the difference between the recommended median width in table 1 and the available median width.

Sisiopiku and Aylsworth-Bonzelet (7) evaluated the design and operation of loons and developed guidelines for loon design and placement. The important findings of the study were:

- Consistent placement of advance warning signs preceding the indirect median crossover and associated loon assisted driver expectancy when using MUTITs.
- Proper design of U turns for the appropriate design vehicle was essential to ensure safe traffic operation at the loons.
- At signalized median crossovers, the clearance intervals should account for the extra travel time required for drivers to travel through the loon.
- Suboptimal gap acceptance for U-turn maneuvers and driver confusion were two issues for loons either tapered into downstream right-turn lanes or for situations where right-turn lanes were located within approximately 45.7 m (150 ft) downstream of the loon. However, the placement of a loon and consecutive right-turn lane was recommended for major roads with MUTITs and high U-turning volumes at the median crossover
- Minimal differences were found between the travel times for commercial and passenger vehicles at MUTIT sites with signalized median crossovers. At unsignalized median crossovers, commercial vehicles were forced to wait for larger gaps in the conflicting traffic stream to complete their U-turn maneuvers.
- Several crashes involved commercial vehicles parked or backing within the median crossovers. Inadequate storage in the left lane preceding the median crossover due to the parked commercial vehicles caused spillback into through lanes. Commercial vehicles parked in the loon presented challenges for larger commercial vehicles executing U turns.

- A majority of the crashes at the loons were fixed-object crashes or sideswipe crashes. The objects most commonly hit were delineator posts, signposts (in the median and along the mainline), and spot locations of guardrail. A majority of the sideswipe crashes involved vehicles merging into traffic from the loon, or mainline traffic attempting to use the right turn lane.
- The study recommended a minimum 1.82-m (6-ft) auxiliary shoulder, with a 0.91-m (3-ft) paved area to provide the additional width necessary to ensure that the required pavement width will not be destroyed by U-turning vehicles that require the entire width of the loon. The study also recommended placement of short curves at both ends of the tapered section of the loon to assist the driver through the loon and U-turn maneuver.

Overall, loons are good design practice for facilities with narrow medians. With the use of loons, agencies can realize safety and operational benefits of a divided roadway (boulevard) with MUTITs, without incurring the significant cost of acquiring enough land along the entire corridor to provide sufficient median width.

Alternative Intersection Design

Michigan corridors with MUTIT typically have medians widths ranging from 18.3 to 30.5 m (60 to 100 ft). A wide median on the major road at the intersection of the major road and the cross street increases the pedestrian crossing distance along the sidestreet. Larger clearance intervals are required for the sidestreet signal phase with an increased possibility of vehicles and pedestrians getting "stranded" in the median space. Therefore, narrower medians with sufficient pedestrian refuge areas may be more efficient for the pedestrians and sidestreet traffic at the intersection of the major road and cross street. Figure 9 shows a possible reduction in median width at the intersection for a roadway with a median width of 18.3 m (60 ft) and a posted speed limit of 80.5 mi/h (50 mi/h). The reduction in median width was achieved by using reverse curves of sufficiently large radii on normal crowned sections of the roadway.

Capacity of Nonsignalized U-Turn Lanes

The Highway Capacity Manual 2000 (HCM) treats U turns as left turns for estimating saturation flow rate. However, the operational effects of U turns and left turns are different. U-turning vehicles have slower turning speeds than left-turning vehicles. Al-Masaeid (8) studied the capacity of U turns at unsignalized intersections as a function of the conflicting traffic flow on two opposing through lanes for median-divided roadways in Jordan . Figure 10 shows the field data collection results. He developed regression equations to predict the U-turn capacity based on the conflicting flows on two opposing through lanes.

$$C = 799 - 0.31 * q_c$$

$$C = 1{,}545 - 790 * \text{exponential } (q_c/3{,}600)$$

$$C = 799 - 0.62 * q_{cp}$$

Where:

C = capacity of U-turn movement in passenger car equivalent units per hour (PCU/hr).

q_c = conflicting traffic flow on two lanes (PCU/hr).

q_{cp} = conflicting traffic flow per lane (PCU/hr).

Yang et al. (9) studied the gap acceptance of U-turn maneuvers at median opening for 10 sites in Tampa, FL, and concluded that the critical gap ranged from 5.8 seconds to 7.4 seconds. Carter et al. (10) collected data at 14 signalized intersections with U turns in North Carolina. Based on a large database, they recommend a saturation flow adjustment factor of 0.82 for U-turn lanes at signalized intersections without conflicting right-turn overlap phase on the side street. Tsao and Ando (11) and Liu et al. (12) suggested saturation flow rate reduction factors of 0.8 and 0.76 for U-turn lanes at signalized intersections, respectively.

Provision of a Signal Phase to Serve U turns

The HCM suggests implementing a protected left-turn phase when the cross product of the hourly left-turning volumes and the corresponding hourly opposing through volumes exceeds the threshold value based on the number of opposing through lanes. Cross product thresholds of 50,000, 90,000, and 110,000 are applicable for one, two, and three lanes of opposing through traffic, respectively. The Traffic Control Devices (TCD) Handbook suggests the following criteria for where and when a left-turn phase should be provided:

1. Volume

a. Number for left turns multiplied by the opposing conflicting volumes in the peak hour exceeds 100,000 on a four-lane street or exceeds 50,000 on a two-lane street.
b. Left-turn peak-hour volume of more than 90 vehicles per hour, or 50 vehicles per hour on streets with through traffic at speeds over 72 km/h (45 mi/h).
c. At pretimed signal-controlled intersections, more than two vehicles per cycle per approach at the end of green during peak

hour.

2. Delay

Left-turn delay of more than 2.0 vehicle hours in the peak hour on a critical approach, provided there are at least two left turns per cycle during peak hour and the average delay per left-turning vehicle exceeds 35 seconds.

3. Crashes—number of left-turn crashes

a. One approach—4 crashes in 1 year or 6 crashes in 2 years.
b. Both approaches—6 crashes in 1 year or 10 crashes in 2 years.

The criteria above apply when determining whether a separate left-turn phase is needed at a signal-controlled intersection. The criteria can be applied equally, or in a more conservative way, applied to determine when signal control is needed at median crossovers to accommodate U turns. Signalized median crossovers can provide higher U-turn capacities compared to unsignalized median crossovers when the green time for the signalized median U-turn phase is adequate to satisfy the traffic demand. In addition, it is relatively easy to coordinate the signal at a median crossover with the signal at the main intersection without adding much extra delay to the high-volume mainline traffic.

Figure 7. Schematic of a loon implementation for a Michigan MUTIT.

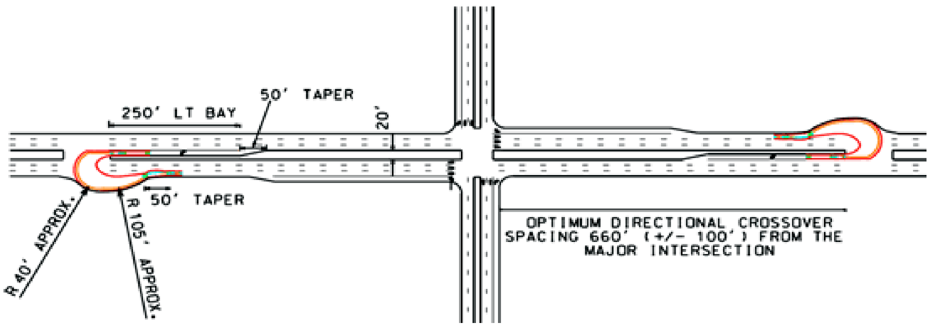
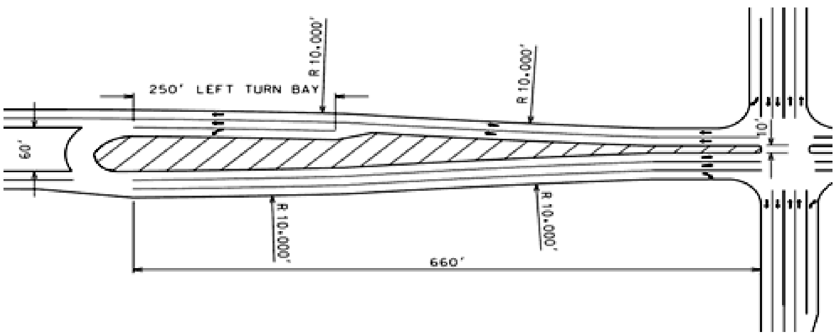


Figure 8. Example of loon implementation for a Michigan MUTIT.

Figure 9. Example of a transition from a wide median section to a narrow median section on MUTIT corridors.



Signal Phasing

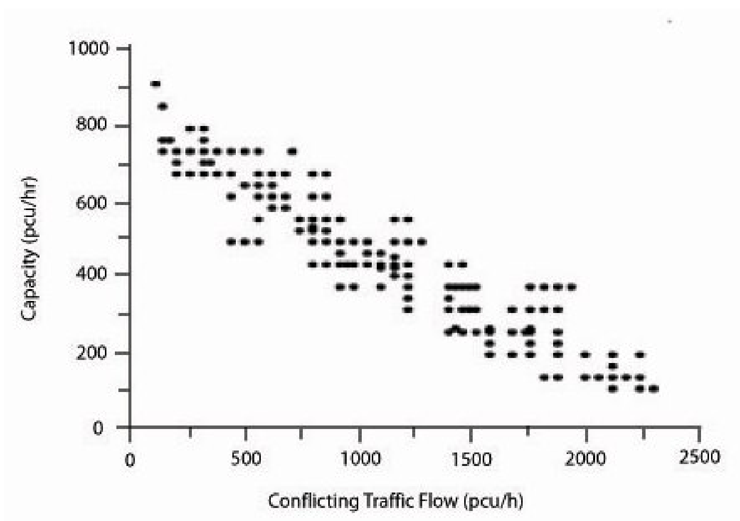
The signal control at the intersection of the major road and minor crossroad operates with two signal phases because all left turns are prohibited at this junction. Figures 11a and 11b show the typical signal phasing diagram for the 2-phase signal. In some cases, the green signal indication at the median crossover junction for phase 2 can be delayed slightly relative to the green signal indication for the through/right-turning vehicles on the crossroad. This facilitates uninterrupted movement for the left-turning vehicles from the crossroad. If the median crossover is unsignalized, the signal phasing would only apply at the major road/minor road junction. Typical signal cycle lengths for the MUTIT range from 60 to 120 seconds. If the left-turn volumes are heavy, shorter cycle lengths will reduce spillback into the intersection. The pedestrians move in the direction of traffic with signalized pedestrian phases. Signalized

pedestrian phases across the major road with wide medians might reduce the operational efficiency of the MUTIT when cross-street traffic is minimal but pedestrian presence is significant during the peak hour periods.

Signing Plan

Figure 12 shows the typical signing plan for MUTIT in Michigan. Figures 13a to 13e show several examples of "innovative" signing treatments for MUTITs executed in Michigan. Sisoupiku and Aylsworth-Bonzelet (7) observed several motorists violating the turn prohibition and executing direct left-turns from the crossroad at rural sites. At intersections where violations were observed, there existed standard indirect left-turn signs and overhead signing prohibiting left-turns. Positive guidance communicated through additional signs may be beneficial in reducing driver confusion and ensuring higher rates of driver compliance.

Figure 10. Scatter plot of U-turn capacity versus conflicting traffic flow for unsignalized median openings. ©1999 Institute of Transportation Engineers, 1099 14th Street, NW, Suite 300 West, Washington, DC 20005-3438 USA, www.ite.org. Used by permission.



Traffic Operational Performance

Reid and Hummer (13) compared traffic operations along a typical arterial highway with MUTITs versus conventional designs with two-way left-turn lanes (TWLTL). The analysis corridor was a 4.02-km (2.5-mi) section of the Northwestern Highway Corridor in Detroit, MI. The section consisted of five major signalized intersections with varied spacing from 0.5 to 1.1 km (1,600 to 3,500 ft) and annual average daily traffic (AADT) ranging from 52,000 to 60,000 vehicles per day. Researchers used CORSIM to simulate traffic performance and used SYNCHRO to develop optimized signal timings. Four time periods were considered in the analysis, including peak periods in the morning, noon, midday (2:00 p.m. to 3:00 p.m.), and evening. Average measures of effectiveness (MOEs) were developed for a total of 48 CORSIM runs. The MUTIT showed a 17 percent decrease in total travel time within the study area network compared to TWLTL.

Figure 11. Example of typical signal phasing for the MUTIT.

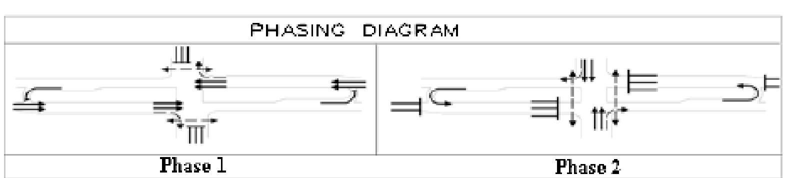


Figure 12. Example of typical signing plan for the MUTIT in Michigan.

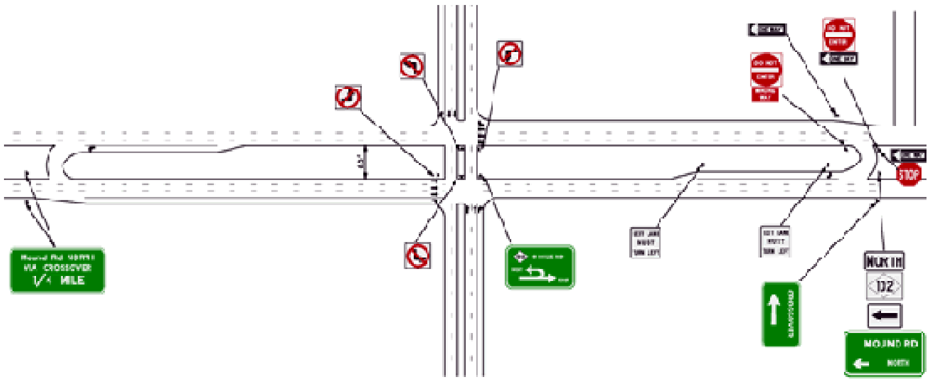


FIGURE 13. EXAMPLES OF "INNOVATIVE" SIGNING PLANS FOR THE MUTIT IN MICHIGAN.

Figure 13a. Example 1 of innovative signing. (Credit: Lee Rodegerdts)

Figure 13b. Example 2 of innovative signing.
(Credit: Chris J. Bessert, www.michiganhighways.org)

Figure 13c. Example 3 of innovative signing.
(Credit: Warren Hughes)

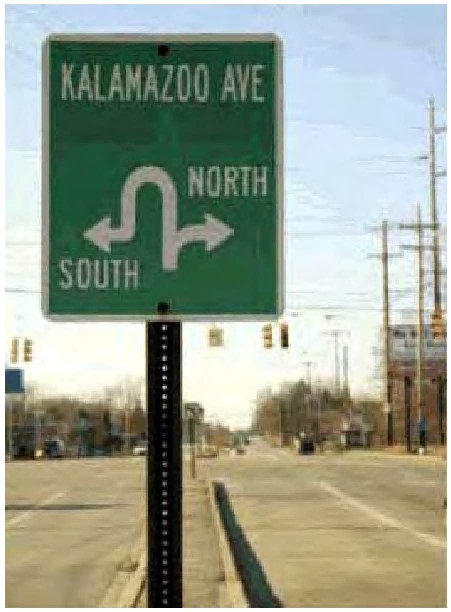


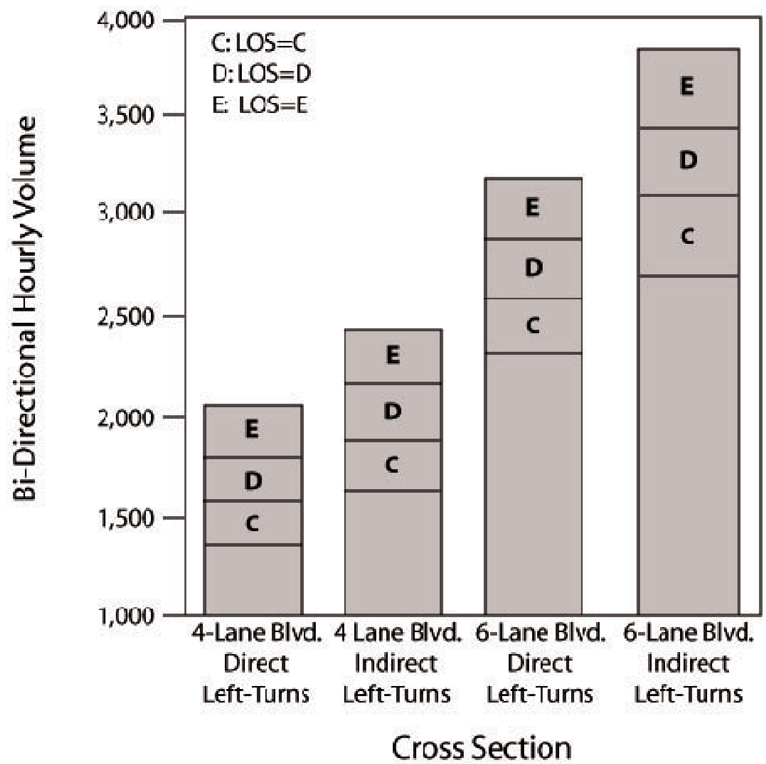
Figure 13d. Example 4 of innovative signing.
(Credit: Shawn Glynn)

Average speeds increased by 25 percent for MUTIT compared to the TWLTL. The average number of stops increased for the MUTIT compared to the TWLTL. The analysis indicated that the MUTIT had the potential to significantly improve system travel times and speeds in the corridor during the busiest hours of the day to not compromise system travel times during off-peak periods. Reid and Hummer (14) later used CORSIM to compare the traffic performance of seven unconventional arterial intersection designs, including the quadrant, median U-turn, superstreet, bowtie, jughandle, split intersection, and continuous flow intersections. The study used turning movement volumes from existing isolated intersections in Virginia and North Carolina. Off-peak, peak, and volumes corresponding to 15 percent higher than the peak volumes were examined. A total of 36 to 42 CORSIM simulation runs of 30-minute durations were analyzed for each intersection. For MUTITs, the CORSIM models used unsignalized U-turn crossovers for two-lane collector roads and signalized U-turn crossovers for four-lane collector roads. Entering volumes for the simulated intersections ranged from 4,500 vehicles per hour (vph) to 7,500 vph.

The MUTIT produced significantly lower average total travel times in comparison to the conventional intersection. The change in overall travel times for all movements through the intersection, when compared to a conventional intersection, was −21 to +6 percent during peak conditions. The overall change in the number of stops when compared to a conventional intersection was −2 to +30 percent during peak conditions.

Maki (15) compared the MUTIT and the conventional TWLTL on 4-lane and 6-lane boulevards and found a 20 to 50 percent increase in capacity (throughput) for the MUTIT. Figure 14 shows the level of service (LOS) comparison between corridors with MUTITs and conventional intersections.

Figure 14. LOS comparison of divided highways.
(Source: Robert Maki, City of Surprise, AZ)



Bared and Kaiser (16) studied the traffic operational benefits of signalized median U turns on a typical 4-lane road intersecting a 4-lane road using CORSIM. The cross-street left turn movement was allowed at the major road/cross street intersection resulting in a three-phase signal. An acceleration lane was provided for the right-turning vehicles from the major road to the cross street. These two features used in the study are different from the typical MUTIT implementations in Michigan. Entering volumes at the intersections used in the simulations ranged from 2,000 vph to 7,000 vph. The key findings of the study were:

- Considerable savings of travel time were observed for the U-turn design at higher entering flows (greater than 6,000 vph) compared to conventional intersections with 10 percent and 20 percent left-turning volumes.
- On average, the proportion of vehicles stopping on the network was lower for the U-turn design. For 10 percent left-turning volumes, differences ranged from 20 percent to 40 percent. For 20 percent left turns, a noticeable reduction in percent stops started at about 4,500 vph.
- Providing an acceleration lane on the crossroad was recommended to improve traffic operational efficiency.
- Longer offsets for the U-turn crossovers resulted in increased travel time but benefited the network at higher traffic volumes by providing adequate storage for the U-turning vehicles and preventing spillback into the intersection.

Dorothy et al. (17) evaluated traffic operational measures to study the differences in the performance of MUTITs compared to the conventional TWLTLs. The TRAF-NETSIM model was used to simulate these situations for 1-hour periods. The simulated network had signals every 0.8 km (0.5 mi) with the directional crossovers every 0.4 km (0.25 mi). A 60/40 split between the entering volumes on major road and cross street was assumed. When turning percentages were low, the crossovers were modeled as STOP-controlled; with higher volumes, signal control was assumed in the model. The signal cycle was 80 seconds with a 60/40 distribution of green time for the major road phase and cross-street phase, respectively. The median width varied from 12.2 to 30.5 m (40 to 100 ft). The key findings were:

- When the left-turning traffic percentage was 10 percent, MUTITs with signalized directional crossovers had lower left-turn total travel times than conventional intersections. The differences were 20 seconds/vehicle, 40 seconds/vehicle and 150 seconds/vehicle at 30 percent, 50 percent and 70 percent mainline saturation, respectively. Similarly, MUTITs with signalized directional crossovers had lower left-turn total travel times than conventional intersections when the left-turning traffic percentage was 25 percent. The differences were 20, 30, and 70 seconds/vehicle at 30 percent, 70 percent, and 90 percent mainline saturation, respectively.
- The MUTITs provided consistently lower network travel times compared to the five-lane TWLTL design.
- For low left-turning percentages, the directional median crossovers with stop control had approximately the same left turn total

time and network total time, as compared to directional medians with signalized crossovers.

Topp and Hummer (18) compared median crossovers on the cross street with median crossovers on the arterial highway for MUTITs using CORSIM. The left-turning volumes on the major road varied from 100 vph to 400 vph, the through volumes on the major road varied from 1,000 vph to 2,000 vph, the left turns on the cross street varied from 50 vph to 200 vph, and the through volumes on the cross street varied from 500 vph to 1,000 vph. The median crossovers were signalized wherever warranted. Results showed that the MUTIT design with the U-turn movement located along the cross street reduced percent stops, total travel time, and delay for most of the volume combinations analyzed in comparison to the crossover on the arterial.

Savage (19) studied the conversion of five-lane roadway with a TWLTL to a MUTIT in Michigan and found a 20 to 50 percent increase in the corridor capacity. Koepke et al. (20) found that the directional crossover design provides about 14 to 18 percent more capacity than the conventional dual left-turn lane designs. The results of critical lane volume analyses, after taking into account overlapping traffic movements, revealed reductions of about 7 to 17 percent in critical lane volumes, depending upon the number of arterial lanes (six or eight) and the traffic mix. Lower critical lane volumes translate into higher traffic flow capacity at the intersection. A study by Stover (21) computed critical lane volumes for the intersection of two six-lane, arterial roads. The effects of redirecting left turns were computed using these volumes. The provision of dual left-turn lanes on all approaches reduces critical lane volumes by 12 percent compared to providing single left-turn lanes but still requires multiphase traffic signal controls. The rerouting of left turns via directional crossovers and their prohibition at the main intersection reduces critical lane volumes by 17 percent.

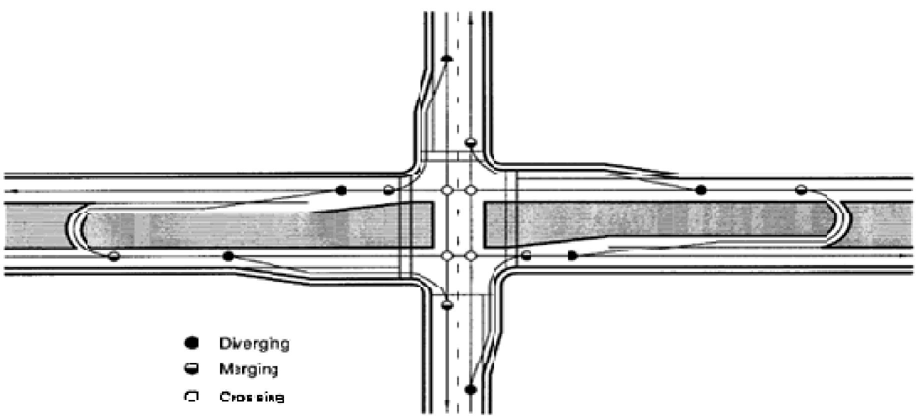
Overall, the literature shows that reducing signal phases and redirecting the left-turning movement at the intersection for the MUTIT provided significant benefits in terms of increased roadway capacity and reductions in travel time and vehicular delay when compared to conventional intersections.

Traffic Safety Performance

Table 2 from the FHWA Signalized Intersections: Informational Guide (22) shows the number of conflict points at a four-leg signalized intersection as compared to the MUTIT. The MUTIT eliminates all crossing (left turn) conflict points and reduces the number of merge/diverge conflict points as compared to a four-leg signalized intersection. Figure 15 shows the conflict point diagram for a MUTIT.

Observations indicated a 60 percent reduction in total crash frequencies and 75 percent reduction in total injuries. Reductions of 17 percent, 96 percent, and 61 percent were observed for rear-end crashes, angle crashes, and side-swipe crashes, respectively.

Figure 15. Conflict point diagram for the MUTIT.



Kach (23) compared the safety performance of conventional signalized intersections to MUTIT locations in the State of Michigan. The final comparison study subset consisted of 15 MUTIT locations and 30 conventional intersections.

Table 2. Number of conflict points at a four-leg signalized intersection compared to the MUTIT.

Conflict Type	Four-Leg Signalized Intersection	MUTIT
Merging/diverging	16	12
Crossing (left turn)	12	0
Crossing (angle)	4	4
Total	**32**	16

Maki (15) evaluated the safety benefits of replacing existing conventional signalized intersections with the MUTITs on Grand River

Avenue in Wayne County, MI. The 0.7-km (0.43-mi) study segment on Grand River Avenue was from the east of Poinciana to west of Delaware Street. The analysis period for the before-after study was 1990 to 1995.

The crossroads in all cases were undivided with crossroads intersecting at either 90 degrees or on a skew. Crash data for the years 1986-1990 were obtained for each site. Table 3 shows the safety performance of the MUTITs in comparison to conventional intersections. "Alpha" in Table 3 denotes the confidence level that the two rates are statistically different. Table 4 shows the estimated reduction in the expected number of crashes by crash type for all crashes, injury crashes, and property damage only (PDO) crashes for a road with 60,000 AADT.

Castronovo et al. (24) analyzed the MUTIT safety benefits versus conventional intersections as a function of traffic signal density using data from 123 segments of boulevards totaling 363.7 km (226 mi). The results indicated that as traffic signal density increased, the MUTIT had increasingly lower crash rates (measured in crashes per 161 million vehicle kilometers (100 million vehicle miles). For typical suburban conditions, with signal densities of one or more signals per 1.61 km (1 mi), the crash rate for MUTITs was about one half of the rate for conventional intersections. For typical rural conditions, with signal densities of one or less signal per 1.61 km (1 mi), the reduction in crashes for MUTITs was 36 percent when compared to conventional intersections.

In NCHRP Report 524 (25), researchers studied the safety performance of unsignalized median openings. The research results indicated that access management strategies that increase U-turn volumes at unsignalized median openings can be used safely and effectively. Analyses of collision data found that collisions related to U-turn and left-turn maneuvers at unsignalized median openings occur infrequently. In urban arterial corridors, unsignalized median openings had an average of 0.41 U-turn-plus-left-turn accidents per median opening per year. In rural arterial corridors, unsignalized median openings experienced an average of 0.20 U-turn-plus-left-turn accidents per median opening per year. On the basis of these limited collision frequencies, the authors concluded that there is no indication that U turns at unsignalized median openings are a general safety concern.

CONCLUSIONS

Based on the literature review conducted, the following summarizes the major conclusions:

- Michigan and other States have successfully used the MUTIT for over four decades without major problems related to traffic operational failures or safety hazards.
- Positive guidance communicated through additional signs and pavement markings at MUTIT sites may be beneficial in reducing driver confusion and enhancing traffic safety.
- With respect to driver expectancy, the MUTIT should not be mixed with other indirect and direct left-turn strategies on corridor level implementations.
- Though the MUTIT is typically a corridor treatment, the concept has been used successfully for isolated intersections to improve traffic operations and safety.
- Loons can be installed to accommodate larger U-turning vehicles, so the MUTIT can be a feasible treatment for corridors with narrow medians.
- Directional median crossovers provide better operational and safety benefits compared to bidirectional median crossovers.
- Reducing signal phases at the intersection provides increased capacity for the MUTIT in comparison to the conventional intersections. The capacity increases are typically in the range of 20 percent to 50 percent.
- The total network travel time savings can and usually does outweigh the additional travel time required for left-turning vehicles from the major road and cross street for corridors with the MUTIT compared to conventional intersections.
- The safety performance of MUTIT is better than conventional intersections because they have fewer vehicle-vehicle conflict points. Typical total crash reductions range from 20 percent to 50 percent.
- Head-on and angle crashes that have high probabilities of injury are significantly reduced for the MUTIT compared to conventional intersections.

Table 3. Safety comparison of MUTITs and conventional intersections.

Dataset	Rate Type	Group	Mean Crash Rates (Crashes/MVE)	Standard Deviation	Alpha
Corridor	**All**	MUTIT (*Reduction*)	1.554 *(14%)*	0.784	73
		Conventional	1.806	0.679	
Intersection Related	**All**	MUTIT (*Reduction*)	1.388 *(16%)*	0.593	80
		Conventional	1.644	0.643	
	PDO	MUTIT (*Reduction*)	0.982 *(9%)*	0.392	49
		Conventional	1.077	0.467	
	Injury	MUTIT (*Reduction*)	0.407 *(30%)*	0.266	97
		Conventional	0.58	0.252	

Table 4. Expected crashes for MUTITs and conventional intersections for a 5-year period [WH12].

Crash Type	Injury Crashes				PDO Crashes				All Crashes			
	Conventional		MUTTIT		Conventional		MUTTIT		Conventional		MUTTIT	
	%	Expected Crashes	%	Expected Crashes	%	Expected Crashes	%	Expected Crashes	%	Expected Crashes	%	Expected Crashes
Overturn	1.53	0.97	0.92	0.41	0.64	0.75	0.27	0.29	0.95	1.71	1.03	1.57
Fixed Object	3.56	2.26	4.25	1.89	4.77	5.62	6.97	7.5	4.36	7.85	6.13	9.38
Head-on	0.80	0.51	0.27	0.12	0.43	0.51	0.33	0.35	0.56	1.01	0.35	0.53
Angle St	36.87	23.4	19.77	8.8	18.35	21.63	9.06	9.75	24.73	44.53	12.12	18.54
Rear End	37.99	24.11	65.93	29.35	51.67	60.9	69.85	75.14	46.94	84.51	68.29	104.44
Angle Turn	3.56	2.26	4.76	2.12	6.71	7.91	7.74	8.33	5.62	10.12	6.84	10.46
Rear End Lt	1.53	0.97	0.81	0.36	4.18	4.93	0.93	1	3.27	5.89	0.88	1.35
Rear End Rt	0.20	0.13	0.65	0.29	1.45	1.71	1.43	1.54	1.02	1.84	1.19	1.82
Sdswipe Opp	0.20	0.13	0.13	0.06	0.27	0.32	0.22	0.24	0.25	0.45	0.20	0.3
Head-on Lt	13.75	8.73	2.52	1.12	10.89	12.84	2.75	2.96	11.87	21.37	2.66	4.07
Sdswpipe same	0.00	0	0.00	0	0.64	0.75	0.44	0.47	0.42	0.76	0.31	0.47
Σ	100.00	63.47	100.00	44.52	100.00	117.87	100.00	107.57	100.00	180.04	100.00	152.93

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Researcher—This synthesis was performed by Ramanujan (Ram) Jagannathan of Vanasse Hangen Brustlin, Inc. (VHB) TFHRC. It has been peer reviewed by Dr. William Taylor, Michigan State University, and Dr. Joseph Hummer, North Carolina State University. For more information about this research, contact Joe Bared, FHWA Project Manager, HRDS, (202)-493-3314, joe.bared@fhwa.dot.gov.

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Key Words—Traffic operation; safety; median U-turn; traffic modeling

Median U-Turn Intersection Treatment: Safety and Operational Benefits

Presentation by:

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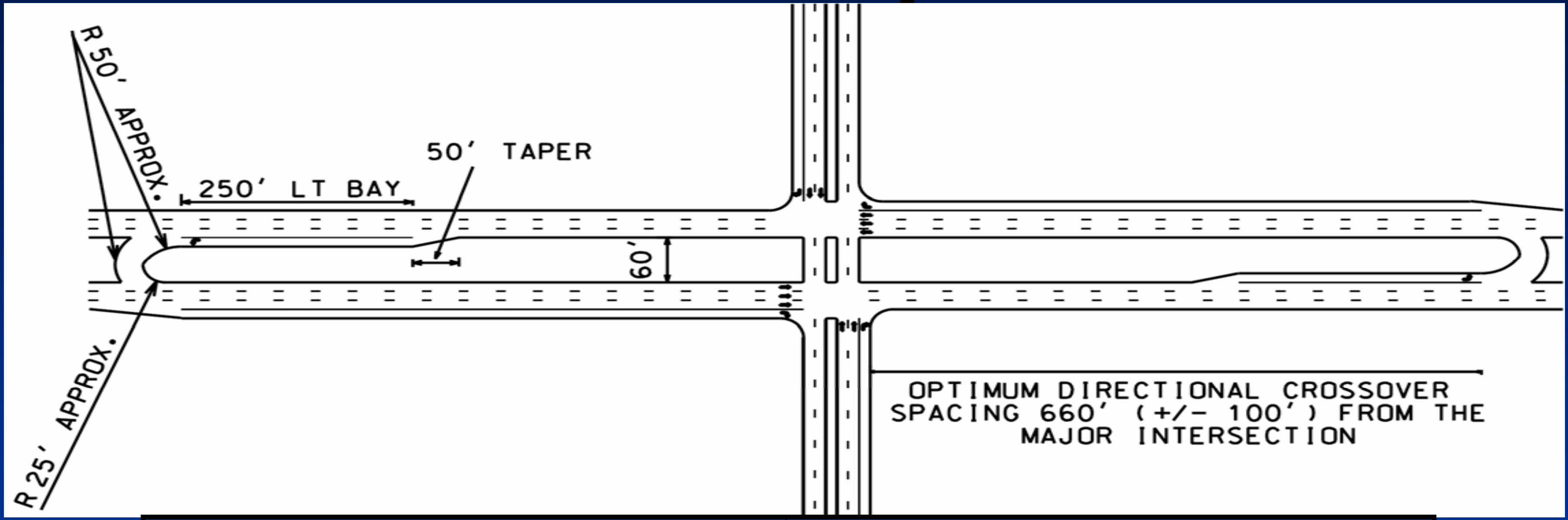
Vienna, VA

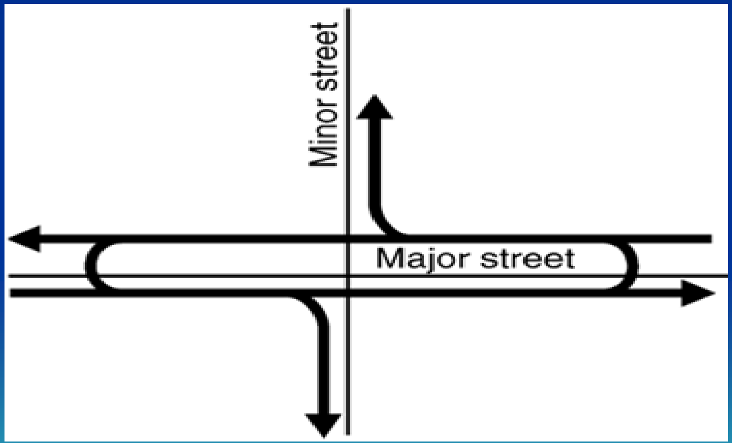
(For *Joe Bared, FHWA*)

U.S. Department of Transportation
Federal Highway Administration

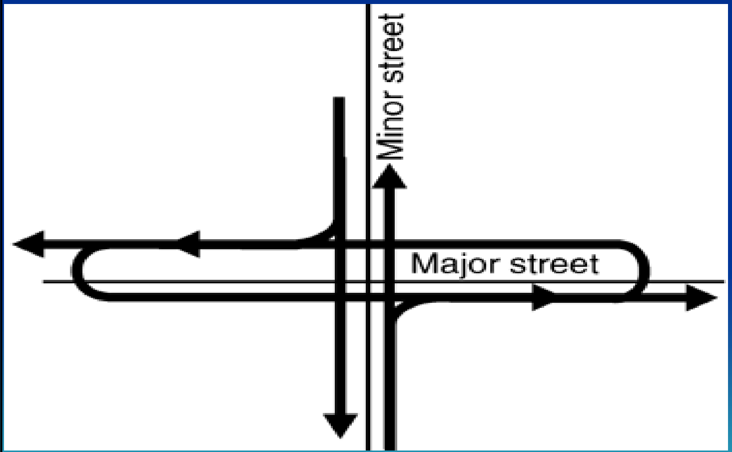
Michigan left-Turn

Concept





Major street movements



Minor street movements

General Advantages

- The two-phase signal control allows shorter cycles.
- Reduced delay for through traffic on the major arterial.
- Increased capacity at the main intersection.
- Improved progression and fewer stops for through traffic, especially where there are STOP-controlled directional crossovers.
- Reduced risk to crossing pedestrians.
- Fewer conflict points. Greater separation of conflict points.

U.S. Department of Transportation
Federal Highway Administration

General Disadvantages

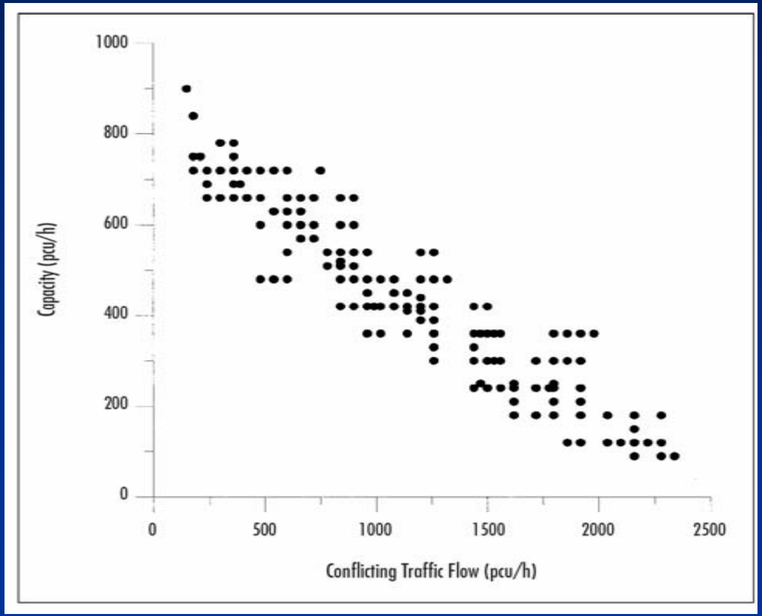
- Possible driver confusion and disregard of left-turn prohibition at the main intersection.
- Possible increased delay, travel distances and stops for ***left-turning*** traffic.
- Larger rights-of-way required for the arterial, although this could potentially be mitigated on roads with narrow medians.
- Higher operation and maintenance costs attributable to additional traffic signal control equipment if the directional crossovers are signalized.
- Longer minimum green times for cross street phases or two-cycle pedestrian crossing.

Traffic Operational Performance

- Difference in travel time (for limited flow scenarios) ranged from -21 to +6% compared to conventional design.
- Lower left-turn travel time at low and high degrees of saturation for mainline traffic.
- Some reported increases in capacity ranging from 20 to 50%, others 14 to 17%.

U-Turn Capacity at unsignalized and signalized crossings

- Capacity for non-signalized intersection (ITE Journal article, figure on right)



- Critical gap range from 5.8 to 7.4 seconds.

- Suggested saturation flow rate reduction factors of 0.82 and 0.76 for U-turn lanes at signalized intersections.

Traffic Conflict Points

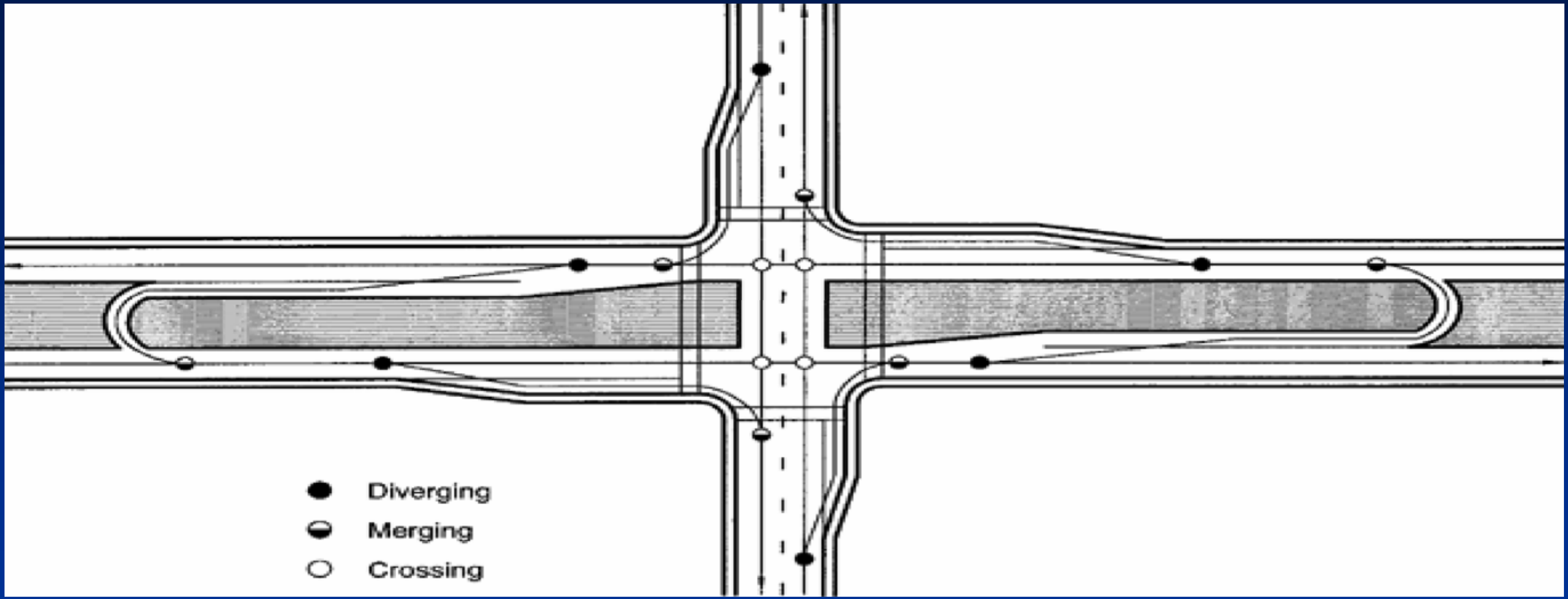


Table 2. Number of conflict points at a four-leg signalized intersection compared to the MUTIT

Conflict type	Four-Leg Signalized Intersection	MUTIT
Merging/diverging	16	12
Crossing (left turn)	12	0
Crossing (angle)	4	4
Total	32	16

Effects on Crashes

- Crash reductions of 17 percent, 96 percent and 61 percent were observed for rear-end crashes, angle crashes, and side-swipe crashes, respectively.

- Overall reduction of 9 to 30%.

- In rural areas, crash rates are about 36%.

Michigan DOT Guidelines

Directional crossover is safer than bi-directional

Bi-Directional Crossover   Directional Crossovers

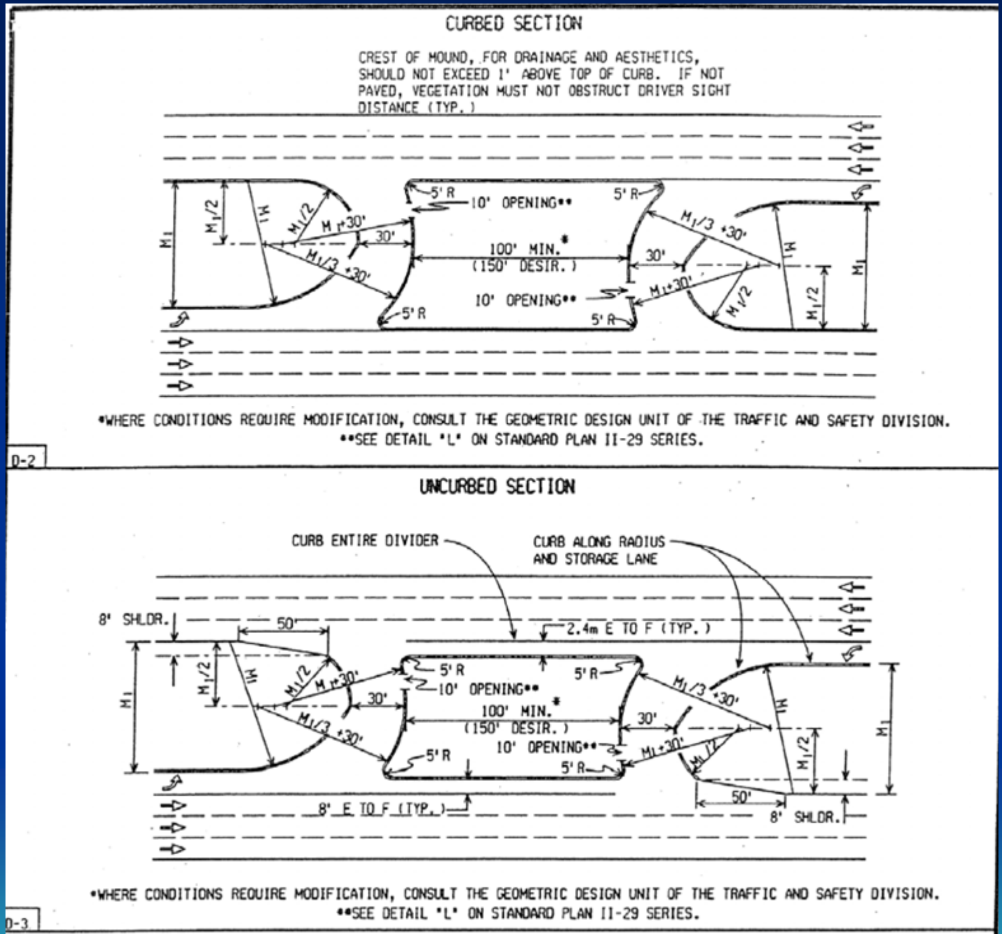
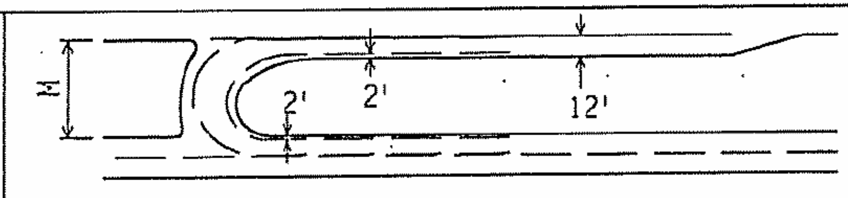
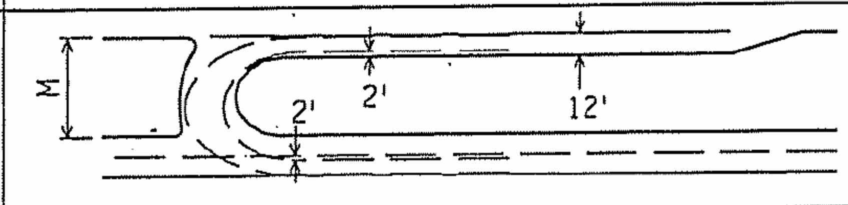
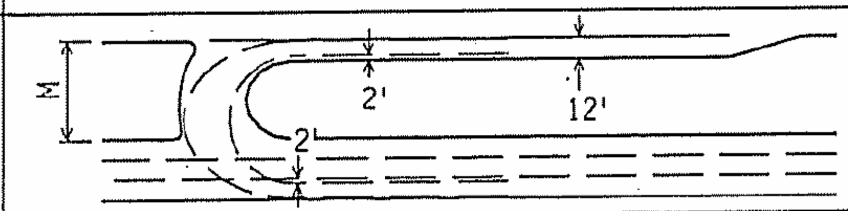


Figure 5. Michigan DOT Design Guidelines for Directional Median Crossovers

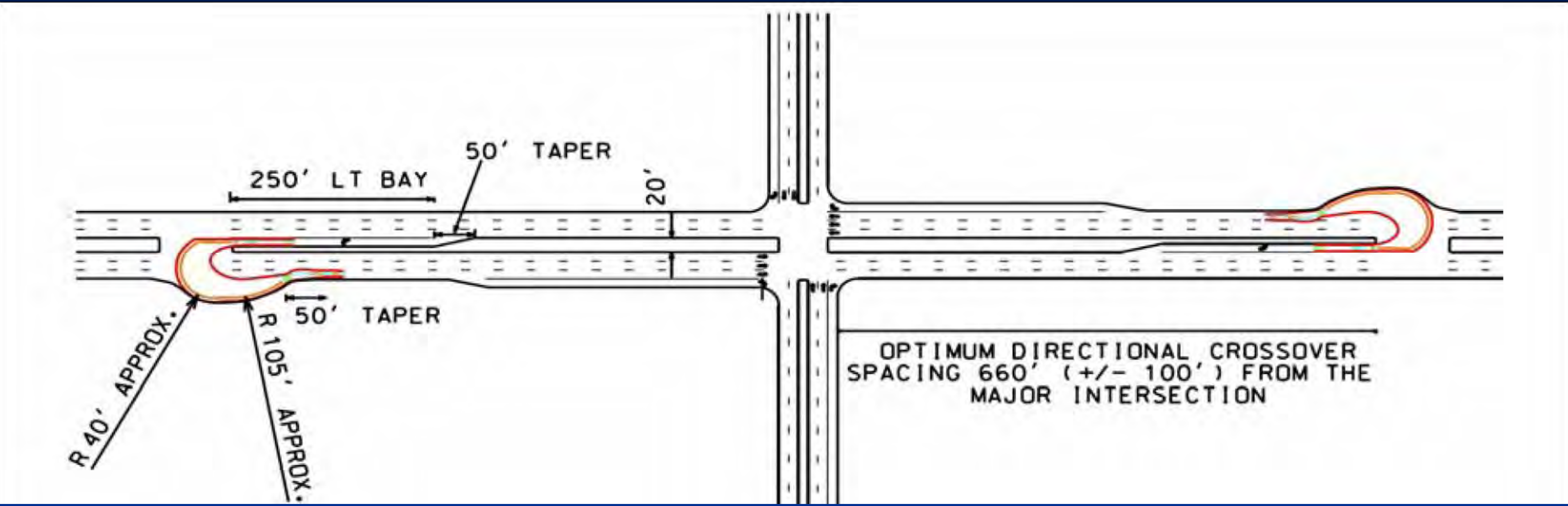
Location and Design of Median Crossovers

Minimum Designs for U-Turns

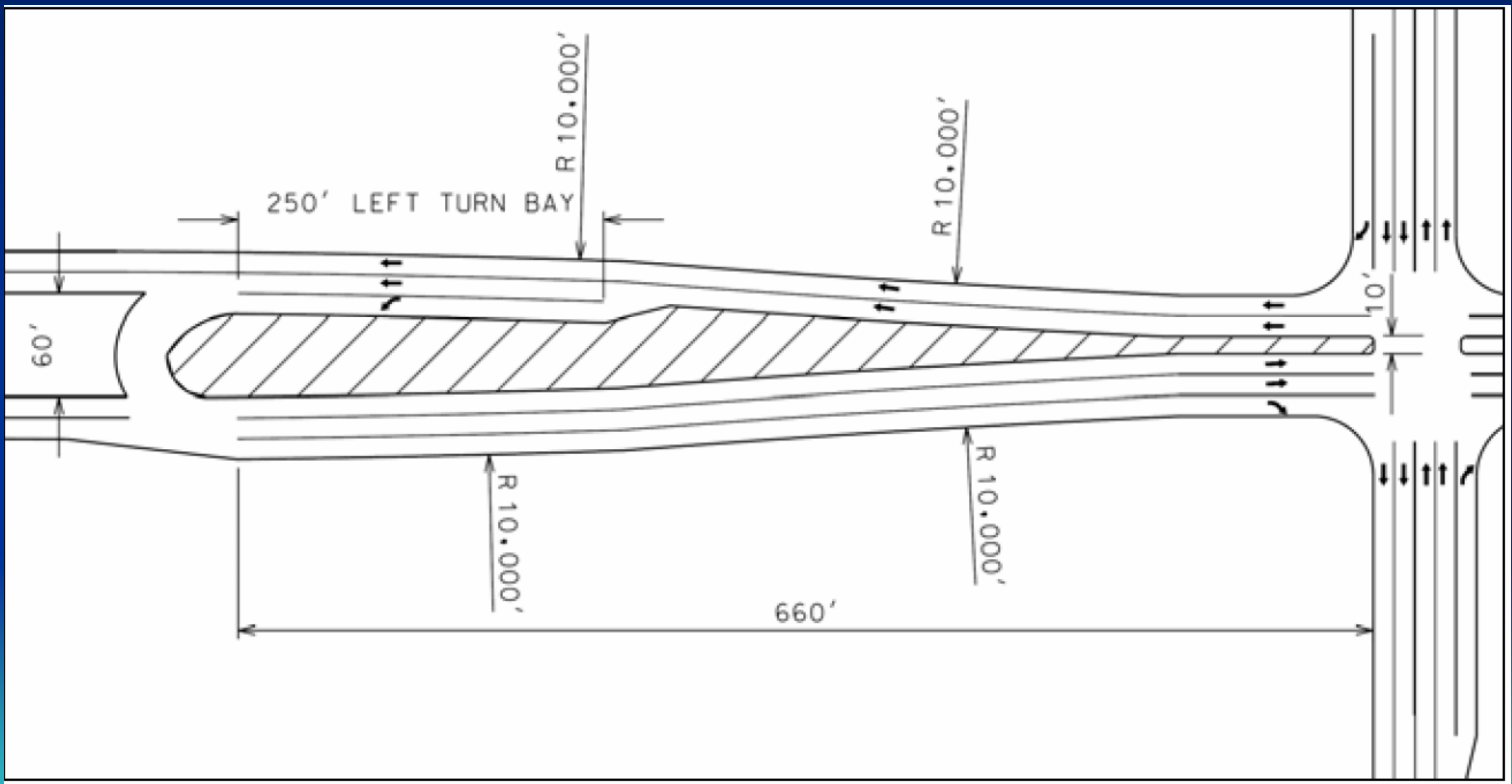
Type of Maneuver		M = Min. width of median - feet for design vehicle				
		P	SU	BUS	WB-50	WB-60
		Length of Design Vehicle				
		19'	30'	40'	55'	70'
Left Lane to Inner Lane		44'	76'	80'	82'	82'
Left Lane to 2nd Lane		32'	64'	68'	70'	70'
Left Lane to 3rd Lane		22'	54'	58'	60'	60'

P = Passenger
SU = Single Unit Truck
WB-50 = Semi-Truck Medium Size
WB-60 = Semi-Truck Large Size

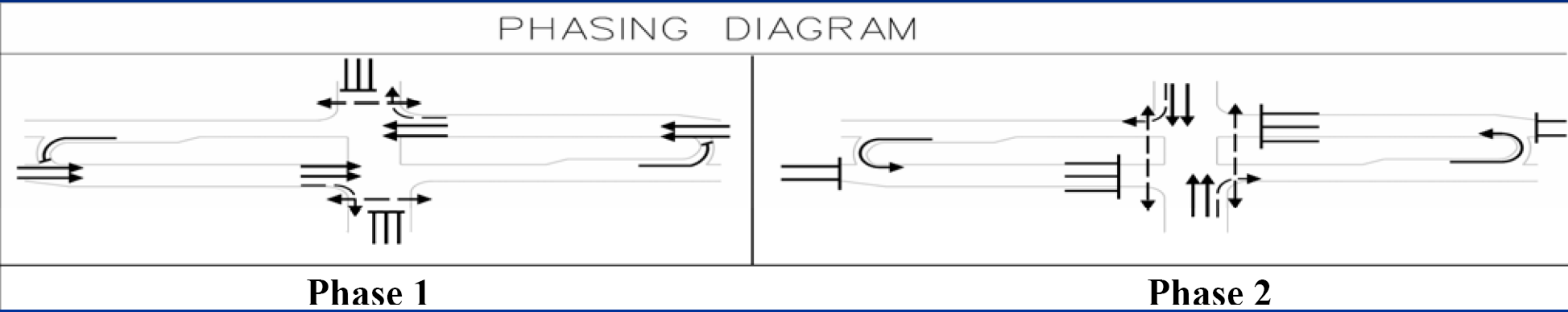
Loons on Roads with Narrow Medians



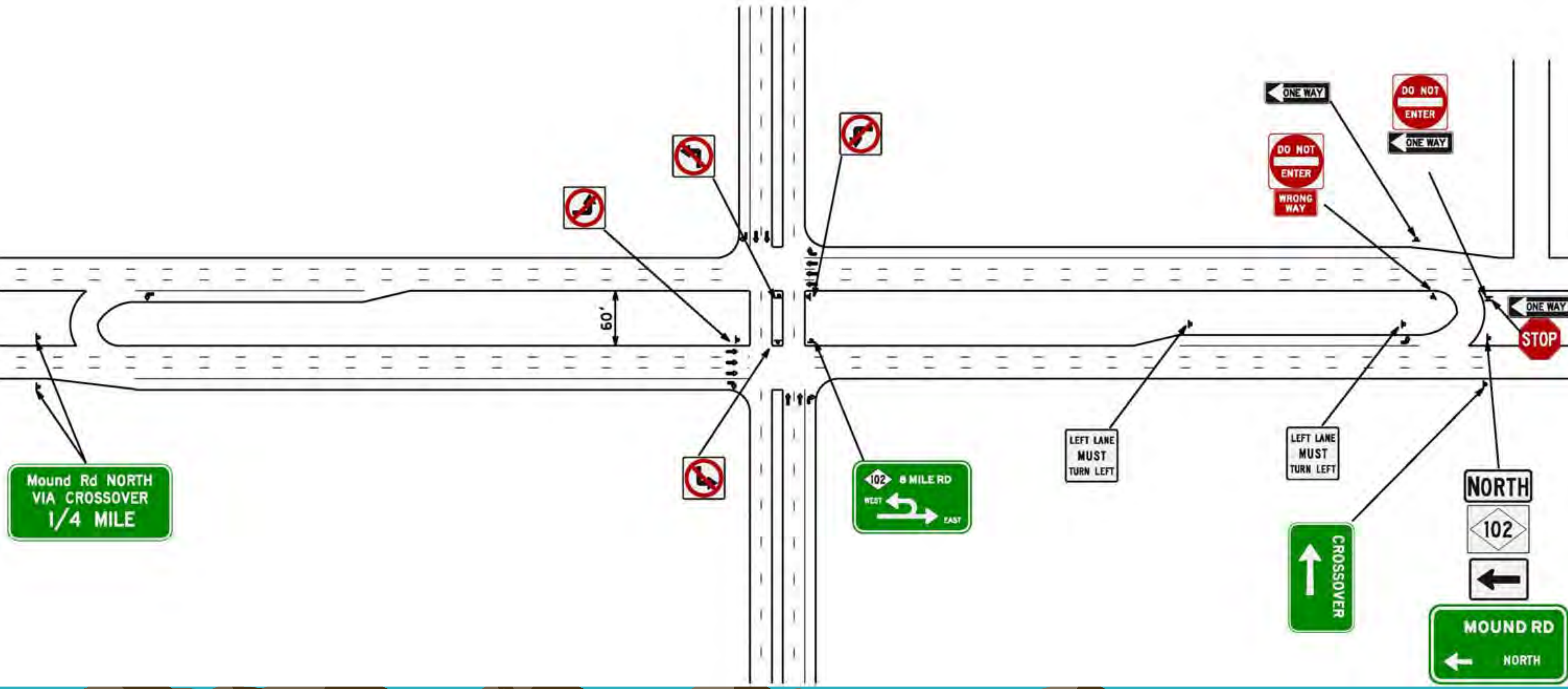
Narrowing at Main Intersection



Signal Phasing



Example of Signing Plan in Michigan



Examples of Signs on Cross Street

Example of a Sign on the Mainline

Additional Resources

- “Synthesis of the Median U-turn Intersection Treatment, Safety and Operational Benefits.” Publication No. FHWA-HRT-07-033.
- Can be found on the internet at the following address: http://www.tfhrc.gov/safety/pubs/07033/07033.pdf

Synthesis of J-Turn Design Standards And Criteria

December 2010

Final Draft Report

MDOT

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

ABMB 25

ENGINEERS, INC.

Contents

I. Abstract

Transportation professionals today are faced with the challenge to meet the mobility needs of an ever increasing population with limited resources. One potential treatment to mitigate congestion and safety problems at rural expressway intersections, while trying to avoid signalization or grade-separation, is the J-Turn intersection treatment, which has been successfully implemented in Michigan, Florida, Maryland, New Jersey, and Louisiana.

The treatment involves the prohibition of left-turn and through movements from the side-street approaches and accommodates them by requiring drivers to turn right onto the main road and then make a u-turn maneuver at a one-way directional median opening downstream. Left-turns from the main road approaches are executed in a manner similar to left-turns at a conventional intersection and are unaffected. Although this type of intersection treatment is typically considered a corridor-wide treatment, the concept has been successfully used at isolated intersections to improve traffic flow and enhance safety

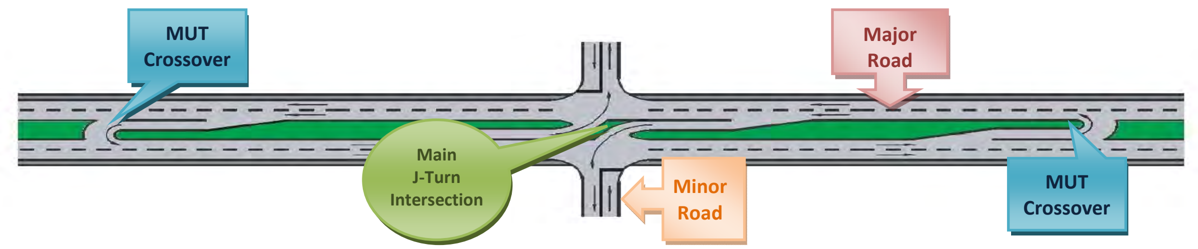
This synthesis presents design guideline recommendations for the implementation of J-Turn intersection treatments in Mississippi. Specific items addressed in this document include general design elements, cross-sectional elements, intersection and crossover design details, pedestrian accommodations, traffic control devices, lighting, signing, historical safety performance, construction costs and phasing, and public involvement efforts. The recommendations herein should be considered as minimums. The recommendations contained in this document cannot apply to all situations as every project is unique and typically require their own variations to site-specific conditions.

Many of the design elements recommended for the J-Turn intersection and MUT crossovers match the current MDOT practices for arterials. All references contained in this document refer to the 2001 edition of the *MDOT Roadway Design Manual,* which is currently undergoing a major revision. Therefore, the designer should verify that the most recent design criteria is being used prior to beginning a design.

II. Summary of J-Turn Intersection Concept

A J-Turn intersection, shown in **Figure 1**, is a variant of the Restricted Crossing U-turn (RCUT) intersection in that both the main intersection and the two crossovers are unsignalized. The J-Turn intersection design is usually recommended for low volume divided expressways. It involves the elimination of direct left turns from an intersection's minor approach using a directional median (which allows direct left-turns from the major road, but prohibits minor road traffic from entering the median) with downstream median u-turn (MUT) crossovers. Although this type of intersection treatment is typically considered a corridor-wide treatment, the concept has been successfully used at isolated intersections to improve traffic flow and enhance safety. This type of intersection design is a conflict point management treatment that eliminates and controls intersection conflict points. The J-Turn intersection treatment should not be mixed with other indirect or direct left turn strategies on corridor level implementations.

Figure 1 - Typical J-Turn Intersection



The J-Turn intersection design concept has been successfully used in Michigan and other states for over four decades. The term "J-Turn" for this style of intersection was coined by the Maryland State Highway Administration (MSHA). This intersection design is also known by other names in other states such as the "Superstreet" intersection in North Carolina or the "Right-Turn U-Turn" (RTUT) intersection in Florida.

If traffic signals are warranted at either the main intersection or the median u-turn (MUT) crossovers the J-Turn intersection design may not wholly apply and is not specifically addressed in this report.

Advantages of the J-Turn intersection design include:

+ Allows the major arterials through traffic to proceed without stopping.
+ Eliminates the need for traffic signals that will not fit into existing time-space (progression) patterns along arterial roadways.
+ Reduces the number of conflict points when compared to conventional intersection designs.
+ Crashes occurring at the conflict points are expected to be less severe than at conflict points of conventional intersections.

Disadvantages of the J-Turn intersection design include:

- Possible driver confusion.
- May be perceived to adversely affect roadside business access.
- Combined median right-of-way and lane width requirements for loon construction can be required for u-turning vehicles.

Situations suitable for a J-Turn intersection:

- Relatively low to medium side-street through volumes and heavy left-turn volumes from the major road.
- The minor road total volume to total intersection volume ratio is typically less than or equal to 0.20.
- Areas where median widths are larger than 64 ft. Narrower medians will require additional design considerations for accommodating large u-turning vehicles (see **Section IV.A**).
- Intersections that experience a high number of far-side right-angle collisions.
- Intersections where minor road crossing traffic gap times are insufficient to complete the maneuver safely and cause multiple vehicles to stack into the median opening.

For intersections with very high left-turn and through volumes from the side road approaches, the J-Turn intersection design is not the optimum choice. The J-Turn intersection design better serves an intersection with more major road left turns than minor road through movements. The AASHTO publication *A policy on Geometric Design of Highways and Streets* (a.k.a. Green Book) currently discourages the use of a J-Turn type intersection on high-speed or high-volume highways due to “the difficulty of weaving and the long lengths involved” in the indirect minor road movements, unless “the volumes intercepted are light and the median is of adequate width.”

III. Design Elements

A J-Turn expressway is basically a principal arterial with the indirect left-turn treatment implemented on a corridor basis. Therefore, many of the design elements recommended for the J-Turn intersection and MUT crossovers match the current MDOT practices for arterials. All references contained in this document refer to the 2001 edition of the *MDOT Roadway Design Manual,* which is currently undergoing a major revision. Therefore, the designer should verify that the most recent edition of the manual is being referenced.

A. Design Speed

For J-Turn intersection and MUT crossover treatment designs on multi-lane rural arterials and collectors, **the recommended design speed is 65 mph**. This applies to both new construction and 3R projects. In urban areas the design speed varies widely and the designer should refer to the MDOT Roadway Design Manual for the appropriate design speed.

B. Design Vehicle

The appropriate design vehicle should be determined by restrictions placed on the intersecting roadway. According to the current edition of the *MDOT Roadway Design Manual,* the minimum design vehicle for rural collectors and urban arterials is a WB-40 and for rural arterials is a WB-50. However, upcoming revisions to the design manual increase the size of the minimum design vehicle for rural arterials to a WB-62. Therefore, all J-Turn intersection and MUT crossover designs recommended in this document were developed using a WB-62 as the design vehicle. At locations with narrow median widths, the WB-62 may not be viable and the design vehicle selection should be based upon all relevant considerations for the specific site.

C. Superelevation

For most situations where the J-Turn intersection treatment is implemented, the typical maximum superelevation rate is 10%. However, the designer should refer to the latest edition of the *MDOT Roadway Design Manual* for each specific location.

D. Clear Zone

The roadside clear zone is the distance beyond the edge of traveled way that should be clear of any non-traversable hazards or fixed objects. The clear zone is variable and should be determined based on design speed, traffic volume and roadway classification as according to *MDOT Roadway Design Manual – Section 9-2.0.* **A clear zone distance of 30 ft is recommended** for practicality and to provide a consistent roadway template.

E. Sight Distance

Sufficient sight distance should be provided at the J-Turn intersections as well as the MUT crossovers. The design of the J-Turn intersection must meet the intersection sight-distance requirements for an at-grade intersection as set forth in the *MDOT Roadway Design Manual*. MUT crossover designs must meet the stopping-sight distance requirements set forth for median openings in the MDOT Roadway Design Manual.

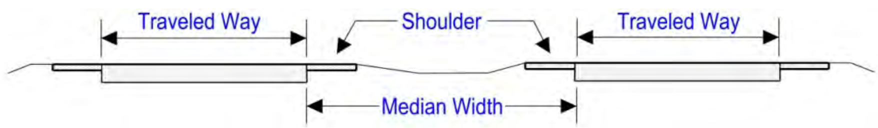
> According to the *FDOT Median Handbook*, the sight distance for u-turns at unsignalized median openings for speeds of 60 mph should be no less than 1,540 ft.

IV. Cross-Sectional Elements

A. Median Widths

As illustrated in **Figure 2,** the median width should be measured between the inside edges of the two traveled ways of the opposing roadways. **Median widths greater than or equal to 64 ft are recommended** to accommodate large trucks and minimize shoulder encroachment when making u-turn maneuvers. In rural areas the typical MDOT median width is 101 ft and in urban areas is 64 ft.

Figure 2 - Median Width Measurement



Existing roadways with median widths of 64 ft or less will require additional design considerations to allow large trucks to execute u-turns at the MUT crossovers. Alternative median design treatments to accommodate u-turns by large trucks include:

- Allow vehicles to turn onto the existing or widened shoulder, which could have strengthened full-depth pavement.
- Add pavement outside the travel lane to allow the design vehicle to complete the u-turn maneuver and merge back into traffic stream (**Figure 3**). The added pavement is known as a *loon*.
- Widen the median, median "bulb-out", using reverse curves in the vicinity of the crossover to better accommodate u-turns (**Figure 4**).

Figure 3 - Loon Illustrations

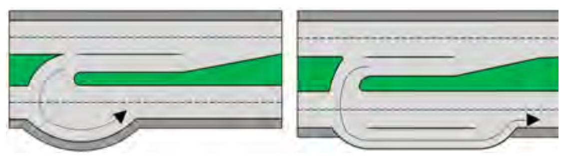
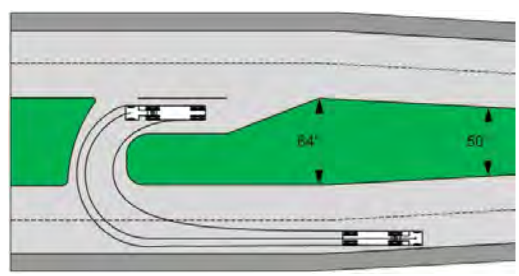


Figure 4 - Median "Bulb-Out" Illustration



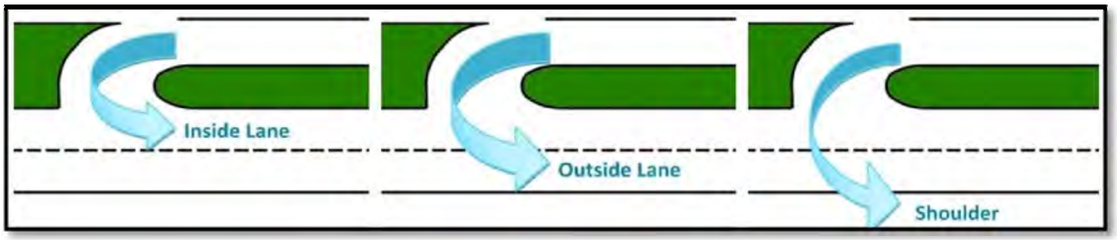
The expected design vehicle u-turn lane destinations for common MDOT median widths are provided in **Table 1**. The possible u-turn lane destinations include the inside lane, outside lane, shoulder, or loon and are illustrated in **Figure 5**.

Table 1 – Design Vehicle U-turn Lane Destinations by Median Widths

DESIGN VEHICLE (length, ft)	MEDIAN WIDTH		
	40'	64'	101' +
BUS (40')	Shoulder	Inside Lane	Inside Lane
WB-40 (40')	*	Outside Lane	Inside Lane
WB-50 (50')	*	Shoulder	Inside Lane
WB-62 (62')	*	Shoulder	Inside Lane
WB-67 (67')	*	Shoulder	Inside Lane

* U-turn cannot be completed within usable roadway width.
- 12 foot-wide lanes have been assumed. All turns begin from median u-turn lane.
- U-turn lane destinations shown on roadway without improvements.

Figure 5 – U-Turn Lane Destination Possibilities



B. Lane Widths

For both rural and urban areas, **it is recommended that the travel lanes and auxiliary lanes be 12 ft wide**. On existing roadways, auxiliary lane widths of 11 ft are acceptable if lane widening is not possible.

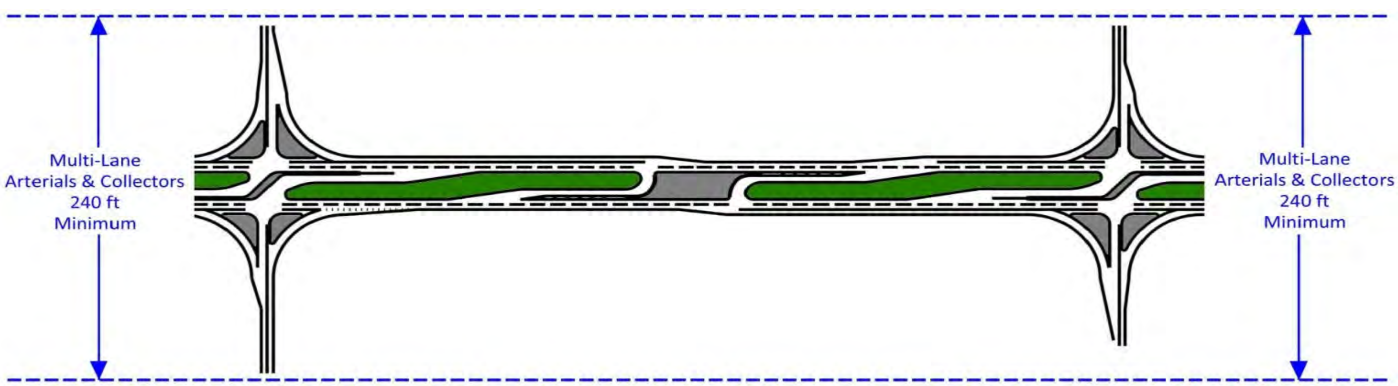
C. Shoulder Widths

Shoulder widths are variable and should be determined based on traffic volume and roadway classification as according to the latest edition of the *MDOT Roadway Design Manual*. If the design includes loons at the MUT crossovers, a total outside shoulder width of 6 ft, with a minimum of 4 ft paved, is recommended in the vicinity of the loons.

D. Right-of-Way

In accordance with the *MDOT Roadway Design Manual* for rural multi-lane arterials and collectors, **the recommended standard minimum right-of-way width is 240 ft** and is illustrated in **Figure 6**. In restrictive areas, it may not be possible to obtain the 240 ft right-of-way needed for the desired median width to accommodate u-turn maneuvers by large trucks. Some design alternatives for areas with restricted right-of-way are discussed in **Section IV.A** of this report.

Figure 6 - J-Turn Intersection Right-of-Way Requirements



V. Intersection Design Elements

The recommended typical designs for the J-Turn intersection treatment with MUT crossovers are shown in **Figures 16 – 19** for commonly used MDOT median widths.

A. J-Turn Intersection Design

The minor road approaches of the J-Turn intersection should be designed for all right turn movements since all through and left-turning vehicles are converted to right-turning vehicles. The J-Turn intersection has only one-way median openings for exclusive use of left-turning traffic from the main road. Turning radii treatments for J-Turn intersection designs should accommodate the design vehicles appropriate for the area type and functional classification of the intersecting roadways. Curbs should be mountable, Type 2, to allow emergency vehicles to cross the curb if required. The recommended geometric design details of the main J-Turn intersection for commonly used MDOT median widths are shown in **Figures 7 -10**.

Figure 7 - Recommended J-Turn Intersection Design Detail for 40 ft Medians

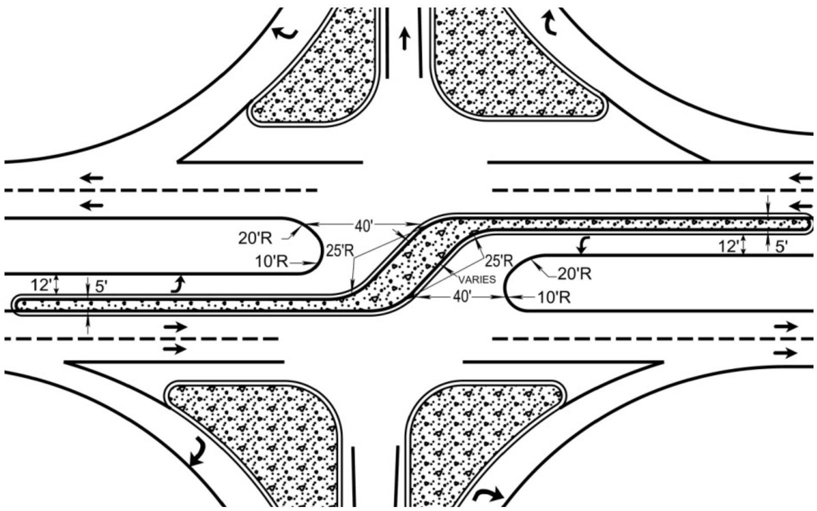


Figure 8 - Recommended J-Turn Intersection Design Detail for 64 ft Medians

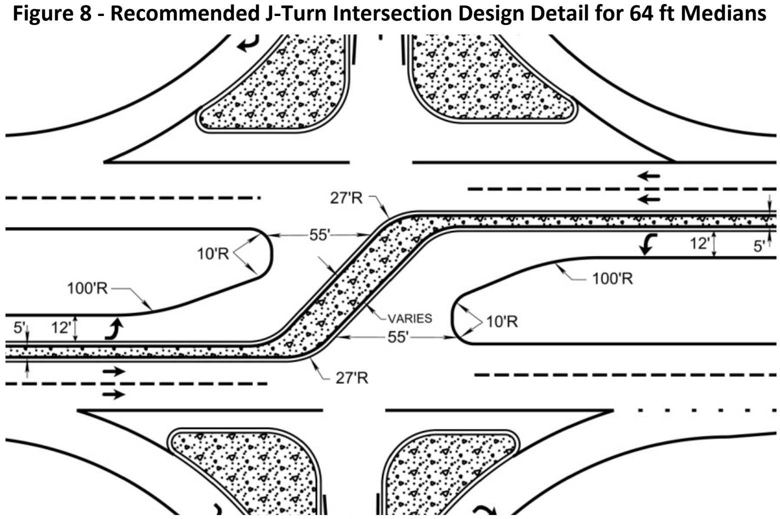


Figure 9 - Recommended J-Turn Intersection Design Detail for 101 ft Medians

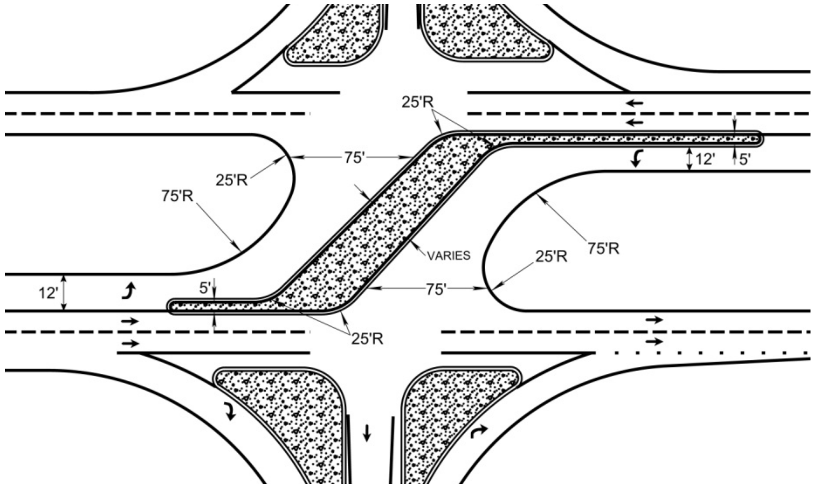
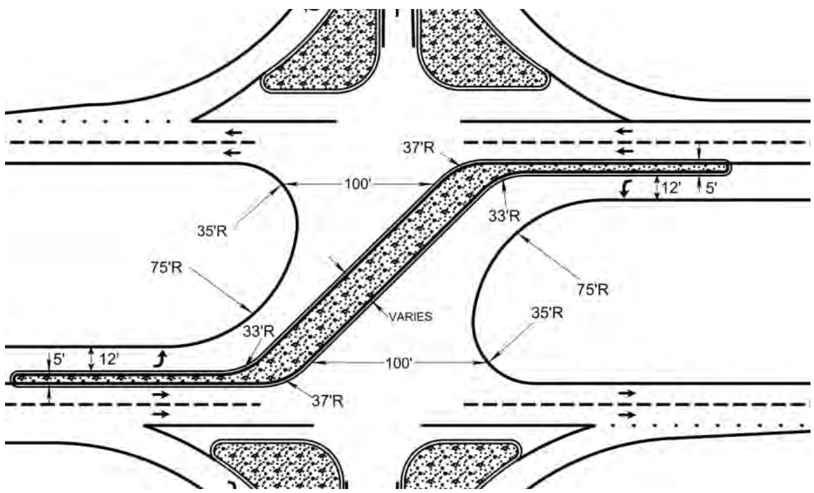


Figure 10 - Recommended J-Turn Intersection Design Detail for 126 ft Medians



1. Access Management

Driveways should not be allowed near the main intersection or on the opposite side of arterial from the MUT to reduce the chance of wrong-way movements in the MUT crossover and main J-Turn intersection.

2. Channelization and Boulevards

If the side roads are not of the boulevard or expressway type, **it is highly recommended that right-turn channels be installed for the minor road right-turn movements** to minimize wrong way maneuvers. If right-turn channels are included in the design, the distance to the MUT crossover may need to be increased.

3. Auxiliary Lanes

Auxiliary lanes should be provided at the main J-Turn intersection. The J-Turn intersection must be designed with exclusive right-turn lanes on the main roadway with sufficient length and width to accommodate the additional volume of right-turning vehicles (those that were the minor road through vehicles.) **It is recommended that the exclusive right-turn lanes on the main roadway are to be a minimum of 200 ft in length with a 150 ft taper if right-of-way allows. The exclusive left-turn lanes on the main roadway are**

recommended to be a minimum of 250 ft with 150 ft taper. For median widths less than 64 ft, a minimum taper length of 75 ft is acceptable if there is insufficient distance to accommodate a 150 ft taper as recommended. To accommodate the additional right-turning traffic from the minor road approach dual right-turn lanes are acceptable.

B. Median U-turn Crossover (MUT) Design

J-Turn intersection design treatments include two unsignalized one-lane directional medians located upstream and downstream from the main J-Turn intersection. Locations where the median width is 64 ft or less, design modifications discussed in **Section IV.A** may be needed near the MUT crossovers to safely accommodate oversized vehicle u-turn maneuvers. Furthermore, if the traffic composition includes a high number of longer vehicles, such as logging trucks, then the design of any required loons should be done such that these trucks do not block each other's line-of-sight when entering the through lanes from a loon area. A loon width of 10 ft is recommended for designs on median widths of less than 64 ft. The recommended geometric design details of the MUT crossovers for commonly used MDOT median widths are shown in **Figures 11 – 14.**

Figure 11 – Recommended MUT Crossover Design Detail for 40 ft Medians

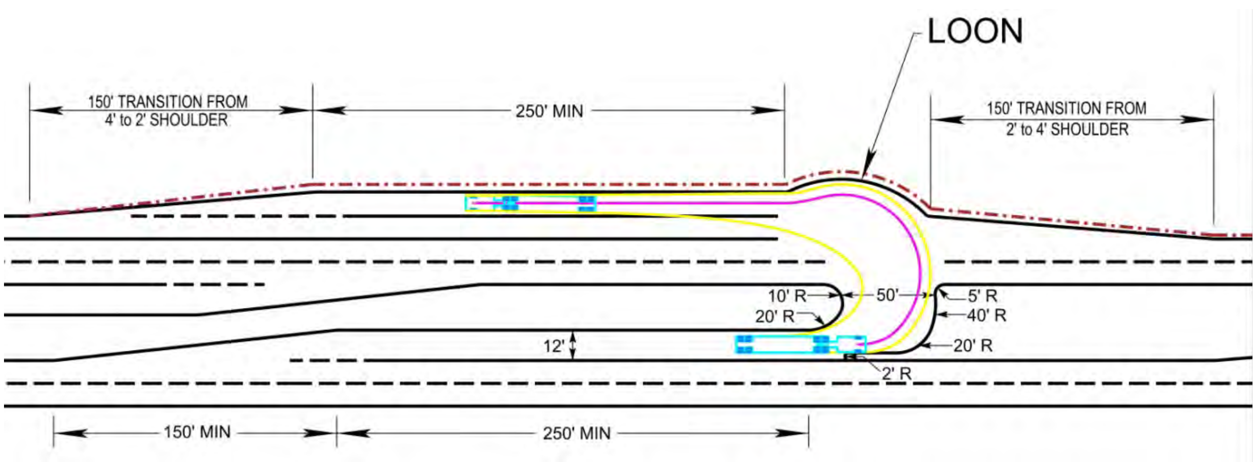


Figure 12 - Recommended MUT Crossover Design Detail for 64 ft Medians

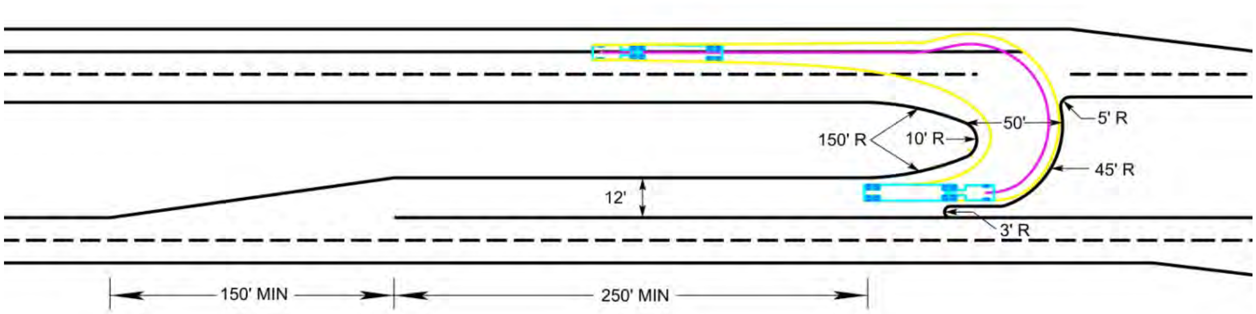


Figure 13 - Recommended MUT Crossover Design Detail for 101 ft Medians

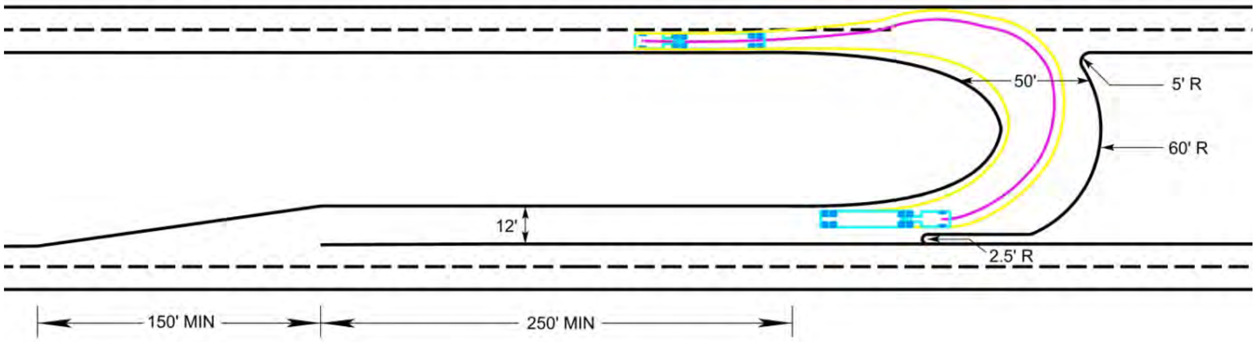
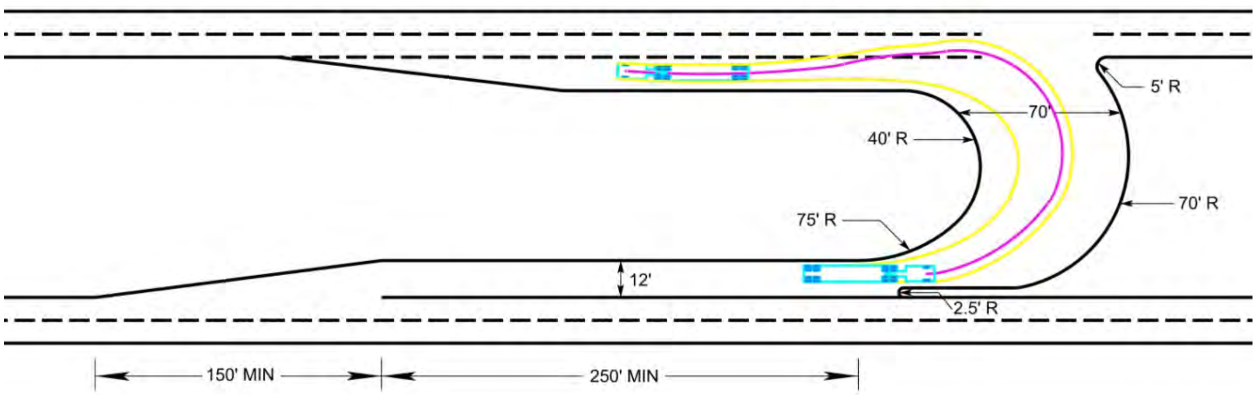


Figure 14 - Recommended MUT Crossover Design Detail for 126 ft Medians



Typically, a common profile grade line is used for both roadways of divided highways where the median width is 64 ft or less. For median widths in excess of 64 ft, independent profile grade lines may be desireable because of the natural terrain. However, an appreciable grade differential between the divided roadways should be avoided at the MUT crossovers as well as at the J-Turn intersection. Traffic entering from the crossroad may make a wrong-way maneuver if the pavement of the far roadway is obscured because of grade differential. In general, the grade of the crossover connections should not exceed 6%. **Table 2** provides the maximum elevation differential between adjacent roadways for various horizontal distances between centerlines. Typical gap acceptance times for a conventional intersection design are provided in **Table 3.**

Table 2 - Maximum Elevation Differential Between Adjacent Roadways

Horizontal Distance ℄ to ℄ (ft)	Maximum Profile Grade Differential With Crossover (ft)
64	1.0
88	2.0
125	4.2
150	5.7
200	8.7
250	11.7

Source: MDOT Roadway Design Manual

Table 3 - Typical Gap Acceptance Times for Conventional Intersections (seconds)

	2-Lane Facility Gap Times			4-Lane Facility Gap Times		
	Passenger Car	Single-Unit Truck	Tractor/Semi-Trailer	Passenger Car	Single-Unit Truck	Tractor/Semi-Trailer
Left-Turn from Minor Road	7.5	9.5	11.5	8.0	10.2	12.2
Right-Turn from Minor Road	7.5	9.5	11.5	7.5	9.5	11.5
Crossing	6.5	8.5	10.5	7.5	9.9	11.9
Left-Turn from Major Road	5.5	6.5	7.5	6.0	7.2	8.2

1. Crossover Spacing

MDOT *Roadway Design Manual* policy regarding median opening spacing states that median openings should be no closer than 880 ft apart in urban areas and 1,760 ft in rural areas. Based on existing information, utilizing existing median spacing required by MDOT design standards should be adequate and provide a safe distance for acceleration, weaving, and deceleration movements. However, access should never be allowed at MUT crossover locations, **therefore utilizing existing 880 ft (urban spacing) and 1760 ft (rural spacing) can be allowed if no access right-of-way can be provided adjacent to the MUT crossovers and other site conditions allow**. Generally, no access limits are preferred within 100 ft of the centerline of MUT crossovers. If the existing median openings are not suitable for conversion to MUT crossovers, **then new MUT crossover sites should be constructed no less than 800 ft and no more than 1,320 ft from the centerline of the J-Turn intersection.**

Recommended MUT Crossover Spacing Requirements:

MIN = 800 ft
MAX = 1,320 ft

Based on existing MDOT design criteria and historical highway construction by MDOT.

Several factors should be considered when selecting the appropriate spacing from the main J-Turn intersection to the two MUT crossovers. Longer spacing between the J-Turn intersection and MUT crossovers decrease spillback probabilities, providing more time and space for drivers to maneuver into the proper lane and react to highway signs. Shorter spacing between the J-Turn intersection and MUT crossovers translates into shorter weaving distances and travel times. Typical MUT crossover spacing requirements set forth by other agencies ranged from 560 ft to 1,320 ft and are provided in **Table 4**. Currently, criteria for a minimum weaving length for this treatment do not exist. The Type C weaving maneuver, as described in the *2000 Highway Capacity Manual*, is most closely compared to the weaving maneuver of a right-turn followed by a u-turn and may be applicable.

Table 4 - Other Agencies MUT Crossover Spacing Requirements

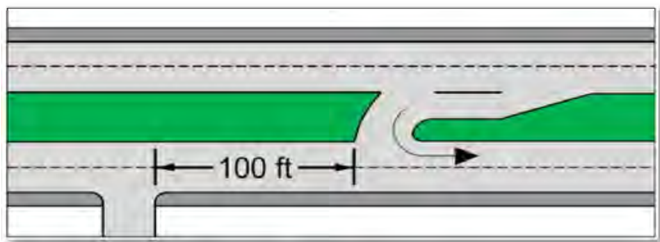
	Minimum	Maximum
AASHTO*	400 ft	600 ft
TRB Access Management Manual	660 ft	1,320 ft
North Carolina	800 ft	1,000 ft
Michigan	560 ft	760 ft
Oregon	990 ft	1,320 ft
Missouri**	600 ft	1,000 ft

** Based on signalized intersection treatment*
*** Specific location to be determined via capacity analysis*

2. Access Management

When selecting a MUT crossover location for the J-Turn intersection design, the highway access type must be considered. The MUT crossover should be designed and built for single-direction u-turns only. At crossovers where u-turns are permitted at the same time as right-turns from a driveway, the potential for conflicts exists and should be considered. **Allowing roadway access near an existing median crossover is undesirable because of the increase in the number of conflict points.** If the desired location of the MUT crossover is located at an existing median opening of Type 2B or Type 3, access rights purchase should be considered to avoid potential access adjacent to the MUT crossover. **Reconfiguration of an existing median crossing should be designed to provide single-direction u-turns only**. Driveway access should be located a minimum of 100 feet away from the MUT crossovers, as illustrated in **Figure 15,** to discourage wrong way maneuvers and minimize conflicts.

Figure 15 – Minimum Driveway Spacing Near MUT Crossovers



3. Auxiliary Lanes

Auxiliary lanes should be provided at both of the MUT crossovers located downstream from the main J-Turn intersection. The MUT crossovers must be designed with exclusive deceleration/storage lanes on the main roadway with sufficient length and width to accommodate the expected volume of u-turning vehicles. **It is recommended that the exclusive u-turn/left-turn lanes at the MUT crossovers be a minimum of 250 ft in length with a 150 ft taper.** One-lane or two-lane crossovers for u-turns may be needed depending on traffic volume demands and the number of receiving lanes. ***However, if two-lane crossovers are used it is recommended that the crossover be signalized and therefore the J-Turn intersection design set forth in this report may not wholly apply.***

To better accommodate trucks and older drivers, acceleration lanes are recommended at the MUT crossover locations to provide traffic with the opportunity to enter the travel lanes at or near the speed of through traffic. The minimum acceleration lane length should be based on *MDOT Roadway Design Manual* requirements. **For situations where auxiliary lanes serving the J-Turn intersection are located downstream from a loon at a distance of 150 ft or less, it is recommended that an auxiliary lane be constructed to connect the loon and existing auxiliary lane.**

For median widths less than 64 ft, a minimum taper length of 75 ft is acceptable if there is insufficient distance to accommodate a 150 ft taper as recommended.

Figure 16 - 40 ft Median Intersection Design

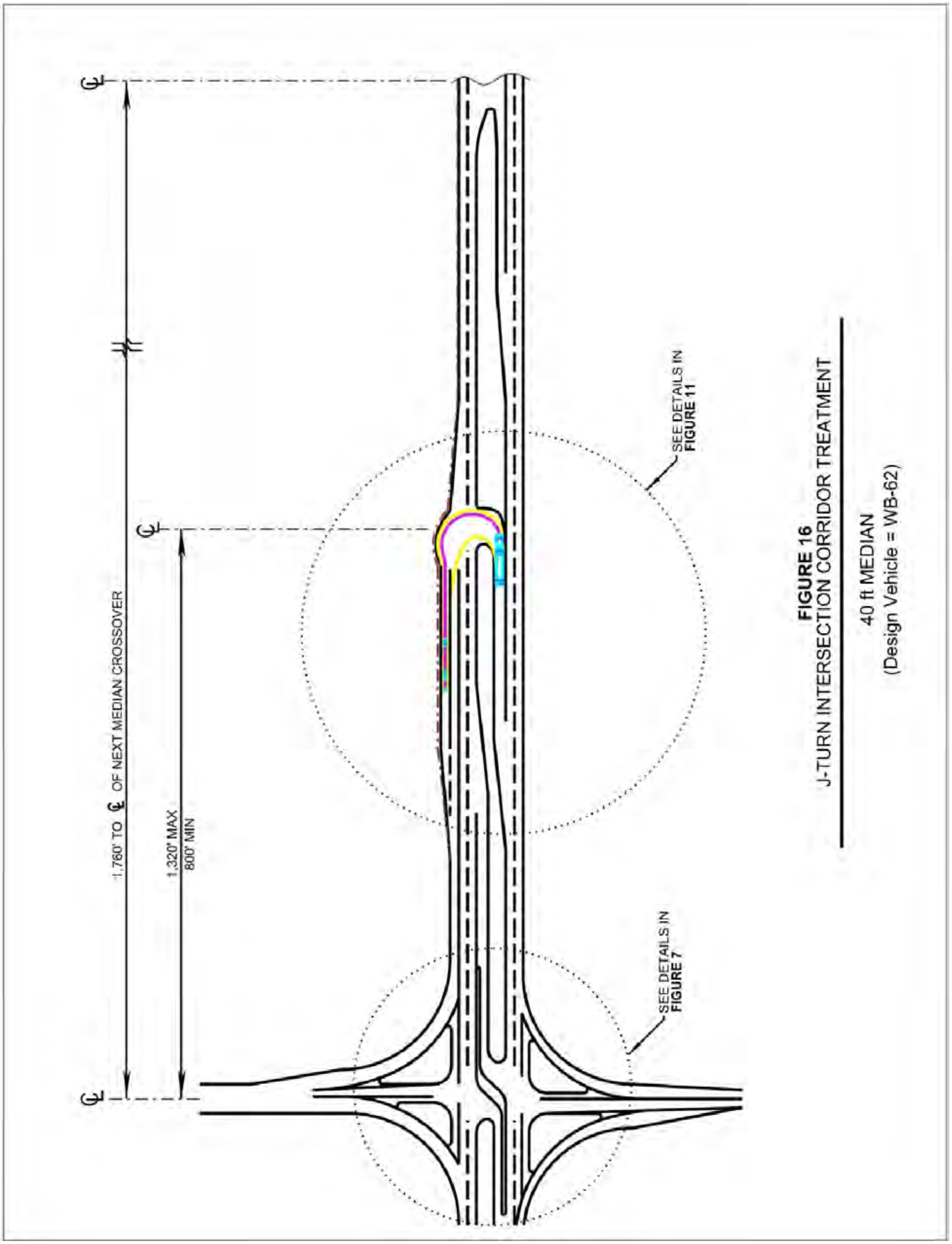


Figure 17 - 64 ft Median Intersection Design

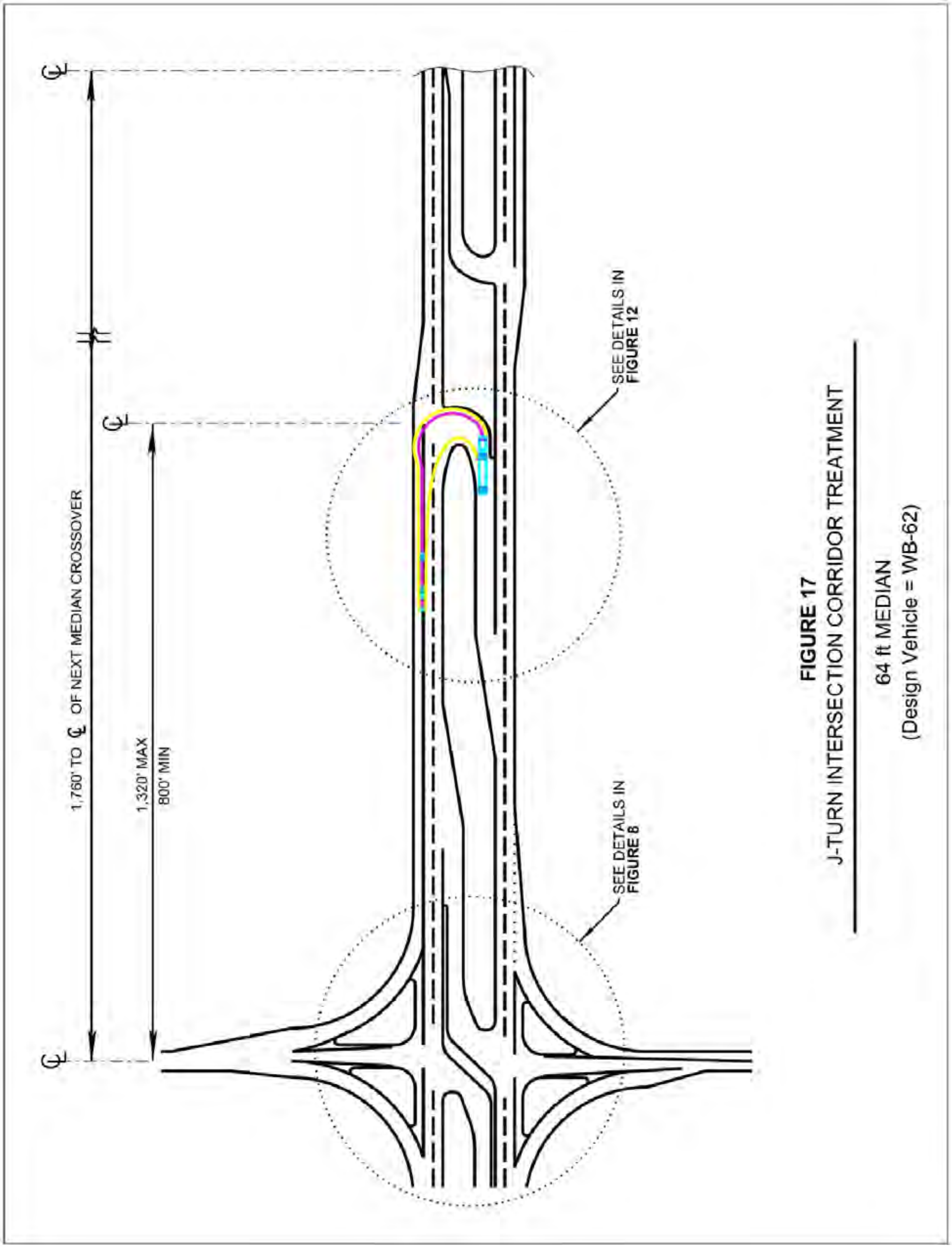


Figure 18 - 101 ft Median Intersection Design

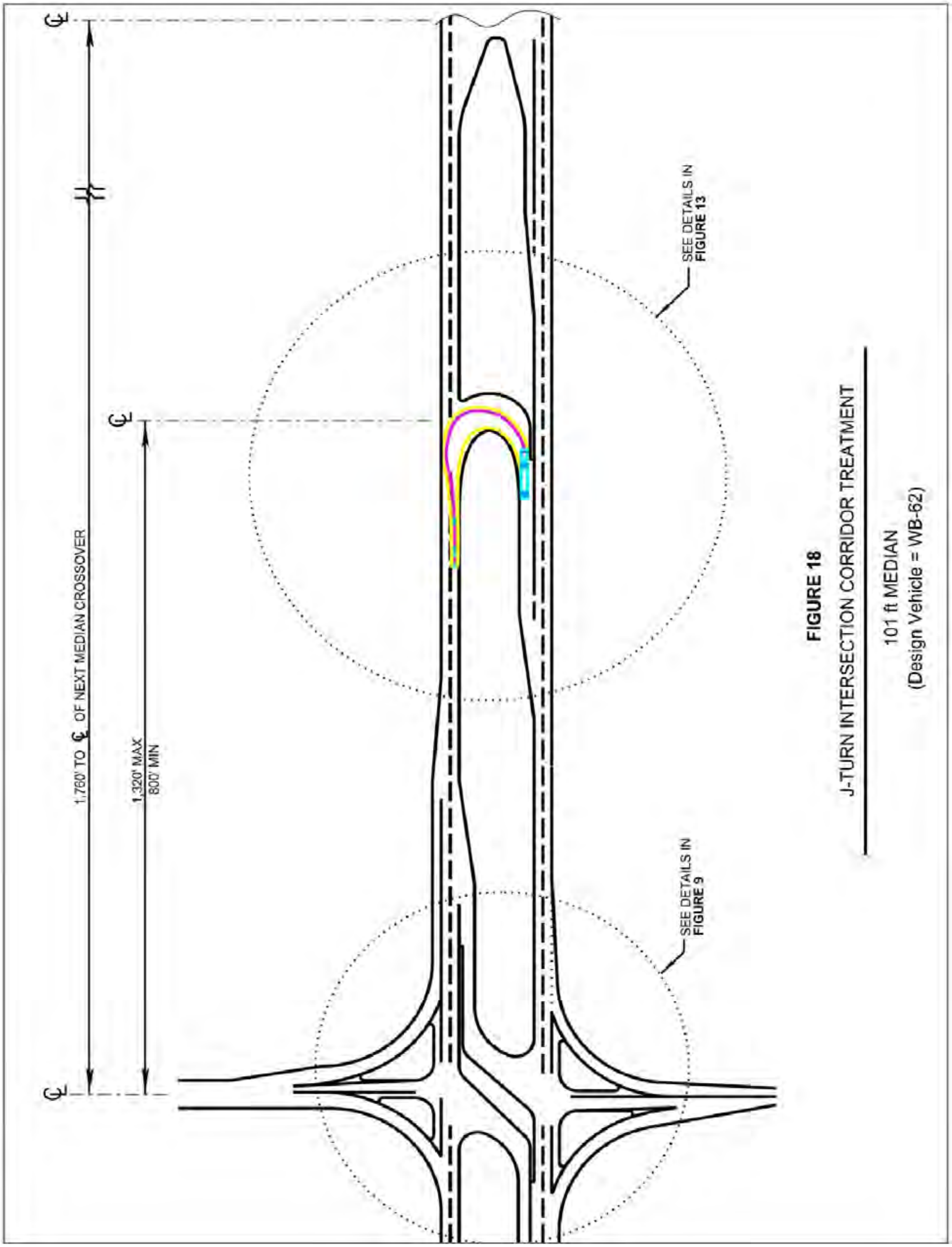
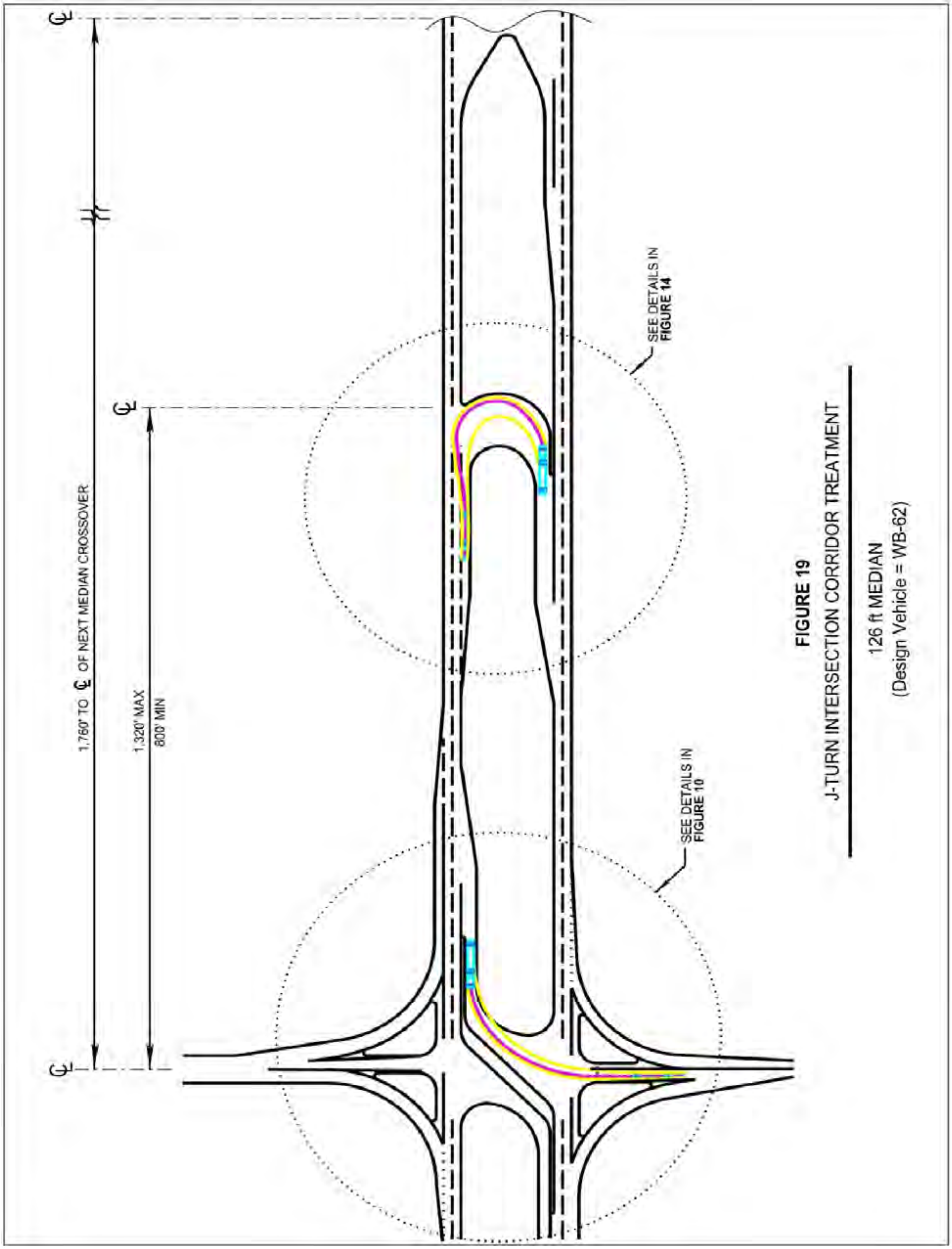


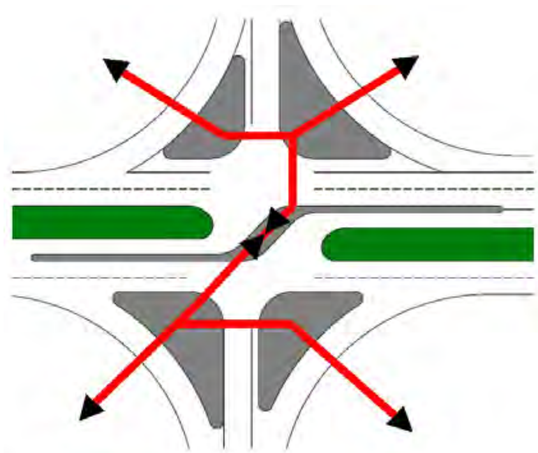
Figure 19 - 126 ft Median Intersection Design



VI. Pedestrian and Bicyclist Accommodations

Pedestrian crossings at a J-Turn intersection are discouraged due to the unsignalized complex crossing maneuvers required to traverse the intersection. The complex maneuvers required for pedestrians to cross a J-Turn intersection are shown in **Figure 20**. Should pedestrians be expected, the J-Turn intersection design may need to be modified to better accommodate them. The J-Turn intersection design may be modified such that the pedestrian crossing distances are shorter. Reducing the pedestrian crossing distance may be achieved by the elimination of right-turn lanes and/or channels, and using the tightest turning radii.

Figure 20 - Typical RCUT Pedestrian Crossings



Bicyclists desiring to make left turns from the side road face a choice of using pedestrian crosswalks to cross the major road and then the far side road or using the MUT crossovers in a manner similar to drivers of motor vehicles. Bicyclists on the major road approaches who want to turn left onto the side road are faced with a similar decision. They can use the pedestrian crosswalks to cross the side road leg and then the far major road leg. It is recommended agencies design the intersection to accommodate most left-turning bicyclists using the crosswalks. In urban areas, curb-cuts with ADA compliant ramps are recommended even if pedestrian crosswalks are not installed so they may be utilized by bicyclists who choose to walk across the intersection pushing their bicycle.

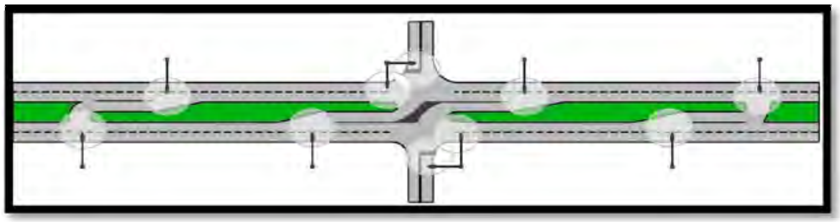
VII. Signals

For existing J-Turn intersections or MUT crossovers, traffic signal warrants contained in the MUTCD should be used in deciding whether or not to install a traffic signal. In this case, the higher major street left-turn volume or median u-turn volume can be treated as the minor street higher volume approach. **If either the J-Turn intersection or MUT crossovers warrant a traffic signal, then RCUT intersection design criteria should be evaluated.** RCUT intersection design criteria can be found in the FHWA publication *FHWA-HRT-09-060, Alternative Intersections/Interchanges: Informational Report (AIIR).*

VIII. Lighting

Since the J-Turn intersection design involves a relatively complex maneuver for left-turning vehicles, there may sometimes be the need to provide lighting at the J-Turn intersection and MUT crossovers. Particular consideration should be given to rural intersections where there may be a substantial need to enhance the visibility of drivers. Individual sites should be evaluated for lighting needs using guidelines such as the *NCHRP Report 152 – "Warrants for Highway Lighting"*. An example J-Turn corridor lighting treatment is illustrated in **Figure 21**.

Figure 21 – Typical Lighting for J-Turn Intersection and MUT Crossovers



IX. Signing

Signing at a J-Turn intersection and MUT crossovers is critical because the design may not meet the expectations of left-turning drivers unfamiliar with the intersection or intersection type. Therefore, a J-Turn intersection may require additional signing compared to a conventional intersection design. Positive guidance communicated through additional signs and pavement markings may be beneficial in reducing driver confusion and ensuring higher rates of driver compliance. The recommended MUT crossover signing is shown in **Figure 22** and the recommended J-Turn intersection signing is shown in **Figure 23**.

It is recommended that parking be proactively prohibited in and near loons. If loons or "bulb-outs" are included in the design, parking in those areas must be proactively prohibited through the use of regulatory signs such as R7-1 "No Parking Any Time".

Customized guide signs are recommended for inclusion in the J-Turn intersection and MUT crossover signing plans.

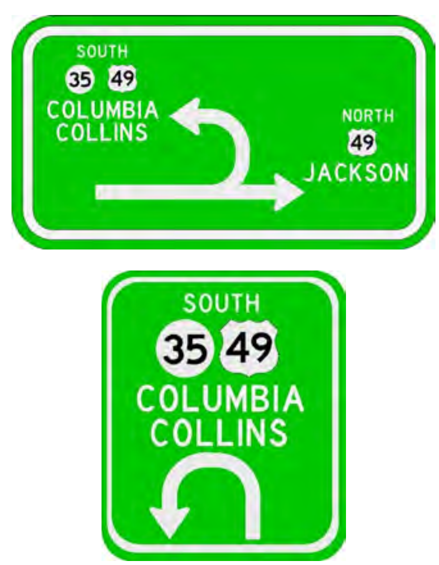
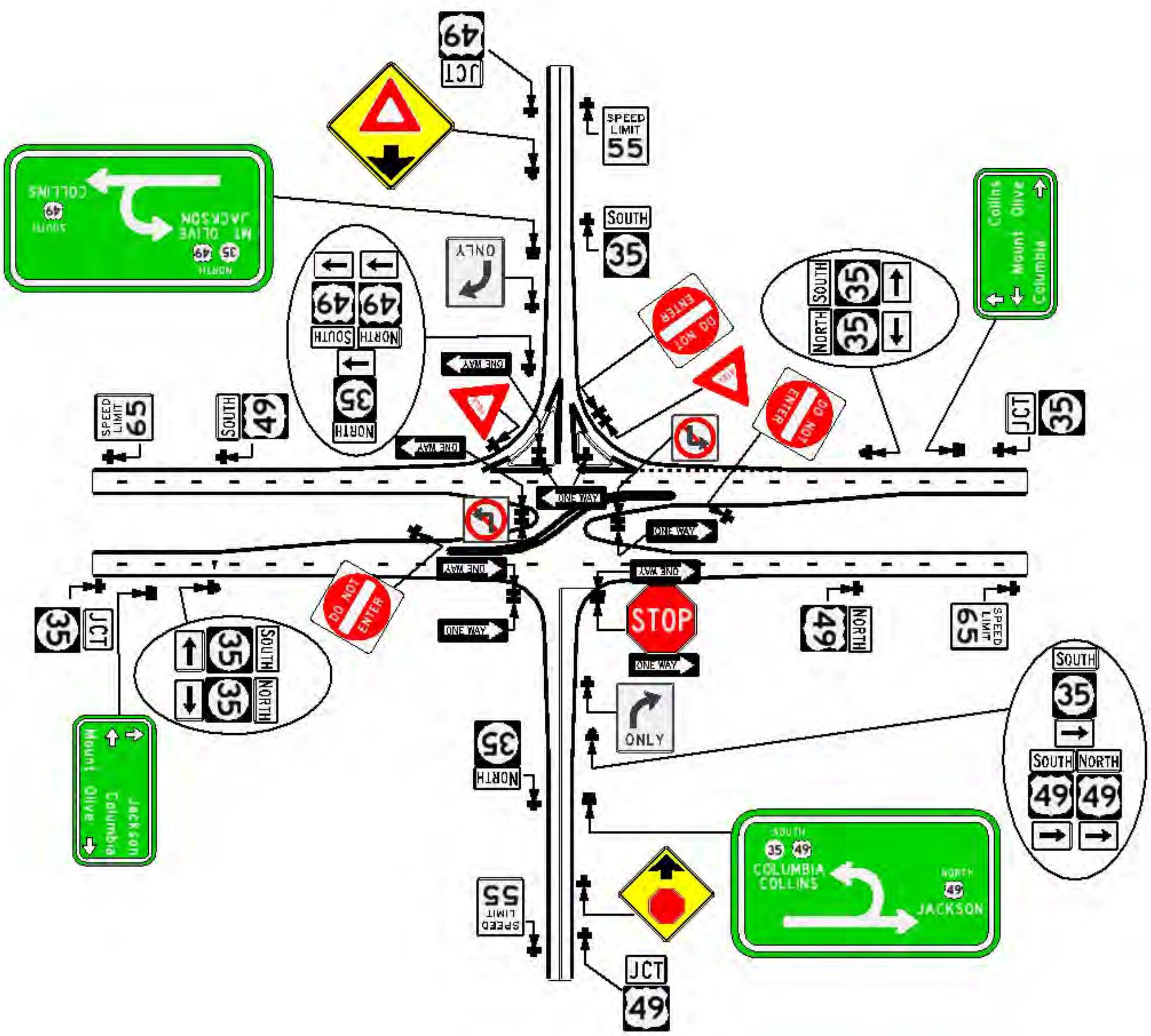


Figure 22 - Recommended MUT Crossover Signing Treatment

Figure 23 – Recommended J-Turn Intersection Signing Treatment

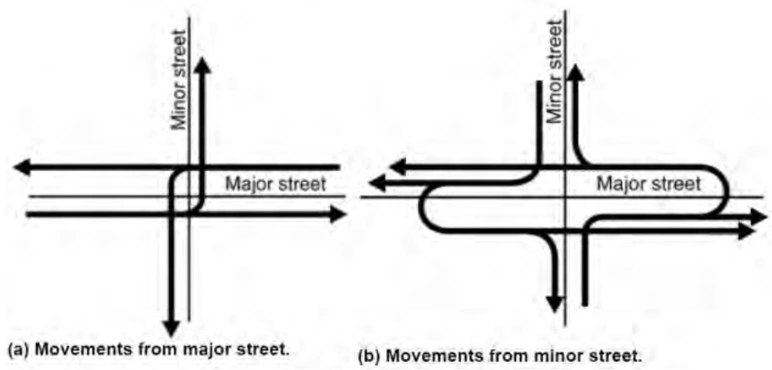


X. Safety Performance

A. Conflict Points Comparison

The assumed safety benefit of J-Turn intersections is that they reduce the potential for right-angle collisions (particularly far-side right-angle collisions) by eliminating direct crossing and left-turn maneuvers from the minor roads at two-way stop controlled (TWSC) expressway intersections. Minor road traffic wishing to turn left or cross straight through the intersection is forced to make these maneuvers indirectly by turning right, weaving to the left, making a downstream u-turn, and then returning to the intersection to complete their desired maneuver (illustrated in **Figure 24**). However, J-Turn intersections may potentially lead to an increase in rear-end and sideswipe collisions related to weaving maneuvers and u-turns when compared to a typical TWSC intersection.

Figure 24 - J-Turn Intersection Vehicle Maneuvers (FHWA)



There is no suggestion that u-turns at unsignalized median openings exhibit increased crash potential; therefore, the J-Turn intersection design replaces the high risk, far-side conflict points associated with direct minor road left-turns and crossing maneuvers with less risky conflict points associated with right-turns, u-turns, and weaving maneuvers. Not only are the total number of conflict points reduced, but more importantly the J-Turn intersection eliminates 14 crossing path conflict points present at a TWSC intersection, greatly reducing the opportunity for right-angle collisions. The J-Turn intersection design exhibits 20 conflict points compared to 32 at a TWSC intersection. **Figure 25** shows a conflict-point diagram for a conventional TWSC intersection and **Figure 26** shows a conflict-point diagram for a J-Turn intersection.

Figure 25 - Conflict-Point Diagram for Conventional Intersection (FHWA)

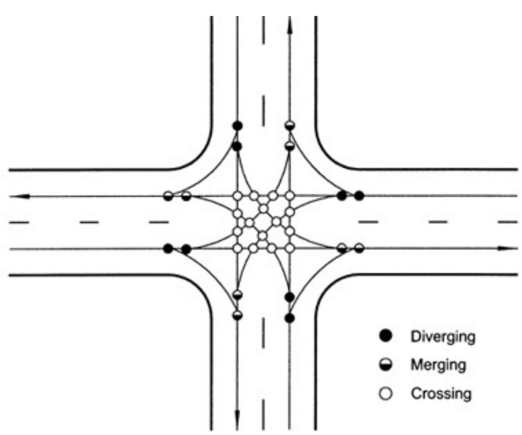
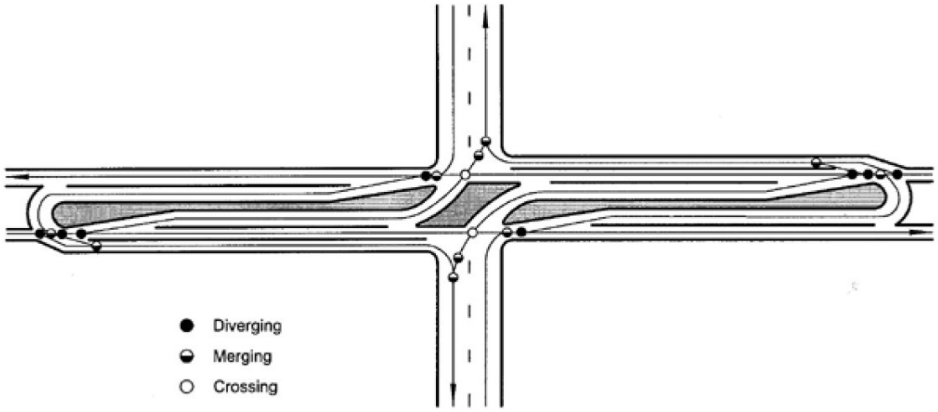


Figure 26 - Conflict-point Diagram for J-Turn Intersection (FHWA)



B. Crash Risk

All movements through a typical TWSC expressway intersection do not have the same crash risk. The highest risk movements (i.e., those accounting for the largest share of severe crashes) tend to be minor road maneuvers across the far-side of the intersection (i.e., left-turn and crossing maneuvers from the minor roadway). Thus, elimination of these maneuvers and their associated conflict points can be an effective means of improving expressway intersection safety. *NCHRP Report 420* reports an estimated 20% reduction in accident rates by replacing direct left-turns from driveways with right-turn/u-turn treatments. **Table 5** provides the accident rate per million turning vehicles for both full and directional median openings.

Table 5 - Median Accident Rate per Million Turning Vehicles

Median Opening Type	Accident Rate (per 10^6 turning vehicles)
Directional Midblock	0.29
Directional 3-Leg	1.40
Directional 4-Leg	2.57
Full 3-Leg	2.69
Full 4-Leg	3.01

Source: NCHRP Report 524

C. Case Studies

The NCDOT Safety Evaluation Group performed *Spot Safety Studies* at various locations where conventional intersections and/or median crossovers were converted to J-Turn intersections and MUTs. The purpose of the study was to determine what effect the modifications had on the collision patterns at the subject intersection over a three year period. The study sites are listed below and a summary of the before and after collision results are provided in **Table 6** and **Table 7.**

- US 23/74 @ NC 1155 – Haywood County, North Carolina
- US 23/74 @ NC 1243/1158 – Haywood County, North Carolina
- US 29-70/I-85 Business @ SR 1774 – Davidson County, North Carolina
- US 74 Bypass @ US 74 Service Rd. (near NC 226) – Cleveland County, North Carolina

- US 70 @ SR 1731 (Piney Grove Rd.) – Wayne County, North Carolina

Table 6 – Case Studies Collision Summary by Type

	BEFORE J-Turn	AFTER J-Turn	% CHANGE
Rear End	13	8	-38%
Angle	47	0	-100%
Turning	32	10	-69%
Sideswipe	8	3	-63%
TOTAL	**100**	**21**	**-79%**

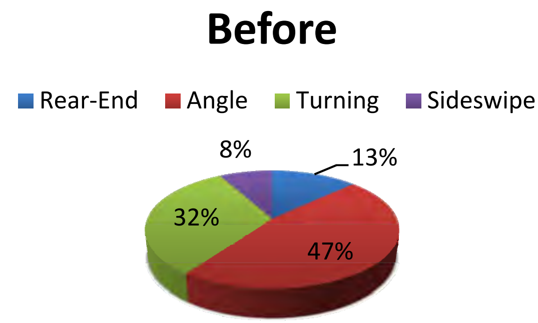
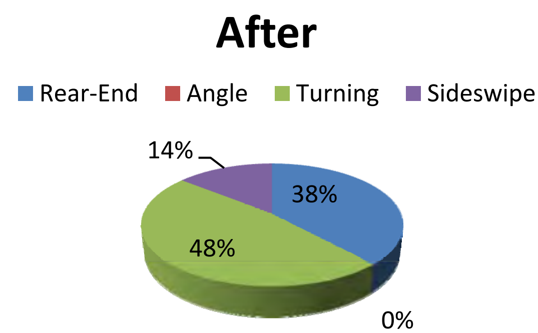


Table 7 – Case Studies Collision Summary by Severity

	BEFORE J-Turn	AFTER J-Turn	% CHANGE
Injury	56	10	-82%
Fatality	2	1	-50 %



In order to track the results of J-Turn intersection treatments, it is recommended that post-implementation safety studies be performed and shared with other transportation agencies. A minimum 3-year post-implementation period for crash analysis is recommended.

XI. Project Budget Considerations

Mobilization, overhead lighting, pavement markings, grading and drainage costs were not significantly different between the J-Turn intersection design and a conventional intersection design. In most cases no special grading or features such as retaining walls are needed.

Additional utility relocations and right-of-way acquisitions may increase the cost of a J-Turn intersection to a slightly higher level than a conventional intersection. Additional pavement width or reinforced shoulders are common in J-Turn intersection designs and extra funds for those elements should be budgeted.

Additional permanent roadway signing is frequently required at a J-Turn intersection than at a conventional intersection. Additional regulatory signing and guide signs for the traffic using the crossovers for left-turn maneuvers can create substantial additional cost. Additional temporary signing and variable message signs may be desirable during the construction phase and initial period of operation to provide additional clarification to unfamiliar drives. Public involvement and media costs associated with driver education can also be a significant component of the project budget and should not be overlooked.

XII. Construction Phasing

Maintenance of traffic during the construction of a J-Turn intersection is similar to that of conventional intersections, and other impacts such as to emergency vehicles, buses, and bicyclists are not likely to be major issues. The recommended stages of construction are as follows:

Phase #1 – Construction of elements necessary for the design vehicle to execute median u-turns.

1 A: Perform work along the outside of the outermost through lanes. This could include:

- Shoulder widening;
- Pavement structure reinforcement or reconstruction;
- Loon construction; and
- Right-turn lane construction (also used as a loon).

1B: Construct median deceleration lanes and u-turn crossovers.

Phase #2 – Construction at the main intersection to prohibit left turns from the minor roadway.

2A: Construction of channelization on the minor roadway that forces all traffic approaching from the minor roadway to turn right.

2B: Construction of median channelization that will ultimately prohibit turns from the minor road approaches but will allow left turns from the main roadway onto the minor roadway.

While the median channelization is under construction the median should be temporarily closed to all traffic. Any traffic desiring to access the minor roadway will be detoured straight through the intersection and then execute a u-turn at the downstream MUT crossover that was constructed under Phase #1.

Phase #3 – Final surface course pavement will be installed. Permanent striping and signing will be installed. Median will be reopened allowing left-turns form the main roadway onto the minor roadway.

XIII. Public Involvement

The potential for confusion with the J-Turn intersection concept exists for any driver who is unfamiliar with the concept or any geographical area that has never been exposed to the concept. A public information campaign that is designed by a team of transportation and media professionals is recommended if it is believed that confusion may occur with the J-Turn intersection implementation. The media campaign should be implemented with sufficient time to educate the public about the design concept and to prepare for a successful opening of the new intersection.

As with any change in traffic operations, driver confusion and acceptance is a concern. The design of a media campaign should be done in coincidence with the roadway design efforts. The execution of the media campaign may need to begin prior to roadway construction activities. That decision may be driven by the estimated construction time and may also depend on construction phasing needed for the specific project. Previous experiences with J-Turn intersection installations in Maryland and at RCUT intersection installations in North Carolina indicate that drivers adapt well to the J-Turn intersection design.

It is sometimes difficult to illustrate unfamiliar traffic operation concepts to the public using traditional drawings and written or verbal descriptions. The implementation of a microsimulation model may be worthwhile for achieving clear public understanding.

Microsimulation modeling software is a tool that is now commonly used to graphically illustrated concepts. The conceptual and operational illustration of a J-Turn intersection design and may be considered useful in any J-Turn media campaign.

A typical J-Turn intersection microsimulation model can be developed and used over and over in media campaigns and public involvement meetings to provide clear illustrations of the J-Turn concept at most any proposed location.

XIV. Summary of Recommendations

Situations most suitable for the J-Turn Intersection treatment:

- Low volume divided expressways.
- Low to medium side-street through volumes and heavy left-turn volumes from the major road.
- Minor road total volume to total intersection volume ratio is typically less than or equal to 0.20.
- Median widths are 64 ft and larger.
- High number of far-side right-angle collisions.
- Minor road crossing traffic gap times are insufficient.
- Intersections with more major road left-turns than minor road through movements.

Design Elements:

- All references contained in this document refer to the 2001 edition of the *MDOT Roadway Design Manual*, which is currently undergoing a major revision. Therefore, the designer should verify that the most recent edition is being used.
- 65 mph design speed for multi-lane arterials and collectors.
- WB-62 design vehicle.
- Typical maximum superelevation rate of 10%.
- 30 ft clear zone.
- J-Turn intersection design must meet the intersection sight-distance requirements for an at-grade intersection as set forth in the *MDOT Roadway Design Manual*.
- MUT crossover design must meet the stopping-sight distance requirements set forth for median openings in the *MDOT Roadway Design Manual*.

Cross-Sectional Elements:

- Median widths should be greater than 64 ft.
- For median widths of 64 ft and less, additional design considerations such as shoulders with strengthened full-depth pavement or loons are needed.
- 12 ft travel lanes and auxiliary lanes.
- Shoulder widths are variable and should be determined according to the *MDOT Roadway Design Manual*.
- If loons are included in the design, the total outside shoulder width should be 6 ft, with a minimum of 4 ft paved in the vicinity of the loons.
- Right-of-way width should be a minimum of 240 ft.

J-Turn Intersection Design Elements:

- Turning radii treatments should accommodate the design vehicles appropriate for the area type and functional classification of the intersecting roadways.
- Curbs should be mountable, Type 2, to allow emergency vehicles to cross the curb if required.
- Driveways should not be allowed near the J-Turn intersection.

- If the side roads are not of the boulevard or expressway type, right-turn channels should be installed to minimize wrong way maneuvers. If right-turn channels are included in the design, the distance to the MUT crossover may need to be increased.
- Design must include exclusive right-turn lanes on the main roadway, at least 200 ft in length with a 150 ft taper.
- Design must include exclusive left-turn lanes on the main roadway, at least 250 ft in length with a 150 ft taper.
- Dual right-turn lanes are acceptable.
- In areas where the median width is less than 64 ft, a minimum taper length of 75 ft is acceptable.
- Appreciable grade differential between the divided roadways should be avoided.

MUT Crossover Design Elements:

- Turning radii treatments should accommodate the design vehicles appropriate for the area type and functional classification of the intersecting roadways.
- Driveways should not be allowed near or on the opposite side of arterial from the crossovers.
- Appreciable grade differential between the divided roadways should be avoided.
- Grade of the crossover connections should not exceed 6%.
- Utilizing existing 880 ft (urban spacing) and 1760 ft (rural spacing) can be allowed if no access right-of-way can be provided adjacent to the MUT crossovers and other site conditions allow.
- New MUT crossover sites should be constructed no less than 800 ft and no more than 1,320 ft from the centerline of the J-Turn intersection.
- If the desired location of the MUT crossover is located at an existing median opening of Type 2B or Type 3, access rights purchase should be considered.
- Reconfiguration of an existing median crossing should be designed to provide single-direction u-turns only.
- Driveway access should be located a minimum of 100 ft away from the MUT crossovers.
- Design must include exclusive u-turn lanes on the main roadway, at least 250 ft in length with a 150 ft taper.
- If the median is wide enough, design should include acceleration lanes in the median for u-turning vehicles.
- Where auxiliary lanes serving the J-Turn intersection are located downstream from a loon, at a distance of 150 ft or less, the auxiliary lane should be constructed to connect the loon and existing auxiliary lane.

Other Considerations:

- Pedestrian crossings at a J-Turn intersection are discouraged.
- In urban areas with a high number of bicyclists, curb-cuts with ADA compliant ramps should be included in the design even if pedestrian crosswalks are not installed.
- Individual sites should be evaluated for lighting needs using guidelines such as the *NCHRP Report 152 – "Warrants for Highway Lighting".*
- Signing is critical to help meet driver expectations.
- Positive guidance communicated through additional signs and pavement markings may be beneficial.

- Parking should be proactively prohibited in the vicinity of "bulb-outs" and loons.
- Customized guide signs specifically designed for this type of intersection treatment should be included in the signing plans.
- 3-year post-implementation safety studies should be performed for crash analyses and shared with other transportation agencies.
- If it is believed that driver confusion may occur, transportation and media professionals should design a public information campaign to educate those impacted. Use of microsimulation models can be helpful.
- Additional funds should be budgeted for items including added pavement widths, reinforced shoulders, custom signing, and driver education through public involvement and media campaigns.
- Stages of construction should be:
  Phase #1 – Construction of elements necessary for the design vehicle to execute median u-turns.
  Phase #2 – Construction at the main intersection to prohibit left-turns from the minor roadway.
  Phase #3 – Final pavement striping and signing installed.

For typical MDOT median widths, the recommended geometric designs of the J-Turn intersection and MUT crossovers are shown on pages 15 – 18.

XV. Glossary

AASHTO

American Association of State Highway Transportation Officials

Access

A public or private roadway used to enter or leave a public highway from adjacent land using a legal motor vehicle. An access may be a driveway or a street.

Arterial

Roadway that provides the highest level of service at the greatest speed for the longest uninterrupted distance with some degree of access control.

Auxiliary Lanes

The portion of the roadway adjoining the traveled way for speed change, turning, storage for turning, weaving, truck climbing, and other purposes supplementary to through-traffic movement.

Clear Zone

Term used to designate the unobstructed, relatively flat area provided beyond the edge of the traveled way for recovery of errant vehicles. The clear zone includes any shoulders or auxiliary lanes.

Collector

Roadway that provides a less highly developed level of service at a lower speed for shorter distances by collecting traffic from local roads and connecting them with arterials.

Conflict-Point

Represent locations where vehicle paths cross as they move from one intersection leg to another.

Conventional Intersection

A four-leg intersection with full median opening.

Corridor

A set of essentially parallel transportation facilities designed for travel between two points. A corridor contains several subsystems, such as freeways, rural (or two-lane) highways, arterials, transit, and pedestrian and bicycle facilities.

Design Speed

A selected speed used to determine the various geometric design features of the roadway.

Design Vehicle

Selected vehicles, with representative weight, dimensions, and operating characteristics used to establish highway design controls for accommodating vehicles of the designated classes.

Directional Median Opening

An opening in a restrictive median which provides for u-turns and/or left-turn ingress or egress movements.

Downstream
The direction of traffic flow.

Expressway
A high-speed (≥ 50 mph), multi-lane, divided highway with partial access control.

FHWA
Federal Highway Administration

Full Median Opening
An opening in a restrictive median that allows all turning and through movements to be made.

Gap Time
The time, in seconds, for the front bumper of the second of two successive vehicles to reach the starting point of the front bumper of the first vehicle.

HCM
TRB's Highway Capacity Manual

J-Turn Intersection
A directional median opening combined with two median u-turns that allow left-turning traffic off the expressway, but forces left-turning and crossing minor road traffic to turn right, merge left, make a u-turn, and return to the intersection.

Loon
Expanded paved aprons opposite a median crossover used to facilitate the larger turning path of commercial vehicles along roadways with narrow medians.

Luminaire
A lighting unit consisting of one or more electric lamps with all of the necessary parts and wiring.

MDOT
Mississippi Department of Transportation

MUTCD
Manual on uniform Traffic Control Devices

Major Street
The intersecting street with greater traffic volume, larger cross-section, and higher functional class.

Median
The portion of a divided highway separating the traveled ways for traffic in opposing directions.

Median "Bulb-Out"
Widened median near vicinity of MUT crossovers to facilitate the larger turning path of commercial vehicles along roadways with narrow medians.

Median U-turn (MUT) Crossover
Crossover median openings that allow u-turn maneuvers only that are located downstream in both directions from the main J-Turn intersection.

Minor Street
The intersecting street with less traffic volume, smaller cross-section, and lower functional class than the major street.

NCHRP
National Cooperative Highway Research Program

Right-of-Way
A general term denoting land, property, or interest therein, usually a strip, acquired for or devoted to transportation purposes.

Roadway
The portion of a highway, including shoulders, for vehicular use. A divided highway has two or more roadways.

Shoulder
The portion of the roadway contiguous with the traveled way that accommodates stopped vehicles, emergency use, and lateral support for subbase, base, and surface courses.

Sight Distance
The length of the roadway ahead that is visible to the driver.

Signal Warrant
A threshold condition to determine whether a traffic signal is justified based on satisfaction of an engineering study. There are eight warrants currently provided in the latest edition of the MUTCD.

Superelevation
An increase in the normal roadway cross slope or transitional removal of adverse crown or cross slope to flat before gradually increasing the roadway slope or tilting the roadway surface to partially counterbalance the centripetal force (i.e., lateral acceleration) on a vehicle that is negotiating a horizontal curve.

TRB
Transportation Research Board

Traveled Way
The portion of the roadway for the movement of vehicles, exclusive of shoulders.

Upstream
The direction from which traffic is flowing.

Weaving
The crossing of traffic streams moving in the same general direction accomplished by merging and diverging.

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TABLE 2

Generalized **Annual Average Daily** Volumes for Florida's
Areas Transitioning into Urbanized Areas OR
Areas Over 5,000 Not In Urbanized Areas[1]

10/4/10

STATE SIGNALIZED ARTERIALS

Class I (>0.00 to 1.99 signalized intersections per mile)

Lanes	Median	B	C	D	E
2	Undivided	8,900	14,100	15,200	***
4	Divided	26,900	32,100	33,800	***
6	Divided	41,500	48,600	51,000	***

Class II (2.00 to 4.50 signalized intersections per mile)

Lanes	Median	B	C	D	E
2	Undivided	**	9,400	13,700	14,700
4	Divided	**	22,700	30,000	31,700
6	Divided	**	35,700	45,400	47,800

Class III (more than 4.5 signalized intersections per mile)

Lanes	Median	B	C	D	E
2	Undivided	**	4,700	10,700	13,400
4	Divided	**	11,500	25,500	28,900
6	Divided	**	18,000	39,800	43,900

Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Major City/County Roadways	- 10%
Other Signalized Roadways	- 35%

State & Non-State Signalized Roadway Adjustments

(Alter corresponding volume by the indicated percent.)

Divided/Undivided & Turn Lane Adjustments

Lanes	Median	Exclusive Left Lanes	Exclusive Right Lanes	Adjustment Factors
2	Divided	Yes	No	+5%
2	Undivided	No	No	-20%
Multi	Undivided	Yes	No	-5%
Multi	Undivided	No	No	-25%
–	–	–	Yes	+ 5%

One-Way Facility Adjustment

Multiply the corresponding two-directional volumes in this table by 0.6.

FREEWAYS

Lanes	B	C	D	E
4	42,600	57,600	68,700	73,600
6	63,900	86,600	103,300	113,700
8	85,200	115,600	137,600	153,700
10	106,400	145,600	172,400	192,800

Freeway Adjustments

Auxiliary Lanes	Ramp Metering
+ 20,000	+5%

UNINTERRUPTED FLOW HIGHWAYS

Lanes	Median	B	C	D	E
2	Undivided	8,000	15,100	21,100	26,800
4	Divided	31,400	45,400	58,800	66,600
6	Divided	47,200	68,100	88,200	100,000

Uninterrupted Flow Highway Adjustments

Lanes	Median	Exclusive left lanes	Adjustment factors
2	Divided	Yes	+5%
Multi	Undivided	Yes	-5%
Multi	Undivided	No	-25%

26,800 X 1.05 = 28,140

BICYCLE MODE[2]

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.

Paved Shoulder/ Bicycle Lane Coverage	B	C	D	E
0-49%	**	2,800	7,300	>7,300
50-84%	2,200	3,400	13,100	>13,100
85-100%	4,100	>4,100	***	***

PEDESTRIAN MODE[2]

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Sidewalk Coverage	B	C	D	E
0-49%	**	**	5,000	14,400
50-84%	**	**	11,300	18,800
85-100%	**	11,400	18,800	>18,800

[1] Values shown are presented as two-way annual average daily volumes for levels of service and are for the automobile/truck modes unless specifically stated. Although presented as daily volumes, they actually represent peak hour direction conditions with applicable K and D factors applied. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the Highway Capacity Manual, Bicycle LOS Model, Pedestrian LOS Model and Transit Capacity and Quality of Service Manual, respectively for the automobile/truck, bicycle, pedestrian and bus modes.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of motorized vehicles, not number of bicyclists or pedestrians using the facility.

** Cannot be achieved using table input value defaults.

*** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

Source:
Florida Department of Transportation
Systems Planning Office
605 Suwannee Street, MS 19
Tallahassee, FL 32399-0450

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HIGHPLAN 2012 Conceptual Planning Analysis

Project Information

Analyst	RDD	**Highway Name**	HP Hwy	**Study Period**	Kother
Date Prepared	4/22/2011 1:23:21 PM	**From**	Transfer Center	**Analysis Type**	Multilane Segment
Agency	F&W	**To**	Mile Marker 14	**Program**	HIGHPLAN 2012
Area Type	Rural Developed	**Peak Direction**	Northbound	**Version Date**	12/12/2012

File Name	C:\2000 - Olowalu New Town\HighPlan Analysis\Highplan analysis for 4 lanes 20150411.xhp
User Notes	Daily future with project in 4 lane section

Highway Data

Roadway Variables				**Traffic Variables**			
Segment Length	5.000	**Median**	No	**AADT**	8000	**PHF**	1.000
# Thru Lanes	4	**Left Turn Impact**	No	**K**	0.095	**% Heavy Vehicles**	4.0
Terrain	Level	**Pass Lane Length**	N/A	**D**	0.575	**Base Capacity**	2100
Posted Speed	50	**% NPZ**	N/A	**Peak Dir. Hrly. Vol.**	437	**Local Adj. Factor**	0.88
Free Flow Speed	55	**Class**	3	**Off Peak Dir. Hrly. Vol.**	323	**Adjusted Capacity**	1721

LOS Results

v/c Ratio	0.13	**Density**	4.8	**PTSF**	N/A	**ATS**	55.0	**% FFS**	100.0
FFS Delay	0.0	**LOS Thresh. Delay**	27.3	**Service Measure**	Density	**LOS**	A		

Service Volumes

Note: The maximum normally acceptable directional service volume for LOS E in Florida for this facility type and area type is 1850 veh/h/ln.

	A	**B**	**C**	**D**	**E**
Lanes	**Hourly Volume In Peak Direction**				
1					
2	540	1260	1980	2580	3030
3	810	1890	2970	3870	4550
4	1080	2520	3960	5160	6060
Lanes	**Hourly Volume In Both Directions**				
2					
4	940	2200	3450	4490	5270
6	1410	3290	5170	6740	7920
8	1880	4390	6890	8980	10540
Lanes	**Annual Average Daily Traffic**				
2					
4	9900	23200	36400	47300	55500
6	14900	34700	54500	71000	83400
8	19800	46300	72600	94600	111000

*** Cannot be achieved based on**

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	63	63	63	63	63	63
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	2947	2841	2923	2873	2860	2888
Vehs Exited	2879	2781	2861	2790	2782	2818
Starting Vehs	116	119	132	111	109	121
Ending Vehs	184	179	194	194	187	189
Denied Entry Before	1	0	0	2	0	1
Denied Entry After	1	0	0	1	0	0
Travel Distance (mi)	4979	4760	4935	4747	4799	4844
Travel Time (hr)	185.9	178.2	184.9	177.3	179.1	181.1
Total Delay (hr)	14.9	14.0	14.6	14.3	14.2	14.4
Total Stops	388	426	431	376	404	403
Fuel Used (gal)	150.6	144.3	149.2	142.8	144.9	146.4

Interval #0 Information Seeding

Start Time	6:57
End Time	7:00
Total Time (min)	3

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	7:15
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	752	756	693	706	674	717
Vehs Exited	690	687	656	643	619	658
Starting Vehs	116	119	132	111	109	121
Ending Vehs	178	188	169	174	164	172
Denied Entry Before	1	0	0	2	0	1
Denied Entry After	0	0	0	0	0	0
Travel Distance (mi)	1299	1272	1162	1163	1120	1203
Travel Time (hr)	48.7	48.1	43.7	43.2	41.7	45.1
Total Delay (hr)	4.0	4.0	3.5	3.3	3.3	3.6
Total Stops	104	147	104	90	84	107
Fuel Used (gal)	39.1	39.1	35.2	34.9	34.0	36.4

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	733	710	722	716	728	721
Vehs Exited	713	743	689	704	720	714
Starting Vehs	178	188	169	174	164	172
Ending Vehs	198	155	202	186	172	180
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	2	2	0	0	1
Travel Distance (mi)	1237	1206	1198	1159	1225	1205
Travel Time (hr)	46.2	45.0	44.6	43.6	45.7	45.0
Total Delay (hr)	3.7	3.5	3.4	3.6	3.6	3.6
Total Stops	116	97	91	99	121	106
Fuel Used (gal)	37.5	36.5	36.2	34.6	36.6	36.3

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	744	681	753	719	739	728
Vehs Exited	746	662	765	725	719	720
Starting Vehs	198	155	202	186	172	180
Ending Vehs	196	174	190	180	192	187
Denied Entry Before	0	2	2	0	0	1
Denied Entry After	3	2	1	0	0	1
Travel Distance (mi)	1235	1134	1286	1238	1218	1222
Travel Time (hr)	45.9	42.4	48.0	46.1	45.3	45.5
Total Delay (hr)	3.6	3.3	3.8	3.8	3.5	3.6
Total Stops	96	84	123	89	98	97
Fuel Used (gal)	37.3	34.1	39.1	37.6	36.8	37.0

Interval #4 Information

Start Time	7:45
End Time	8:00
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	718	694	755	732	719	720
Vehs Exited	730	689	751	718	724	720
Starting Vehs	196	174	190	180	192	187
Ending Vehs	184	179	194	194	187	189
Denied Entry Before	3	2	1	0	0	1
Denied Entry After	1	0	0	1	0	0
Travel Distance (mi)	1208	1149	1289	1187	1237	1214
Travel Time (hr)	45.1	42.8	48.6	44.4	46.3	45.4
Total Delay (hr)	3.6	3.2	3.9	3.6	3.8	3.6
Total Stops	72	98	113	98	101	93
Fuel Used (gal)	36.8	34.5	38.8	35.8	37.5	36.7

2: Bend Performance by approach

Approach	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	1.8	0.1	1.9
Total Del/Veh (s)	5.7	0.2	3.3
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0
Total Stops	0	0	0
Stop/Veh	0.00	0.00	0.00
Travel Dist (mi)	467.3	15.5	482.8
Travel Time (hr)	17.6	1.3	18.9
Avg Speed (mph)	27	11	26
Fuel Used (gal)	13.1	1.4	14.6
Fuel Eff. (mpg)	35.6	10.7	33.1
HC Emissions (g)	209	27	236
CO Emissions (g)	3037	701	3738
NOx Emissions (g)	500	99	599
Vehicles Entered	1142	868	2010
Vehicles Exited	1138	868	2006
Hourly Exit Rate	1138	868	2006
Input Volume	1143	861	2004
% of Volume	100	101	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

3: Olowalu Access 2 & HP Hwy Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.3	0.0	0.0	0.1
Total Delay (hr)	0.2	0.1	0.1	0.4
Total Del/Veh (s)	2.2	0.7	1.8	1.1
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0	0.0
Total Stops	5	0	0	5
Stop/Veh	0.02	0.00	0.00	0.00
Travel Dist (mi)	14.6	121.9	25.0	161.6
Travel Time (hr)	0.8	4.3	1.0	6.1
Avg Speed (mph)	19	28	25	26
Fuel Used (gal)	0.3	3.7	0.6	4.6
Fuel Eff. (mpg)	43.3	33.1	40.4	34.8
HC Emissions (g)	3	46	5	54
CO Emissions (g)	107	955	119	1182
NOx Emissions (g)	10	133	14	157
Vehicles Entered	289	825	173	1287
Vehicles Exited	290	823	173	1286
Hourly Exit Rate	290	823	173	1286
Input Volume	295	806	175	1276
% of Volume	98	102	99	101
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

4: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.2	0.2
Total Del/Veh (s)	3.2	3.2
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	11.2	11.2
Travel Time (hr)	0.7	0.7
Avg Speed (mph)	16	16
Fuel Used (gal)	0.8	0.8
Fuel Eff. (mpg)	13.9	13.9
HC Emissions (g)	13	13
CO Emissions (g)	520	520
NOx Emissions (g)	42	42
Vehicles Entered	173	173
Vehicles Exited	173	173
Hourly Exit Rate	173	173
Input Volume	175	175
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0

5: External Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.2	0.2
Total Del/Veh (s)	0.6	0.6
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	96.6	96.6
Travel Time (hr)	3.4	3.4
Avg Speed (mph)	28	28
Fuel Used (gal)	3.1	3.1
Fuel Eff. (mpg)	31.1	31.1
HC Emissions (g)	31	31
CO Emissions (g)	901	901
NOx Emissions (g)	87	87
Vehicles Entered	1231	1231
Vehicles Exited	1230	1230
Hourly Exit Rate	1230	1230
Input Volume	1260	1260
% of Volume	98	98
Denied Entry Before	0	0
Denied Entry After	0	0

6: HP Hwy & Mauka Access 2 Performance by movement

Movement	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.2	0.0	0.3
Total Del/Veh (s)	0.8	0.7	0.5	0.6
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.1	0.0
Total Stops	0	2	0	2
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	3.2	133.2	5.7	142.0
Travel Time (hr)	0.2	4.8	0.2	5.2
Avg Speed (mph)	20	28	23	27
Fuel Used (gal)	0.1	4.4	0.2	4.6
Fuel Eff. (mpg)	56.6	30.5	37.2	31.0
HC Emissions (g)	0	55	1	56
CO Emissions (g)	9	1316	40	1364
NOx Emissions (g)	1	161	3	165
Vehicles Entered	61	1306	55	1422
Vehicles Exited	60	1311	55	1426
Hourly Exit Rate	60	1311	55	1426
Input Volume	60	1295	60	1415
% of Volume	100	101	92	101
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

7: HP Hwy & O-turn 2E Performance by movement

Movement	EBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.5	0.6
Total Del/Veh (s)	1.9	1.6	1.6
Stop Delay (hr)	0.1	0.0	0.1
Stop Del/Veh (s)	1.6	0.0	0.3
Total Stops	62	2	64
Stop/Veh	0.28	0.00	0.05
Travel Dist (mi)	3.6	299.2	302.8
Travel Time (hr)	0.3	10.6	10.9
Avg Speed (mph)	10	28	28
Fuel Used (gal)	0.2	8.6	8.8
Fuel Eff. (mpg)	19.3	34.8	34.5
HC Emissions (g)	1	141	142
CO Emissions (g)	40	2388	2428
NOx Emissions (g)	5	379	384
Vehicles Entered	225	1134	1359
Vehicles Exited	225	1137	1362
Hourly Exit Rate	225	1137	1362
Input Volume	213	1142	1355
% of Volume	106	100	101
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

8: HP Hwy & O-turn 2E Performance by movement

Movement	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.2	0.4	0.6
Total Del/Veh (s)	2.8	1.5	1.8
Stop Delay (hr)	0.0	0.1	0.1
Stop Del/Veh (s)	0.6	0.3	0.4
Total Stops	42	62	104
Stop/Veh	0.19	0.07	0.09
Travel Dist (mi)	23.0	90.3	113.2
Travel Time (hr)	1.1	3.6	4.7
Avg Speed (mph)	21	25	24
Fuel Used (gal)	0.8	3.5	4.2
Fuel Eff. (mpg)	29.9	26.0	26.7
HC Emissions (g)	5	52	57
CO Emissions (g)	238	1422	1659
NOx Emissions (g)	20	159	180
Vehicles Entered	225	895	1120
Vehicles Exited	225	895	1120
Hourly Exit Rate	225	895	1120
Input Volume	213	888	1101
% of Volume	106	101	102
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

9: O-turn 2W Performance by movement

Movement	NBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.4	0.5
Total Del/Veh (s)	3.2	1.2	1.3
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.3	0.1	0.1
Total Stops	4	25	29
Stop/Veh	0.04	0.02	0.02
Travel Dist (mi)	16.4	182.7	199.1
Travel Time (hr)	0.7	6.6	7.3
Avg Speed (mph)	24	28	27
Fuel Used (gal)	0.5	5.5	5.9
Fuel Eff. (mpg)	35.1	33.5	33.6
HC Emissions (g)	4	74	78
CO Emissions (g)	86	1438	1525
NOx Emissions (g)	12	207	219
Vehicles Entered	109	1253	1362
Vehicles Exited	109	1247	1356
Hourly Exit Rate	109	1247	1356
Input Volume	106	1236	1342
% of Volume	103	101	101
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

10: HP Hwy & O-turn 2W Performance by movement

Movement	WBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.2	0.2
Total Del/Veh (s)	1.8	0.8	0.9
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	1.5	0.0	0.2
Total Stops	34	0	34
Stop/Veh	0.31	0.00	0.03
Travel Dist (mi)	1.9	184.4	186.3
Travel Time (hr)	0.2	6.4	6.6
Avg Speed (mph)	11	29	28
Fuel Used (gal)	0.1	5.3	5.3
Fuel Eff. (mpg)	20.2	35.1	34.9
HC Emissions (g)	1	45	46
CO Emissions (g)	26	821	847
NOx Emissions (g)	3	129	132
Vehicles Entered	109	868	977
Vehicles Exited	109	866	975
Hourly Exit Rate	109	866	975
Input Volume	106	851	957
% of Volume	103	102	102
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

11: HP Hwy & O-turn 1E Performance by movement

Movement	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.3	0.5
Total Del/Veh (s)	3.2	1.4	1.6
Stop Delay (hr)	0.0	0.0	0.1
Stop Del/Veh (s)	0.3	0.2	0.2
Total Stops	7	38	45
Stop/Veh	0.05	0.04	0.04
Travel Dist (mi)	17.6	120.1	137.8
Travel Time (hr)	0.8	4.5	5.3
Avg Speed (mph)	23	27	26
Fuel Used (gal)	0.5	4.0	4.5
Fuel Eff. (mpg)	32.8	30.2	30.5
HC Emissions (g)	4	48	52
CO Emissions (g)	130	1184	1314
NOx Emissions (g)	15	146	161
Vehicles Entered	130	894	1024
Vehicles Exited	130	891	1021
Hourly Exit Rate	130	891	1021
Input Volume	133	875	1008
% of Volume	98	102	101
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

12: O-turn 1E & HP Hwy Performance by movement

Movement	EBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.4	0.5
Total Del/Veh (s)	1.8	1.2	1.3
Stop Delay (hr)	0.1	0.0	0.1
Stop Del/Veh (s)	1.4	0.0	0.1
Total Stops	38	0	38
Stop/Veh	0.29	0.00	0.03
Travel Dist (mi)	2.3	257.4	259.7
Travel Time (hr)	0.2	9.1	9.3
Avg Speed (mph)	11	28	28
Fuel Used (gal)	0.1	7.4	7.5
Fuel Eff. (mpg)	20.4	35.0	34.7
HC Emissions (g)	1	123	124
CO Emissions (g)	29	2041	2069
NOx Emissions (g)	4	332	336
Vehicles Entered	130	1209	1339
Vehicles Exited	129	1202	1331
Hourly Exit Rate	129	1202	1331
Input Volume	133	1200	1333
% of Volume	97	100	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

13: O-turn 1 W Performance by movement

Movement	NBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.3	0.4
Total Del/Veh (s)	2.6	1.0	1.1
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.1	0.1	0.1
Total Stops	2	26	28
Stop/Veh	0.02	0.02	0.02
Travel Dist (mi)	8.5	129.1	137.6
Travel Time (hr)	0.4	4.7	5.1
Avg Speed (mph)	23	27	27
Fuel Used (gal)	0.2	4.1	4.3
Fuel Eff. (mpg)	35.1	31.7	31.9
HC Emissions (g)	1	60	61
CO Emissions (g)	38	1285	1324
NOx Emissions (g)	5	174	179
Vehicles Entered	81	1251	1332
Vehicles Exited	81	1250	1331
Hourly Exit Rate	81	1250	1331
Input Volume	76	1260	1336
% of Volume	107	99	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

14: HP Hwy & O-turn 1 W Performance by movement

Movement	WBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.0	0.3	0.3
Total Del/Veh (s)	2.1	1.0	1.1
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	1.7	0.0	0.1
Total Stops	30	0	30
Stop/Veh	0.37	0.00	0.03
Travel Dist (mi)	1.4	273.0	274.4
Travel Time (hr)	0.1	9.4	9.6
Avg Speed (mph)	10	29	29
Fuel Used (gal)	0.1	7.7	7.8
Fuel Eff. (mpg)	20.3	35.5	35.4
HC Emissions (g)	0	73	74
CO Emissions (g)	16	1245	1261
NOx Emissions (g)	2	206	208
Vehicles Entered	81	861	942
Vehicles Exited	81	860	941
Hourly Exit Rate	81	860	941
Input Volume	76	843	919
% of Volume	107	102	102
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

15: HP Hwy & Olowalu Access 1 Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.2	0.0	0.0	0.0
Total Delay (hr)	0.1	0.1	0.1	0.2
Total Del/Veh (s)	1.8	0.4	1.6	0.8
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0	0.0
Total Stops	2	0	0	2
Stop/Veh	0.01	0.00	0.00	0.00
Travel Dist (mi)	11.4	86.8	11.2	109.4
Travel Time (hr)	0.6	3.1	0.5	4.1
Avg Speed (mph)	21	28	23	27
Fuel Used (gal)	0.3	2.7	0.3	3.2
Fuel Eff. (mpg)	42.7	32.5	41.3	34.1
HC Emissions (g)	2	36	2	40
CO Emissions (g)	78	767	72	917
NOx Emissions (g)	7	102	6	115
Vehicles Entered	176	849	114	1139
Vehicles Exited	175	846	114	1135
Hourly Exit Rate	175	846	114	1135
Input Volume	175	832	110	1117
% of Volume	100	102	104	102
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

16: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.1	0.1
Total Del/Veh (s)	3.1	3.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	9.0	9.0
Travel Time (hr)	0.5	0.5
Avg Speed (mph)	18	18
Fuel Used (gal)	0.6	0.6
Fuel Eff. (mpg)	15.1	15.1
HC Emissions (g)	10	10
CO Emissions (g)	360	360
NOx Emissions (g)	31	31
Vehicles Entered	114	114
Vehicles Exited	113	113
Hourly Exit Rate	113	113
Input Volume	110	110
% of Volume	103	103
Denied Entry Before	0	0
Denied Entry After	0	0

17: RIRO Access & HP Hwy Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.1	0.0	0.1
Total Del/Veh (s)	0.5	0.6	0.2	0.6
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0	0.0
Total Stops	0	0	0	0
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	0.7	116.9	1.4	119.0
Travel Time (hr)	0.0	4.1	0.1	4.2
Avg Speed (mph)	20	29	25	29
Fuel Used (gal)	0.0	3.5	0.0	3.5
Fuel Eff. (mpg)	62.5	33.6	44.2	33.8
HC Emissions (g)	0	47	0	48
CO Emissions (g)	1	911	3	916
NOx Emissions (g)	0	138	0	138
Vehicles Entered	16	884	10	910
Vehicles Exited	16	883	10	909
Hourly Exit Rate	16	883	10	909
Input Volume	13	879	10	902
% of Volume	123	100	100	101
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

18: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.6	0.6
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	20	20
Fuel Used (gal)	0.0	0.0
Fuel Eff. (mpg)	14.2	14.2
HC Emissions (g)	0	0
CO Emissions (g)	23	23
NOx Emissions (g)	1	1
Vehicles Entered	10	10
Vehicles Exited	10	10
Hourly Exit Rate	10	10
Input Volume	10	10
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

19: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.3	0.3
Total Del/Veh (s)	1.3	1.3
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	115.1	115.1
Travel Time (hr)	4.2	4.2
Avg Speed (mph)	27	27
Fuel Used (gal)	3.6	3.6
Fuel Eff. (mpg)	32.0	32.0
HC Emissions (g)	59	59
CO Emissions (g)	1163	1163
NOx Emissions (g)	174	174
Vehicles Entered	870	870
Vehicles Exited	871	871
Hourly Exit Rate	871	871
Input Volume	861	861
% of Volume	101	101
Denied Entry Before	0	0
Denied Entry After	0	0

20: HP Hwy Performance by movement

Movement	NBT	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.3	0.3
Total Del/Veh (s)	0.9	0.9
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	152.5	152.5
Travel Time (hr)	5.4	5.4
Avg Speed (mph)	28	28
Fuel Used (gal)	4.8	4.8
Fuel Eff. (mpg)	32.1	32.1
HC Emissions (g)	83	83
CO Emissions (g)	1694	1694
NOx Emissions (g)	229	229
Vehicles Entered	1136	1136
Vehicles Exited	1134	1134
Hourly Exit Rate	1134	1134
Input Volume	1142	1142
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0

21: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.4	0.4
Total Del/Veh (s)	1.4	1.4
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	112.3	112.3
Travel Time (hr)	4.1	4.1
Avg Speed (mph)	27	27
Fuel Used (gal)	3.3	3.3
Fuel Eff. (mpg)	33.5	33.5
HC Emissions (g)	54	54
CO Emissions (g)	878	878
NOx Emissions (g)	151	151
Vehicles Entered	871	871
Vehicles Exited	870	870
Hourly Exit Rate	870	870
Input Volume	861	861
% of Volume	101	101
Denied Entry Before	0	0
Denied Entry After	0	0

23: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.8	0.8
Total Del/Veh (s)	3.2	3.2
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	102.5	102.5
Travel Time (hr)	4.2	4.2
Avg Speed (mph)	24	24
Fuel Used (gal)	2.2	2.2
Fuel Eff. (mpg)	45.9	45.9
HC Emissions (g)	35	35
CO Emissions (g)	541	541
NOx Emissions (g)	80	80
Vehicles Entered	870	870
Vehicles Exited	867	867
Hourly Exit Rate	867	867
Input Volume	861	861
% of Volume	101	101
Denied Entry Before	0	0
Denied Entry After	0	0

24: Performance by movement

Movement	NBT	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.6	0.6
Total Del/Veh (s)	1.8	1.8
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	126.0	126.0
Travel Time (hr)	4.8	4.8
Avg Speed (mph)	26	26
Fuel Used (gal)	3.7	3.7
Fuel Eff. (mpg)	34.5	34.5
HC Emissions (g)	59	59
CO Emissions (g)	928	928
NOx Emissions (g)	140	140
Vehicles Entered	1137	1137
Vehicles Exited	1136	1136
Hourly Exit Rate	1136	1136
Input Volume	1143	1143
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0

26: Bend Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.2	0.2
Total Del/Veh (s)	0.6	0.6
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	41.9	41.9
Travel Time (hr)	1.6	1.6
Avg Speed (mph)	26	26
Fuel Used (gal)	1.2	1.2
Fuel Eff. (mpg)	35.6	35.6
HC Emissions (g)	19	19
CO Emissions (g)	271	271
NOx Emissions (g)	44	44
Vehicles Entered	1138	1138
Vehicles Exited	1137	1137
Hourly Exit Rate	1137	1137
Input Volume	1143	1143
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0

27: HP Hwy & Ehehene Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.4	0.0	0.0	0.0	0.4
Denied Del/Veh (s)	0.1	0.1	1.3	3.3	0.0	0.0	0.7
Total Delay (hr)	0.1	0.0	0.7	0.0	0.0	1.0	1.8
Total Del/Veh (s)	58.5	10.9	2.1	1.6	11.8	4.3	3.2
Stop Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Stop Del/Veh (s)	57.0	11.1	0.0	0.0	6.6	0.0	0.2
Total Stops	4	7	0	0	2	0	13
Stop/Veh	1.00	1.00	0.00	0.00	0.67	0.00	0.01
Travel Dist (mi)	0.2	0.3	223.8	0.4	1.1	352.5	578.3
Travel Time (hr)	0.1	0.0	8.6	0.0	0.0	13.0	21.8
Avg Speed (mph)	2	8	27	25	23	27	27
Fuel Used (gal)	0.0	0.0	6.5	0.0	0.0	11.2	17.8
Fuel Eff. (mpg)	9.3	28.0	34.2	36.7	30.0	31.5	32.5
HC Emissions (g)	0	0	106	0	0	202	309
CO Emissions (g)	1	2	1780	2	6	3917	5708
NOx Emissions (g)	0	0	272	0	1	546	819
Vehicles Entered	4	7	1136	2	3	866	2018
Vehicles Exited	4	7	1135	2	3	855	2006
Hourly Exit Rate	4	7	1135	2	3	855	2006
Input Volume	5	6	1137	2	3	859	2012
% of Volume	80	117	100	100	100	100	100
Denied Entry Before	0	0	1	0	0	0	1
Denied Entry After	0	0	0	0	0	0	0

28: Performance by movement

Movement	NBT	SET	SER	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0		0.0	0.0
Total Delay (hr)	0.1	0.0	0.7	0.8
Total Del/Veh (s)	0.3		2.8	1.4
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0		0.0	0.0
Total Stops	0	0	0	0
Stop/Veh	0.00		0.00	0.00
Travel Dist (mi)	23.9	0.0	29.3	53.2
Travel Time (hr)	0.9	0.0	2.3	3.2
Avg Speed (mph)	26	12	13	17
Fuel Used (gal)	0.7	0.0	0.7	1.4
Fuel Eff. (mpg)	35.6	37.2	40.7	38.2
HC Emissions (g)	11	0	11	22
CO Emissions (g)	154	0	194	349
NOx Emissions (g)	25	0	22	47
Vehicles Entered	1138	0	868	2006
Vehicles Exited	1138	0	868	2006
Hourly Exit Rate	1138	0	868	2006
Input Volume	1143	1	861	2005
% of Volume	100	0	101	100
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

29: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.4	0.4
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.2	0.2
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.2	0.2
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	20	20
Fuel Used (gal)	0.0	0.0
Fuel Eff. (mpg)	12.1	12.1
HC Emissions (g)	0	0
CO Emissions (g)	11	11
NOx Emissions (g)	1	1
Vehicles Entered	5	5
Vehicles Exited	5	5
Hourly Exit Rate	5	5
Input Volume	5	5
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

30: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	3.4	3.4
Travel Time (hr)	0.2	0.2
Avg Speed (mph)	20	20
Fuel Used (gal)	0.2	0.2
Fuel Eff. (mpg)	14.2	14.2
HC Emissions (g)	2	2
CO Emissions (g)	141	141
NOx Emissions (g)	9	9
Vehicles Entered	55	55
Vehicles Exited	55	55
Hourly Exit Rate	55	55
Input Volume	60	60
% of Volume	92	92
Denied Entry Before	0	0
Denied Entry After	0	0

31: HP Hwy & Mauka Access1 Performance by movement

Movement	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.3	0.0	0.3
Total Del/Veh (s)	0.7	0.8	0.3	0.8
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0	0.0
Total Stops	0	0	0	0
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	2.9	168.7	8.2	179.8
Travel Time (hr)	0.1	6.0	0.3	6.5
Avg Speed (mph)	20	28	25	28
Fuel Used (gal)	0.1	5.1	0.2	5.4
Fuel Eff. (mpg)	57.3	32.8	40.9	33.3
HC Emissions (g)	0	69	2	71
CO Emissions (g)	13	1384	46	1444
NOx Emissions (g)	1	194	5	200
Vehicles Entered	60	1271	60	1391
Vehicles Exited	60	1265	60	1385
Hourly Exit Rate	60	1265	60	1385
Input Volume	60	1273	60	1393
% of Volume	100	99	100	99
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

32: Conn to Transfer Sta/Transfer Station Performance by movement

Movement	EBT	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.0	0.9	0.0	0.9
Total Del/Veh (s)	11.3	8.2	2.5	0.6	2.5
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	10.1	8.7	0.0	0.0	0.1
Total Stops	5	2	2	0	9
Stop/Veh	1.00	1.00	0.00	0.00	0.01
Travel Dist (mi)	0.1	0.3	390.8	1.0	392.2
Travel Time (hr)	0.0	0.0	14.0	0.0	14.1
Avg Speed (mph)	5	17	28	28	28
Fuel Used (gal)	0.0	0.0	11.5	0.0	11.6
Fuel Eff. (mpg)	18.2	37.4	33.9	36.7	33.9
HC Emissions (g)	0	0	149	0	149
CO Emissions (g)	0	0	2677	4	2682
NOx Emissions (g)	0	0	434	0	435
Vehicles Entered	5	2	1282	3	1292
Vehicles Exited	5	2	1268	3	1278
Hourly Exit Rate	5	2	1268	3	1278
Input Volume	5	2	1296	2	1305
% of Volume	100	100	98	150	98
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

33: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	1.7	1.7
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.3	0.3
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	1.1	1.1
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	26	26
Fuel Used (gal)	0.1	0.1
Fuel Eff. (mpg)	21.0	21.0
HC Emissions (g)	0	0
CO Emissions (g)	22	22
NOx Emissions (g)	2	2
Vehicles Entered	8	8
Vehicles Exited	8	8
Hourly Exit Rate	8	8
Input Volume	7	7
% of Volume	114	114
Denied Entry Before	0	0
Denied Entry After	0	0

34: HP Hwy & Conn to Transfer Sta Performance by movement

Movement	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	2.8	0.2	0.2
Total Delay (hr)	0.0	0.0	0.0
Total Del/Veh (s)	0.2	0.2	0.2
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0
Total Stops	0	0	0
Stop/Veh	0.00	0.00	0.00
Travel Dist (mi)	0.4	60.8	61.2
Travel Time (hr)	0.0	2.1	2.1
Avg Speed (mph)	26	29	29
Fuel Used (gal)	0.0	1.9	1.9
Fuel Eff. (mpg)	31.1	32.6	32.6
HC Emissions (g)	0	20	20
CO Emissions (g)	6	493	499
NOx Emissions (g)	0	56	56
Vehicles Entered	5	860	865
Vehicles Exited	5	861	866
Hourly Exit Rate	5	861	866
Input Volume	5	843	848
% of Volume	100	102	102
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

35: External Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.6	0.6
Total Del/Veh (s)	2.6	2.6
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	177.4	177.4
Travel Time (hr)	6.6	6.6
Avg Speed (mph)	27	27
Fuel Used (gal)	5.5	5.5
Fuel Eff. (mpg)	32.0	32.0
HC Emissions (g)	93	93
CO Emissions (g)	1869	1869
NOx Emissions (g)	238	238
Vehicles Entered	859	859
Vehicles Exited	852	852
Hourly Exit Rate	852	852
Input Volume	864	864
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0

36: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	3.5	3.5
Travel Time (hr)	0.2	0.2
Avg Speed (mph)	20	20
Fuel Used (gal)	0.3	0.3
Fuel Eff. (mpg)	13.9	13.9
HC Emissions (g)	4	4
CO Emissions (g)	164	164
NOx Emissions (g)	12	12
Vehicles Entered	60	60
Vehicles Exited	60	60
Hourly Exit Rate	60	60
Input Volume	60	60
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

Total Network Performance

Denied Delay (hr)	0.5
Denied Del/Veh (s)	0.6
Total Delay (hr)	13.9
Total Del/Veh (s)	16.6
Stop Delay (hr)	0.6
Stop Del/Veh (s)	0.8
Total Stops	403
Stop/Veh	0.13
Travel Dist (mi)	4843.8
Travel Time (hr)	181.1
Avg Speed (mph)	27
Fuel Used (gal)	146.4
Fuel Eff. (mpg)	33.1
HC Emissions (g)	2100
CO Emissions (g)	40713
NOx Emissions (g)	5772
Vehicles Entered	2888
Vehicles Exited	2818
Hourly Exit Rate	2818
Input Volume	32190
% of Volume	9
Denied Entry Before	1
Denied Entry After	0

Arterial Level of Service: SB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Conn to Transfer Sta	34	0.2	8.9	0.1	31
O-turn 1 W	14	1.0	39.1	0.3	29
Olowalu Access 1	15	0.4	12.8	0.1	30
O-turn 1E	11	0.8	16.9	0.1	29
O-turn 2W	10	0.8	26.3	0.2	29
Olowalu Access 2	3	0.7	18.4	0.2	30
Total		3.9	122.4	1.0	29

Intersection: 3: Olowalu Access 2 & HP Hwy

Movement	EB
Directions Served	R
Maximum Queue (ft)	55
Average Queue (ft)	8
95th Queue (ft)	41
Link Distance (ft)	300
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: HP Hwy & Mauka Access 2

Movement	WB
Directions Served	R
Maximum Queue (ft)	11
Average Queue (ft)	0
95th Queue (ft)	8
Link Distance (ft)	290
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: HP Hwy & O-turn 2E

Movement	EB	NB	NB	NB
Directions Served	L	T	T	T
Maximum Queue (ft)	70	21	4	5
Average Queue (ft)	32	1	0	0
95th Queue (ft)	66	10	3	4
Link Distance (ft)	46	1359	1359	1359
Upstream Blk Time (%)	3			
Queuing Penalty (veh)	6			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: HP Hwy & O-turn 2E

Movement	SB	SB
Directions Served	L	T
Maximum Queue (ft)	53	92
Average Queue (ft)	6	3
95th Queue (ft)	31	67
Link Distance (ft)		502
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	800	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: O-turn 2W

Movement	NB
Directions Served	LT
Maximum Queue (ft)	49
Average Queue (ft)	2
95th Queue (ft)	25
Link Distance (ft)	752
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 10: HP Hwy & O-turn 2W

Movement	WB	SB
Directions Served	L	T
Maximum Queue (ft)	60	4
Average Queue (ft)	23	0
95th Queue (ft)	54	3
Link Distance (ft)	58	1078
Upstream Blk Time (%)	1	
Queuing Penalty (veh)	1	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: HP Hwy & O-turn 1E

Movement	SB	SB
Directions Served	L	LT
Maximum Queue (ft)	17	49
Average Queue (ft)	1	3
95th Queue (ft)	10	21
Link Distance (ft)		687
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	800	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 12: O-turn 1E & HP Hwy

Movement	EB
Directions Served	L
Maximum Queue (ft)	54
Average Queue (ft)	26
95th Queue (ft)	54
Link Distance (ft)	48
Upstream Blk Time (%)	1
Queuing Penalty (veh)	1
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 13: O-turn 1 W

Movement	NB
Directions Served	LT
Maximum Queue (ft)	17
Average Queue (ft)	1
95th Queue (ft)	11
Link Distance (ft)	519
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 14: HP Hwy & O-turn 1 W

Movement	WB
Directions Served	L
Maximum Queue (ft)	58
Average Queue (ft)	22
95th Queue (ft)	50
Link Distance (ft)	56
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 15: HP Hwy & Olowalu Access 1

Movement	EB
Directions Served	R
Maximum Queue (ft)	54
Average Queue (ft)	3
95th Queue (ft)	22
Link Distance (ft)	377
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 17: RIRO Access & HP Hwy

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 20: HP Hwy

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 24:

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 27: HP Hwy & Ehehene

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	40	31
Average Queue (ft)	8	2
95th Queue (ft)	29	16
Link Distance (ft)	228	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		250
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 28:

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 31: HP Hwy & Mauka Access1

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 32: Conn to Transfer Sta/Transfer Station

Movement	EB	WB
Directions Served	T	TR
Maximum Queue (ft)	35	21
Average Queue (ft)	5	1
95th Queue (ft)	25	10
Link Distance (ft)	60	641
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 34: HP Hwy & Conn to Transfer Sta

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 8

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:57	4:57	4:57	4:57	4:57	4:57
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	63	63	63	63	63	63
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	3963	3921	3941	3928	3986	3947
Vehs Exited	3832	3790	3807	3742	3897	3814
Starting Vehs	174	171	157	162	155	162
Ending Vehs	305	302	291	348	244	299
Denied Entry Before	1	0	0	0	0	0
Denied Entry After	1	1	1	2	1	1
Travel Distance (mi)	6553	6590	6500	6525	6698	6573
Travel Time (hr)	281.3	291.7	258.8	281.2	279.1	278.4
Total Delay (hr)	55.8	65.1	34.9	56.3	48.9	52.2
Total Stops	1952	2542	954	2064	1563	1814
Fuel Used (gal)	210.1	213.9	202.9	208.8	213.8	209.9

Interval #0 Information Seeding

Start Time	4:57
End Time	5:00
Total Time (min)	3

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	5:00
End Time	5:15
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	996	1045	1009	982	1000	1003
Vehs Exited	903	895	891	876	873	887
Starting Vehs	174	171	157	162	155	162
Ending Vehs	267	321	275	268	282	280
Denied Entry Before	1	0	0	0	0	0
Denied Entry After	3	2	0	1	1	1
Travel Distance (mi)	1610	1701	1614	1629	1607	1632
Travel Time (hr)	62.8	70.2	62.5	63.6	62.4	64.3
Total Delay (hr)	7.3	11.6	6.8	7.5	7.3	8.1
Total Stops	185	411	208	184	218	239
Fuel Used (gal)	49.9	54.1	50.7	50.2	49.6	50.9

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	1005	940	930	948	1012	967
Vehs Exited	988	978	961	941	1015	974
Starting Vehs	267	321	275	268	282	280
Ending Vehs	284	283	244	275	279	272
Denied Entry Before	3	2	0	1	1	1
Denied Entry After	1	4	0	1	1	1
Travel Distance (mi)	1667	1633	1565	1576	1693	1627
Travel Time (hr)	70.4	73.7	61.9	62.7	71.3	68.0
Total Delay (hr)	13.1	17.7	7.9	8.4	13.1	12.1
Total Stops	437	675	201	199	479	402
Fuel Used (gal)	53.1	53.5	47.6	48.6	54.6	51.5

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	956	964	966	1005	1004	979
Vehs Exited	961	964	949	975	987	968
Starting Vehs	284	283	244	275	279	272
Ending Vehs	279	283	261	305	296	282
Denied Entry Before	1	4	0	1	1	1
Denied Entry After	1	1	2	0	5	1
Travel Distance (mi)	1623	1636	1624	1694	1707	1657
Travel Time (hr)	73.8	73.3	65.3	76.4	74.1	72.6
Total Delay (hr)	18.0	17.0	9.4	18.0	15.5	15.6
Total Stops	704	668	228	744	536	577
Fuel Used (gal)	53.3	53.2	50.9	55.6	55.4	53.7

Interval #4 Information

Start Time	5:45
End Time	6:00
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	1006	972	1036	993	970	995
Vehs Exited	980	953	1006	950	1022	984
Starting Vehs	279	283	261	305	296	282
Ending Vehs	305	302	291	348	244	299
Denied Entry Before	1	1	2	0	5	1
Denied Entry After	1	1	1	2	1	1
Travel Distance (mi)	1653	1620	1696	1626	1691	1657
Travel Time (hr)	74.3	74.5	69.1	78.5	71.2	73.5
Total Delay (hr)	17.3	18.8	10.7	22.3	13.0	16.4
Total Stops	626	788	317	937	330	598
Fuel Used (gal)	53.8	53.1	53.8	54.4	54.2	53.8

2: Bend Performance by approach

Approach	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	2.6	0.1	2.7
Total Del/Veh (s)	6.6	0.3	3.6
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0
Total Stops	0	0	0
Stop/Veh	0.00	0.00	0.00
Travel Dist (mi)	565.9	23.1	589.0
Travel Time (hr)	21.6	2.0	23.6
Avg Speed (mph)	26	11	25
Fuel Used (gal)	16.0	2.2	18.2
Fuel Eff. (mpg)	35.4	10.6	32.4
HC Emissions (g)	267	41	308
CO Emissions (g)	3860	1024	4884
NOx Emissions (g)	624	150	775
Vehicles Entered	1383	1296	2679
Vehicles Exited	1381	1295	2676
Hourly Exit Rate	1381	1295	2676
Input Volume	1367	1338	2705
% of Volume	101	97	99
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

3: Olowalu Access 2 & HP Hwy Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.3	0.0	0.0	0.1
Total Delay (hr)	0.3	0.3	0.3	0.9
Total Del/Veh (s)	3.0	0.9	2.6	1.6
Stop Delay (hr)	0.0	0.0	0.0	0.1
Stop Del/Veh (s)	0.5	0.0	0.1	0.1
Total Stops	39	0	0	39
Stop/Veh	0.11	0.00	0.00	0.02
Travel Dist (mi)	18.3	192.6	52.0	263.0
Travel Time (hr)	1.1	6.9	2.2	10.2
Avg Speed (mph)	17	28	24	26
Fuel Used (gal)	0.5	6.0	1.3	7.8
Fuel Eff. (mpg)	40.0	32.0	39.7	33.8
HC Emissions (g)	4	84	11	99
CO Emissions (g)	136	1824	289	2249
NOx Emissions (g)	13	243	31	287
Vehicles Entered	362	1306	359	2027
Vehicles Exited	362	1306	358	2026
Hourly Exit Rate	362	1306	358	2026
Input Volume	365	1289	357	2011
% of Volume	99	101	100	101
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

4: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.3	0.3
Total Del/Veh (s)	3.3	3.3
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	23.2	23.2
Travel Time (hr)	1.4	1.4
Avg Speed (mph)	16	16
Fuel Used (gal)	1.7	1.7
Fuel Eff. (mpg)	13.5	13.5
HC Emissions (g)	24	24
CO Emissions (g)	1023	1023
NOx Emissions (g)	83	83
Vehicles Entered	358	358
Vehicles Exited	357	357
Hourly Exit Rate	357	357
Input Volume	357	357
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

5: External Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.2	0.2
Total Del/Veh (s)	0.6	0.6
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	108.4	108.4
Travel Time (hr)	3.9	3.9
Avg Speed (mph)	28	28
Fuel Used (gal)	3.5	3.5
Fuel Eff. (mpg)	30.6	30.6
HC Emissions (g)	39	39
CO Emissions (g)	1098	1098
NOx Emissions (g)	109	109
Vehicles Entered	1383	1383
Vehicles Exited	1381	1381
Hourly Exit Rate	1381	1381
Input Volume	1404	1404
% of Volume	98	98
Denied Entry Before	0	0
Denied Entry After	0	0

6: HP Hwy & Mauka Access 2 Performance by movement

Movement	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.1	0.0
Total Delay (hr)	0.0	0.3	0.0	0.4
Total Del/Veh (s)	0.8	0.7	0.6	0.7
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.1	0.0
Total Stops	1	4	0	5
Stop/Veh	0.02	0.00	0.00	0.00
Travel Dist (mi)	3.3	163.0	6.1	172.4
Travel Time (hr)	0.2	5.9	0.3	6.4
Avg Speed (mph)	21	28	23	27
Fuel Used (gal)	0.1	5.4	0.2	5.7
Fuel Eff. (mpg)	58.0	30.0	35.2	30.5
HC Emissions (g)	1	75	1	77
CO Emissions (g)	14	1771	44	1829
NOx Emissions (g)	1	221	4	226
Vehicles Entered	63	1616	60	1739
Vehicles Exited	62	1618	60	1740
Hourly Exit Rate	62	1618	60	1740
Input Volume	60	1600	60	1720
% of Volume	103	101	100	101
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

7: HP Hwy & O-turn 2E Performance by movement

Movement	EBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.2	0.6	0.8
Total Del/Veh (s)	2.7	1.7	1.8
Stop Delay (hr)	0.2	0.0	0.2
Stop Del/Veh (s)	2.4	0.0	0.4
Total Stops	98	1	99
Stop/Veh	0.39	0.00	0.06
Travel Dist (mi)	4.0	363.8	367.8
Travel Time (hr)	0.4	12.9	13.3
Avg Speed (mph)	9	28	28
Fuel Used (gal)	0.2	10.5	10.8
Fuel Eff. (mpg)	18.6	34.5	34.2
HC Emissions (g)	1	184	185
CO Emissions (g)	46	3150	3196
NOx Emissions (g)	6	493	499
Vehicles Entered	252	1378	1630
Vehicles Exited	252	1380	1632
Hourly Exit Rate	252	1380	1632
Input Volume	248	1370	1618
% of Volume	102	101	101
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

8: HP Hwy & O-turn 2E Performance by movement

Movement	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.2	0.8	1.0
Total Del/Veh (s)	3.3	1.9	2.1
Stop Delay (hr)	0.1	0.2	0.3
Stop Del/Veh (s)	1.4	0.6	0.7
Total Stops	64	132	196
Stop/Veh	0.25	0.09	0.12
Travel Dist (mi)	25.6	143.2	168.8
Travel Time (hr)	1.2	5.8	7.1
Avg Speed (mph)	21	25	24
Fuel Used (gal)	0.8	5.5	6.4
Fuel Eff. (mpg)	30.8	25.8	26.5
HC Emissions (g)	7	80	87
CO Emissions (g)	270	2218	2488
NOx Emissions (g)	25	253	278
Vehicles Entered	252	1422	1674
Vehicles Exited	252	1421	1673
Hourly Exit Rate	252	1421	1673
Input Volume	248	1406	1654
% of Volume	102	101	101
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

9: O-turn 2W Performance by movement

Movement	NBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.2	0.6	0.8
Total Del/Veh (s)	3.6	1.4	1.7
Stop Delay (hr)	0.0	0.1	0.1
Stop Del/Veh (s)	0.5	0.1	0.2
Total Stops	17	33	50
Stop/Veh	0.08	0.02	0.03
Travel Dist (mi)	30.5	216.2	246.8
Travel Time (hr)	1.3	7.9	9.2
Avg Speed (mph)	23	27	27
Fuel Used (gal)	0.9	6.6	7.4
Fuel Eff. (mpg)	35.4	32.9	33.2
HC Emissions (g)	7	99	106
CO Emissions (g)	170	1954	2124
NOx Emissions (g)	24	277	301
Vehicles Entered	205	1480	1685
Vehicles Exited	204	1476	1680
Hourly Exit Rate	204	1476	1680
Input Volume	196	1465	1661
% of Volume	104	101	101
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

10: HP Hwy & O-turn 2W Performance by movement

Movement	WBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.2	0.5	0.7
Total Del/Veh (s)	3.3	1.2	1.5
Stop Delay (hr)	0.2	0.0	0.2
Stop Del/Veh (s)	2.8	0.0	0.3
Total Stops	95	1	96
Stop/Veh	0.47	0.00	0.06
Travel Dist (mi)	3.5	303.1	306.7
Travel Time (hr)	0.4	10.7	11.1
Avg Speed (mph)	9	28	28
Fuel Used (gal)	0.2	8.8	9.0
Fuel Eff. (mpg)	18.8	34.4	34.1
HC Emissions (g)	1	84	86
CO Emissions (g)	43	1589	1632
NOx Emissions (g)	6	244	249
Vehicles Entered	204	1425	1629
Vehicles Exited	203	1426	1629
Hourly Exit Rate	203	1426	1629
Input Volume	196	1412	1608
% of Volume	104	101	101
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

11: HP Hwy & O-turn 1E Performance by movement

Movement	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.2	0.7	0.8
Total Del/Veh (s)	3.7	1.7	1.9
Stop Delay (hr)	0.0	0.2	0.2
Stop Del/Veh (s)	0.7	0.5	0.5
Total Stops	15	101	116
Stop/Veh	0.10	0.07	0.07
Travel Dist (mi)	20.1	196.9	217.0
Travel Time (hr)	0.9	7.5	8.4
Avg Speed (mph)	22	26	26
Fuel Used (gal)	0.6	6.5	7.2
Fuel Eff. (mpg)	32.1	30.1	30.3
HC Emissions (g)	5	85	90
CO Emissions (g)	155	1986	2141
NOx Emissions (g)	19	259	277
Vehicles Entered	148	1463	1611
Vehicles Exited	148	1462	1610
Hourly Exit Rate	148	1462	1610
Input Volume	149	1452	1601
% of Volume	99	101	101
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

12: O-turn 1E & HP Hwy Performance by movement

Movement	EBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.5	0.6
Total Del/Veh (s)	2.2	1.3	1.4
Stop Delay (hr)	0.1	0.0	0.1
Stop Del/Veh (s)	1.8	0.0	0.2
Total Stops	53	0	53
Stop/Veh	0.36	0.00	0.03
Travel Dist (mi)	2.6	305.7	308.3
Travel Time (hr)	0.3	10.8	11.1
Avg Speed (mph)	10	28	28
Fuel Used (gal)	0.1	8.9	9.0
Fuel Eff. (mpg)	20.2	34.4	34.2
HC Emissions (g)	1	159	160
CO Emissions (g)	33	2742	2774
NOx Emissions (g)	4	433	437
Vehicles Entered	148	1434	1582
Vehicles Exited	147	1424	1571
Hourly Exit Rate	147	1424	1571
Input Volume	149	1422	1571
% of Volume	99	100	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

13: O-turn 1 W Performance by movement

Movement	NBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.5	0.5
Total Del/Veh (s)	2.7	1.1	1.3
Stop Delay (hr)	0.0	0.0	0.1
Stop Del/Veh (s)	0.2	0.1	0.1
Total Stops	5	35	40
Stop/Veh	0.04	0.02	0.03
Travel Dist (mi)	13.2	148.9	162.0
Travel Time (hr)	0.6	5.5	6.1
Avg Speed (mph)	22	27	27
Fuel Used (gal)	0.4	4.8	5.1
Fuel Eff. (mpg)	36.0	31.3	31.7
HC Emissions (g)	4	71	74
CO Emissions (g)	84	1541	1625
NOx Emissions (g)	12	208	219
Vehicles Entered	125	1438	1563
Vehicles Exited	125	1434	1559
Hourly Exit Rate	125	1434	1559
Input Volume	125	1443	1568
% of Volume	100	99	99
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

14: HP Hwy & O-turn 1 W Performance by movement

Movement	WBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.7	0.8
Total Del/Veh (s)	4.2	1.7	1.9
Stop Delay (hr)	0.1	0.0	0.1
Stop Del/Veh (s)	3.8	0.0	0.3
Total Stops	70	0	70
Stop/Veh	0.56	0.00	0.04
Travel Dist (mi)	2.1	458.7	460.9
Travel Time (hr)	0.3	16.1	16.4
Avg Speed (mph)	8	28	28
Fuel Used (gal)	0.1	13.2	13.3
Fuel Eff. (mpg)	19.0	34.7	34.6
HC Emissions (g)	1	126	127
CO Emissions (g)	26	2358	2384
NOx Emissions (g)	3	360	363
Vehicles Entered	125	1447	1572
Vehicles Exited	124	1445	1569
Hourly Exit Rate	124	1445	1569
Input Volume	125	1440	1565
% of Volume	99	100	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

15: HP Hwy & Olowalu Access 1 Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.2	0.0	0.0	0.0
Total Delay (hr)	0.1	0.2	0.1	0.5
Total Del/Veh (s)	2.1	0.6	2.0	1.0
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.1	0.0	0.0	0.0
Total Stops	10	0	0	10
Stop/Veh	0.05	0.00	0.00	0.01
Travel Dist (mi)	14.3	142.1	21.4	177.8
Travel Time (hr)	0.7	5.1	0.9	6.7
Avg Speed (mph)	20	28	23	26
Fuel Used (gal)	0.3	4.5	0.5	5.3
Fuel Eff. (mpg)	42.0	31.8	40.3	33.3
HC Emissions (g)	2	67	4	73
CO Emissions (g)	98	1443	158	1699
NOx Emissions (g)	8	190	12	210
Vehicles Entered	219	1387	217	1823
Vehicles Exited	220	1388	217	1825
Hourly Exit Rate	220	1388	217	1825
Input Volume	212	1388	216	1816
% of Volume	104	100	100	100
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

16: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.2	0.2
Total Del/Veh (s)	3.2	3.2
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	17.3	17.3
Travel Time (hr)	1.0	1.0
Avg Speed (mph)	18	18
Fuel Used (gal)	1.1	1.1
Fuel Eff. (mpg)	15.4	15.4
HC Emissions (g)	13	13
CO Emissions (g)	604	604
NOx Emissions (g)	46	46
Vehicles Entered	217	217
Vehicles Exited	217	217
Hourly Exit Rate	217	217
Input Volume	216	216
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

17: RIRO Access & HP Hwy Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.2	0.0	0.0	0.0
Total Delay (hr)	0.0	0.5	0.0	0.5
Total Del/Veh (s)	0.6	1.3	0.2	1.2
Stop Delay (hr)	0.0	0.1	0.0	0.1
Stop Del/Veh (s)	0.0	0.1	0.0	0.1
Total Stops	0	13	0	13
Stop/Veh	0.00	0.01	0.00	0.01
Travel Dist (mi)	0.8	184.0	2.6	187.3
Travel Time (hr)	0.0	6.7	0.1	6.8
Avg Speed (mph)	20	28	26	27
Fuel Used (gal)	0.0	5.7	0.1	5.8
Fuel Eff. (mpg)	64.0	32.2	43.2	32.3
HC Emissions (g)	0	79	0	79
CO Emissions (g)	2	1769	7	1777
NOx Emissions (g)	0	238	1	239
Vehicles Entered	17	1401	19	1437
Vehicles Exited	17	1399	19	1435
Hourly Exit Rate	17	1399	19	1435
Input Volume	15	1385	22	1422
% of Volume	113	101	86	101
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

18: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	1.1	1.1
Travel Time (hr)	0.1	0.1
Avg Speed (mph)	20	20
Fuel Used (gal)	0.1	0.1
Fuel Eff. (mpg)	13.0	13.0
HC Emissions (g)	1	1
CO Emissions (g)	48	48
NOx Emissions (g)	3	3
Vehicles Entered	19	19
Vehicles Exited	19	19
Hourly Exit Rate	19	19
Input Volume	22	22
% of Volume	86	86
Denied Entry Before	0	0
Denied Entry After	0	0

19: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	5.5	5.5
Total Del/Veh (s)	14.6	14.6
Stop Delay (hr)	3.7	3.7
Stop Del/Veh (s)	9.9	9.9
Total Stops	422	422
Stop/Veh	0.31	0.31
Travel Dist (mi)	177.8	177.8
Travel Time (hr)	11.5	11.5
Avg Speed (mph)	15	15
Fuel Used (gal)	6.5	6.5
Fuel Eff. (mpg)	27.4	27.4
HC Emissions (g)	101	101
CO Emissions (g)	2392	2392
NOx Emissions (g)	291	291
Vehicles Entered	1352	1352
Vehicles Exited	1335	1335
Hourly Exit Rate	1335	1335
Input Volume	1338	1338
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

20: HP Hwy Performance by movement

Movement	NBT	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.4	0.4
Total Del/Veh (s)	1.0	1.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	185.2	185.2
Travel Time (hr)	6.6	6.6
Avg Speed (mph)	28	28
Fuel Used (gal)	5.8	5.8
Fuel Eff. (mpg)	31.7	31.7
HC Emissions (g)	109	109
CO Emissions (g)	2216	2216
NOx Emissions (g)	297	297
Vehicles Entered	1380	1380
Vehicles Exited	1378	1378
Hourly Exit Rate	1378	1378
Input Volume	1370	1370
% of Volume	101	101
Denied Entry Before	0	0
Denied Entry After	0	0

21: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	11.2	11.2
Total Del/Veh (s)	30.2	30.2
Stop Delay (hr)	5.8	5.8
Stop Del/Veh (s)	15.5	15.5
Total Stops	565	565
Stop/Veh	0.42	0.42
Travel Dist (mi)	170.8	170.8
Travel Time (hr)	17.0	17.0
Avg Speed (mph)	10	10
Fuel Used (gal)	7.4	7.4
Fuel Eff. (mpg)	23.0	23.0
HC Emissions (g)	100	100
CO Emissions (g)	2098	2098
NOx Emissions (g)	246	246
Vehicles Entered	1335	1335
Vehicles Exited	1317	1317
Hourly Exit Rate	1317	1317
Input Volume	1338	1338
% of Volume	98	98
Denied Entry Before	0	0
Denied Entry After	0	0

23: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	11.2	11.2
Total Del/Veh (s)	30.7	30.7
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	1	1
Stop/Veh	0.00	0.00
Travel Dist (mi)	154.5	154.5
Travel Time (hr)	16.4	16.4
Avg Speed (mph)	9	9
Fuel Used (gal)	6.5	6.5
Fuel Eff. (mpg)	23.9	23.9
HC Emissions (g)	82	82
CO Emissions (g)	1554	1554
NOx Emissions (g)	159	159
Vehicles Entered	1317	1317
Vehicles Exited	1301	1301
Hourly Exit Rate	1301	1301
Input Volume	1338	1338
% of Volume	97	97
Denied Entry Before	0	0
Denied Entry After	0	0

24: Performance by movement

Movement	NBT	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.8	0.8
Total Del/Veh (s)	2.0	2.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	153.3	153.3
Travel Time (hr)	5.9	5.9
Avg Speed (mph)	26	26
Fuel Used (gal)	4.5	4.5
Fuel Eff. (mpg)	34.1	34.1
HC Emissions (g)	77	77
CO Emissions (g)	1218	1218
NOx Emissions (g)	181	181
Vehicles Entered	1383	1383
Vehicles Exited	1380	1380
Hourly Exit Rate	1380	1380
Input Volume	1370	1370
% of Volume	101	101
Denied Entry Before	0	0
Denied Entry After	0	0

26: Bend Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.3	0.3
Total Del/Veh (s)	0.7	0.7
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	1	1
Stop/Veh	0.00	0.00
Travel Dist (mi)	50.9	50.9
Travel Time (hr)	2.0	2.0
Avg Speed (mph)	26	26
Fuel Used (gal)	1.5	1.5
Fuel Eff. (mpg)	34.9	34.9
HC Emissions (g)	25	25
CO Emissions (g)	363	363
NOx Emissions (g)	58	58
Vehicles Entered	1383	1383
Vehicles Exited	1383	1383
Hourly Exit Rate	1383	1383
Input Volume	1370	1370
% of Volume	101	101
Denied Entry Before	0	0
Denied Entry After	0	0

27: HP Hwy & Ehehene Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	1.0	0.0	0.0	0.0	1.0
Denied Del/Veh (s)	0.1	0.1	2.6	2.6	0.0	0.0	1.4
Total Delay (hr)	0.6	0.1	1.2	0.0	0.0	2.0	3.9
Total Del/Veh (s)	321.2	144.4	3.1	2.4	17.1	5.5	5.2
Stop Delay (hr)	0.6	0.1	0.0	0.0	0.0	0.0	0.8
Stop Del/Veh (s)	319.5	144.0	0.0	0.0	11.5	0.0	1.0
Total Stops	7	3	0	0	2	0	12
Stop/Veh	1.00	1.00	0.00	0.00	0.67	0.00	0.00
Travel Dist (mi)	0.3	0.1	271.8	0.3	1.2	526.9	800.6
Travel Time (hr)	0.6	0.1	11.3	0.0	0.1	19.8	32.0
Avg Speed (mph)	0	1	26	24	21	27	26
Fuel Used (gal)	0.2	0.0	8.4	0.0	0.0	16.6	25.2
Fuel Eff. (mpg)	1.9	3.6	32.5	31.1	32.0	31.7	31.7
HC Emissions (g)	0	0	136	0	0	296	433
CO Emissions (g)	8	2	2217	1	6	5308	7543
NOx Emissions (g)	0	0	357	0	1	800	1158
Vehicles Entered	7	3	1380	2	3	1295	2690
Vehicles Exited	5	2	1381	2	3	1280	2673
Hourly Exit Rate	5	2	1381	2	3	1280	2673
Input Volume	7	3	1364	2	3	1337	2716
% of Volume	71	67	101	100	100	96	98
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

28: Performance by movement

Movement	NBT	SET	SER	All
Denied Delay (hr)	0.0	0.0	0.4	0.4
Denied Del/Veh (s)	0.0	0.0	1.0	0.5
Total Delay (hr)	0.1	0.0	2.6	2.8
Total Del/Veh (s)	0.4	7.2	7.2	3.7
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0	0.0
Total Stops	0	0	0	0
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	29.0	0.0	43.9	72.9
Travel Time (hr)	1.1	0.0	5.4	6.5
Avg Speed (mph)	26	8	9	12
Fuel Used (gal)	0.8	0.0	2.1	3.0
Fuel Eff. (mpg)	35.2	20.1	20.5	24.6
HC Emissions (g)	14	0	33	46
CO Emissions (g)	201	0	585	786
NOx Emissions (g)	32	0	67	99
Vehicles Entered	1383	1	1300	2684
Vehicles Exited	1383	1	1296	2680
Hourly Exit Rate	1383	1	1296	2680
Input Volume	1370	1	1338	2709
% of Volume	101	100	97	99
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	1	1

29: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.6	0.6
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.4	0.4
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.2	0.2
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	20	20
Fuel Used (gal)	0.0	0.0
Fuel Eff. (mpg)	12.2	12.2
HC Emissions (g)	0	0
CO Emissions (g)	11	11
NOx Emissions (g)	1	1
Vehicles Entered	4	4
Vehicles Exited	4	4
Hourly Exit Rate	4	4
Input Volume	5	5
% of Volume	80	80
Denied Entry Before	0	0
Denied Entry After	0	0

30: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	3.8	3.8
Travel Time (hr)	0.2	0.2
Avg Speed (mph)	20	20
Fuel Used (gal)	0.3	0.3
Fuel Eff. (mpg)	13.8	13.8
HC Emissions (g)	3	3
CO Emissions (g)	162	162
NOx Emissions (g)	13	13
Vehicles Entered	60	60
Vehicles Exited	60	60
Hourly Exit Rate	60	60
Input Volume	60	60
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

31: HP Hwy & Mauka Access1 Performance by movement

Movement	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.4	0.0	0.4
Total Del/Veh (s)	0.7	0.9	0.3	0.9
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.1	0.0
Total Stops	0	1	0	1
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	2.8	203.6	7.6	214.1
Travel Time (hr)	0.1	7.3	0.3	7.7
Avg Speed (mph)	20	28	25	28
Fuel Used (gal)	0.0	6.3	0.2	6.5
Fuel Eff. (mpg)	57.3	32.5	37.9	32.8
HC Emissions (g)	0	86	2	89
CO Emissions (g)	11	1769	52	1831
NOx Emissions (g)	1	246	6	252
Vehicles Entered	59	1516	56	1631
Vehicles Exited	59	1509	56	1624
Hourly Exit Rate	59	1509	56	1624
Input Volume	60	1511	60	1631
% of Volume	98	100	93	100
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

32: Conn to Transfer Sta/Transfer Station Performance by movement

Movement	EBT	WBT	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.1	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.0	0.0	1.1	0.0	1.2
Total Del/Veh (s)	13.7	14.4	10.7	2.9	0.9	3.0
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.1
Stop Del/Veh (s)	12.6	11.6	11.1	0.0	0.0	0.2
Total Stops	9	3	8	2	0	22
Stop/Veh	1.00	1.00	1.00	0.00	0.00	0.02
Travel Dist (mi)	0.2	0.3	1.0	436.2	0.9	438.6
Travel Time (hr)	0.0	0.0	0.1	15.8	0.0	16.0
Avg Speed (mph)	4	14	15	28	27	27
Fuel Used (gal)	0.0	0.0	0.0	13.2	0.0	13.3
Fuel Eff. (mpg)	15.4	33.3	34.5	32.9	35.3	32.9
HC Emissions (g)	0	0	0	192	0	192
CO Emissions (g)	1	1	2	3589	4	3597
NOx Emissions (g)	0	0	0	555	0	556
Vehicles Entered	9	3	8	1430	3	1453
Vehicles Exited	9	3	8	1416	3	1439
Hourly Exit Rate	9	3	8	1416	3	1439
Input Volume	9	2	6	1440	2	1459
% of Volume	100	150	133	98	150	99
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0

33: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	1.9	1.9
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.5	0.5
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	1.6	1.6
Travel Time (hr)	0.1	0.1
Avg Speed (mph)	25	25
Fuel Used (gal)	0.1	0.1
Fuel Eff. (mpg)	20.3	20.3
HC Emissions (g)	1	1
CO Emissions (g)	30	30
NOx Emissions (g)	2	2
Vehicles Entered	12	12
Vehicles Exited	12	12
Hourly Exit Rate	12	12
Input Volume	11	11
% of Volume	109	109
Denied Entry Before	0	0
Denied Entry After	0	0

34: HP Hwy & Conn to Transfer Sta Performance by movement

Movement	WBL	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.1	0.1
Denied Del/Veh (s)	0.0	2.4	0.3	0.3
Total Delay (hr)	0.0	0.0	0.1	0.2
Total Del/Veh (s)	13.3	0.2	0.4	0.4
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	11.7	0.0	0.0	0.0
Total Stops	3	0	0	3
Stop/Veh	1.00	0.00	0.00	0.00
Travel Dist (mi)	0.1	0.6	102.1	102.8
Travel Time (hr)	0.0	0.0	3.7	3.7
Avg Speed (mph)	4	25	29	28
Fuel Used (gal)	0.0	0.0	3.2	3.3
Fuel Eff. (mpg)	10.8	28.5	31.5	31.4
HC Emissions (g)	0	0	34	34
CO Emissions (g)	1	10	901	912
NOx Emissions (g)	0	1	99	100
Vehicles Entered	3	9	1444	1456
Vehicles Exited	3	9	1445	1457
Hourly Exit Rate	3	9	1445	1457
Input Volume	2	9	1438	1449
% of Volume	150	100	100	101
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

35: External Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	1.0	1.0
Total Del/Veh (s)	2.9	2.9
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	265.2	265.2
Travel Time (hr)	9.9	9.9
Avg Speed (mph)	27	27
Fuel Used (gal)	8.4	8.4
Fuel Eff. (mpg)	31.6	31.6
HC Emissions (g)	142	142
CO Emissions (g)	2909	2909
NOx Emissions (g)	360	360
Vehicles Entered	1285	1285
Vehicles Exited	1278	1278
Hourly Exit Rate	1278	1278
Input Volume	1344	1344
% of Volume	95	95
Denied Entry Before	0	0
Denied Entry After	0	0

36: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	3.2	3.2
Travel Time (hr)	0.2	0.2
Avg Speed (mph)	20	20
Fuel Used (gal)	0.2	0.2
Fuel Eff. (mpg)	13.2	13.2
HC Emissions (g)	4	4
CO Emissions (g)	166	166
NOx Emissions (g)	13	13
Vehicles Entered	56	56
Vehicles Exited	56	56
Hourly Exit Rate	56	56
Input Volume	60	60
% of Volume	93	93
Denied Entry Before	0	0
Denied Entry After	0	0

Total Network Performance

Denied Delay (hr)	1.6
Denied Del/Veh (s)	1.4
Total Delay (hr)	50.6
Total Del/Veh (s)	44.3
Stop Delay (hr)	11.7
Stop Del/Veh (s)	10.3
Total Stops	1814
Stop/Veh	0.44
Travel Dist (mi)	6573.5
Travel Time (hr)	278.4
Avg Speed (mph)	24
Fuel Used (gal)	209.9
Fuel Eff. (mpg)	31.3
HC Emissions (g)	3065
CO Emissions (g)	61364
NOx Emissions (g)	8387
Vehicles Entered	3947
Vehicles Exited	3814
Hourly Exit Rate	3814
Input Volume	44087
% of Volume	9
Denied Entry Before	0
Denied Entry After	1

Arterial Level of Service: SB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Conn to Transfer Sta	34	0.4	9.2	0.1	30
O-turn 1 W	14	1.7	39.6	0.3	29
Olowalu Access 1	15	0.6	12.9	0.1	30
O-turn 1E	11	0.9	17.1	0.1	29
O-turn 2W	10	1.2	26.8	0.2	29
Olowalu Access 2	3	0.9	18.7	0.2	29
Total		5.7	124.2	1.0	29

Intersection: 3: Olowalu Access 2 & HP Hwy

Movement	EB
Directions Served	R
Maximum Queue (ft)	158
Average Queue (ft)	31
95th Queue (ft)	104
Link Distance (ft)	300
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: HP Hwy & Mauka Access 2

Movement	WB
Directions Served	R
Maximum Queue (ft)	32
Average Queue (ft)	1
95th Queue (ft)	13
Link Distance (ft)	290
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: HP Hwy & O-turn 2E

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	72	8	4
Average Queue (ft)	41	0	0
95th Queue (ft)	70	4	3
Link Distance (ft)	46	1359	1359
Upstream Blk Time (%)	6		
Queuing Penalty (veh)	14		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 8: HP Hwy & O-turn 2E

Movement	SB	SB
Directions Served	L	T
Maximum Queue (ft)	61	10
Average Queue (ft)	13	0
95th Queue (ft)	50	7
Link Distance (ft)		502
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	800	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: O-turn 2W

Movement	NB	NB
Directions Served	LT	T
Maximum Queue (ft)	71	10
Average Queue (ft)	11	0
95th Queue (ft)	45	0
Link Distance (ft)	752	752
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 10: HP Hwy & O-turn 2W

Movement	WB	SB
Directions Served	L	T
Maximum Queue (ft)	74	9
Average Queue (ft)	44	0
95th Queue (ft)	73	5
Link Distance (ft)	58	1078
Upstream Blk Time (%)	3	
Queuing Penalty (veh)	5	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 11: HP Hwy & O-turn 1E

Movement	SB	SB	SB
Directions Served	L	LT	T
Maximum Queue (ft)	26	37	18
Average Queue (ft)	2	4	1
95th Queue (ft)	17	27	13
Link Distance (ft)		687	687
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	800		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 12: O-turn 1E & HP Hwy

Movement	EB	NB
Directions Served	L	T
Maximum Queue (ft)	60	4
Average Queue (ft)	30	0
95th Queue (ft)	58	3
Link Distance (ft)	48	1084
Upstream Blk Time (%)	2	
Queuing Penalty (veh)	3	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: O-turn 1 W

Movement	NB	NB
Directions Served	LT	T
Maximum Queue (ft)	51	9
Average Queue (ft)	3	0
95th Queue (ft)	22	6
Link Distance (ft)	519	519
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 14: HP Hwy & O-turn 1 W

Movement	WB	SB
Directions Served	L	T
Maximum Queue (ft)	68	3
Average Queue (ft)	36	0
95th Queue (ft)	64	2
Link Distance (ft)	56	1614
Upstream Blk Time (%)	2	
Queuing Penalty (veh)	2	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 15: HP Hwy & Olowalu Access 1

Movement	EB
Directions Served	R
Maximum Queue (ft)	76
Average Queue (ft)	13
95th Queue (ft)	55
Link Distance (ft)	377
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 17: RIRO Access & HP Hwy

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	47	40
Average Queue (ft)	3	3
95th Queue (ft)	44	35
Link Distance (ft)	674	674
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 20: HP Hwy

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 24:

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 27: HP Hwy & Ehehene

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	70	31
Average Queue (ft)	19	3
95th Queue (ft)	70	16
Link Distance (ft)	228	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		250
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 28:

Movement	NB	B21	B21	B19	B19	B19
Directions Served	T	T		T	T	
Maximum Queue (ft)	6	710	545	360	330	89
Average Queue (ft)	0	362	238	129	109	3
95th Queue (ft)	5	920	739	437	391	52
Link Distance (ft)	54	625	625	655	655	655
Upstream Blk Time (%)		36	7	0	0	
Queuing Penalty (veh)		242	48	2	1	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 31: HP Hwy & Mauka Access1

Movement	WB
Directions Served	R
Maximum Queue (ft)	6
Average Queue (ft)	0
95th Queue (ft)	5
Link Distance (ft)	267
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 32: Conn to Transfer Sta/Transfer Station

Movement	EB	WB
Directions Served	T	TR
Maximum Queue (ft)	30	34
Average Queue (ft)	8	6
95th Queue (ft)	30	24
Link Distance (ft)	60	641
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 34: HP Hwy & Conn to Transfer Sta

Movement	WB
Directions Served	L
Maximum Queue (ft)	28
Average Queue (ft)	2
95th Queue (ft)	14
Link Distance (ft)	60
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 317

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	63	63	63	63	63	63
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	2700	2711	2695	2666	2639	2679
Vehs Exited	2719	2703	2669	2609	2641	2669
Starting Vehs	130	127	108	108	127	119
Ending Vehs	111	135	134	165	125	132
Denied Entry Before	5	0	1	1	1	1
Denied Entry After	1	1	1	0	1	0
Travel Distance (mi)	4623	4631	4558	4488	4491	4558
Travel Time (hr)	138.2	139.3	135.0	132.8	133.7	135.8
Total Delay (hr)	29.9	31.0	28.5	27.7	28.6	29.2
Total Stops	1872	2011	1867	1811	1878	1887
Fuel Used (gal)	138.6	140.0	136.8	133.7	135.2	136.9

Interval #0 Information Seeding

Start Time	6:57
End Time	7:00
Total Time (min)	3

Volumes adjusted by PHF, Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	640	655	631	666	660	648
Vehs Exited	660	634	609	629	635	633
Starting Vehs	130	127	108	108	127	119
Ending Vehs	110	148	130	145	152	132
Denied Entry Before	5	0	1	1	1	1
Denied Entry After	0	0	1	0	1	0
Travel Distance (mi)	1134	1100	1063	1094	1112	1101
Travel Time (hr)	33.7	33.1	30.8	32.7	34.2	32.9
Total Delay (hr)	7.2	7.3	6.0	7.2	8.1	7.2
Total Stops	430	511	390	458	529	465
Fuel Used (gal)	34.0	33.5	31.5	32.8	34.3	33.2

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	712	657	632	611	670	655
Vehs Exited	678	664	633	622	671	653
Starting Vehs	110	148	130	145	152	132
Ending Vehs	144	141	129	134	151	138
Denied Entry Before	0	0	1	0	1	0
Denied Entry After	1	0	0	1	0	0
Travel Distance (mi)	1177	1147	1067	1067	1155	1123
Travel Time (hr)	35.2	34.4	31.2	31.1	34.1	33.2
Total Delay (hr)	7.6	7.6	6.4	6.2	7.2	7.0
Total Stops	476	495	426	426	470	457
Fuel Used (gal)	35.1	34.5	31.8	31.7	34.4	33.5

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	723	714	743	712	670	715
Vehs Exited	728	728	738	701	675	716
Starting Vehs	144	141	129	134	151	138
Ending Vehs	139	127	134	145	146	139
Denied Entry Before	1	0	0	1	0	0
Denied Entry After	0	2	2	1	1	1
Travel Distance (mi)	1237	1225	1258	1192	1121	1207
Travel Time (hr)	37.8	37.0	38.2	35.2	32.9	36.2
Total Delay (hr)	8.7	8.4	8.8	7.4	6.7	8.0
Total Stops	541	514	570	496	427	509
Fuel Used (gal)	37.4	37.2	38.4	35.4	33.6	36.4

Interval #4 Information

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	625	685	689	677	639	666
Vehs Exited	653	677	689	657	660	666
Starting Vehs	139	127	134	145	146	139
Ending Vehs	111	135	134	165	125	132
Denied Entry Before	0	2	2	1	1	1
Denied Entry After	1	1	1	0	1	0
Travel Distance (mi)	1075	1159	1169	1136	1103	1128
Travel Time (hr)	31.6	34.9	34.8	33.7	32.5	33.5
Total Delay (hr)	6.4	7.7	7.3	7.0	6.6	7.0
Total Stops	425	491	481	431	452	455
Fuel Used (gal)	32.1	34.8	35.1	33.7	32.9	33.7

1: HP Hwy & RIRO Access 3 Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Delay (hr)	0.0	0.3	0.9	0.0	1.2
Total Del/Veh (s)	4.7	0.9	3.8	5.2	2.2
Stop Delay (hr)	0.0	0.0	0.1	0.0	0.1
Stop Del/Veh (s)	4.6	0.0	0.5	1.6	0.3
Total Stops	14	0	39	1	54
Stop/Veh	1.00	0.00	0.04	0.09	0.03
Travel Dist (mi)	2.8	226.1	213.2	2.5	444.7
Travel Time (hr)	0.1	5.4	5.8	0.1	11.4
Avg Speed (mph)	23	42	36	30	39
Fuel Used (gal)	0.1	6.3	8.2	0.1	14.6
Fuel Eff. (mpg)	38.2	36.2	26.0	26.9	30.4
HC Emissions (g)	0	141	196	1	338
CO Emissions (g)	5	3421	6235	55	9716
NOx Emissions (g)	1	519	659	3	1183
Vehicles Entered	14	1161	868	10	2053
Vehicles Exited	14	1162	873	10	2059
Hourly Exit Rate	14	1162	873	10	2059
Input Volume	14	1168	870	10	2062
% of Volume	98	100	100	98	100
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0
Density (ft/veh)					505
Occupancy (veh)	0	5	6	0	11

2: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	2.2	2.2
Travel Time (hr)	0.1	0.1
Avg Speed (mph)	28	28
Fuel Used (gal)	0.1	0.1
Fuel Eff. (mpg)	25.3	25.3
HC Emissions (g)	1	1
CO Emissions (g)	30	30
NOx Emissions (g)	2	2
Vehicles Entered	10	10
Vehicles Exited	10	10
Hourly Exit Rate	10	10
Input Volume	10	10
% of Volume	98	98
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

3: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.8	0.8
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.3	0.3
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	36.9	36.9
Travel Time (hr)	1.4	1.4
Avg Speed (mph)	26	26
Fuel Used (gal)	1.5	1.5
Fuel Eff. (mpg)	24.6	24.6
HC Emissions (g)	11	11
CO Emissions (g)	481	481
NOx Emissions (g)	41	41
Vehicles Entered	175	175
Vehicles Exited	174	174
Hourly Exit Rate	174	174
Input Volume	179	179
% of Volume	97	97
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	1	1

4: HP Hwy Performance by movement

Movement	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.4	1.0	1.4
Total Del/Veh (s)	1.1	4.1	2.4
Stop Delay (hr)	0.0	0.1	0.1
Stop Del/Veh (s)	0.0	0.4	0.2
Total Stops	0	80	80
Stop/Veh	0.00	0.09	0.04
Travel Dist (mi)	144.2	176.1	320.3
Travel Time (hr)	3.6	5.0	8.6
Avg Speed (mph)	40	35	37
Fuel Used (gal)	3.7	4.3	8.0
Fuel Eff. (mpg)	39.0	41.3	40.2
HC Emissions (g)	79	96	176
CO Emissions (g)	1599	2211	3810
NOx Emissions (g)	293	325	618
Vehicles Entered	1162	889	2051
Vehicles Exited	1161	890	2051
Hourly Exit Rate	1161	890	2051
Input Volume	1168	888	2056
% of Volume	99	100	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0
Density (ft/veh)			318
Occupancy (veh)	4	5	9

5: HP Hwy & Olowalu Town Access 2/Mauka Access 2 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	3.3	0.4	0.2	3.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	2.1	0.2	0.0	0.2	0.3	0.0	0.9	3.3	0.0	0.2	2.8	0.2
Total Del/Veh (s)	41.9	32.3	1.4	46.9	53.3	0.7	51.0	10.9	3.3	27.5	13.0	6.1
Stop Delay (hr)	2.0	0.2	0.0	0.2	0.3	0.0	0.9	1.6	0.0	0.1	1.3	0.0
Stop Del/Veh (s)	39.1	29.7	0.1	45.8	52.0	0.0	47.6	5.3	0.8	22.1	6.0	1.9
Total Stops	158	16	2	18	16	0	61	327	4	20	236	31
Stop/Veh	0.86	0.67	0.02	0.95	0.89	0.00	0.92	0.30	0.19	0.91	0.31	0.33
Travel Dist (mi)	35.7	4.8	20.3	3.7	3.5	4.5	15.4	258.8	5.1	8.1	283.6	34.6
Travel Time (hr)	3.6	0.4	0.8	0.5	0.4	0.2	1.3	9.1	0.2	0.4	9.2	1.0
Avg Speed (mph)	10	13	26	8	8	19	11	28	31	22	31	33
Fuel Used (gal)	1.5	0.2	0.5	0.2	0.2	0.1	0.5	6.5	0.1	0.3	9.8	1.1
Fuel Eff. (mpg)	23.5	26.2	38.9	20.8	20.2	30.9	28.5	39.7	50.0	28.4	29.0	30.9
HC Emissions (g)	12	1	4	0	0	0	3	132	0	2	243	8
CO Emissions (g)	325	25	105	15	12	12	114	2853	17	98	6933	542
NOx Emissions (g)	34	2	12	1	1	1	12	454	3	9	796	41
Vehicles Entered	179	24	104	18	17	24	65	1079	21	21	758	91
Vehicles Exited	179	24	104	19	18	23	65	1080	21	22	760	92
Hourly Exit Rate	179	24	104	19	18	23	65	1080	21	22	760	92
Input Volume	177	20	104	20	20	20	68	1082	20	20	758	91
% of Volume	101	117	100	93	88	112	96	100	102	107	100	101
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0
Density (ft/veh)												
Occupancy (veh)	3	0	1	0	0	0	1	9	0	0	9	1

5: HP Hwy & Olowalu Town Access 2/Mauka Access 2 Performance by movement

Movement	All
Denied Delay (hr)	0.2
Denied Del/Veh (s)	0.3
Total Delay (hr)	10.3
Total Del/Veh (s)	15.2
Stop Delay (hr)	6.7
Stop Del/Veh (s)	9.8
Total Stops	889
Stop/Veh	0.37
Travel Dist (mi)	677.9
Travel Time (hr)	27.1
Avg Speed (mph)	25
Fuel Used (gal)	21.1
Fuel Eff. (mpg)	32.2
HC Emissions (g)	405
CO Emissions (g)	11051
NOx Emissions (g)	1368
Vehicles Entered	2401
Vehicles Exited	2407
Hourly Exit Rate	2407
Input Volume	2403
% of Volume	100
Denied Entry Before	0
Denied Entry After	0
Density (ft/veh)	789
Occupancy (veh)	27

6: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	1.0	1.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.4	0.4
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	14.1	14.1
Travel Time (hr)	0.7	0.7
Avg Speed (mph)	19	19
Fuel Used (gal)	0.5	0.5
Fuel Eff. (mpg)	26.5	26.5
HC Emissions (g)	1	1
CO Emissions (g)	65	65
NOx Emissions (g)	7	7
Vehicles Entered	67	67
Vehicles Exited	66	66
Hourly Exit Rate	66	66
Input Volume	62	62
% of Volume	107	107
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	1	1

7: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.9	0.9
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.4	0.4
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	23.4	23.4
Travel Time (hr)	0.9	0.9
Avg Speed (mph)	26	26
Fuel Used (gal)	1.0	1.0
Fuel Eff. (mpg)	24.1	24.1
HC Emissions (g)	10	10
CO Emissions (g)	362	362
NOx Emissions (g)	34	34
Vehicles Entered	115	115
Vehicles Exited	115	115
Hourly Exit Rate	115	115
Input Volume	112	112
% of Volume	102	102
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	1	1

9: Bend Performance by approach

Approach	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.9	0.8	1.7
Total Del/Veh (s)	2.8	3.2	3.0
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.2	0.1
Total Stops	0	29	29
Stop/Veh	0.00	0.03	0.01
Travel Dist (mi)	388.8	106.9	495.7
Travel Time (hr)	9.6	3.2	12.8
Avg Speed (mph)	40	34	39
Fuel Used (gal)	9.4	5.3	14.7
Fuel Eff. (mpg)	41.2	20.4	33.7
HC Emissions (g)	200	131	331
CO Emissions (g)	3536	4126	7662
NOx Emissions (g)	756	443	1199
Vehicles Entered	1164	890	2054
Vehicles Exited	1162	890	2052
Hourly Exit Rate	1162	890	2052
Input Volume	1168	888	2056
% of Volume	99	100	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0
Density (ft/veh)	182	199	186
Occupancy (veh)	10	3	13

18: HP Hwy & Olowalu Town Access 1/Mauka Access 1 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	3.4	0.3	0.2	4.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.1	0.2	0.0	0.3	0.3	0.0	0.6	4.6	0.1	0.1	2.3	0.0
Total Del/Veh (s)	44.7	32.4	1.1	49.9	48.4	1.2	54.6	13.4	10.0	13.2	10.3	2.1
Stop Delay (hr)	1.1	0.2	0.0	0.3	0.2	0.0	0.5	1.5	0.0	0.1	1.2	0.0
Stop Del/Veh (s)	42.4	29.4	0.0	47.6	45.0	0.0	48.7	4.3	0.8	10.0	5.6	1.1
Total Stops	82	15	1	20	18	0	39	342	2	14	244	18
Stop/Veh	0.89	0.79	0.02	0.91	0.90	0.00	1.00	0.28	0.11	0.78	0.31	0.31
Travel Dist (mi)	17.2	3.5	11.8	3.0	2.7	2.9	14.6	450.4	7.0	7.2	330.2	23.8
Travel Time (hr)	1.8	0.3	0.5	0.4	0.4	0.1	1.0	15.0	0.2	0.2	9.7	0.6
Avg Speed (mph)	10	12	26	7	7	26	15	30	30	29	34	38
Fuel Used (gal)	0.7	0.1	0.3	0.2	0.1	0.1	0.6	15.7	0.2	0.2	8.4	0.6
Fuel Eff. (mpg)	23.1	26.7	39.9	18.5	20.4	44.3	24.4	28.7	32.2	42.4	39.4	41.5
HC Emissions (g)	5	0	4	1	0	0	6	328	1	1	196	7
CO Emissions (g)	133	15	71	26	18	7	264	10090	79	25	4044	214
NOx Emissions (g)	15	2	10	2	1	1	22	1103	7	5	702	29
Vehicles Entered	90	18	63	21	19	22	39	1222	19	17	789	57
Vehicles Exited	89	18	63	21	20	22	39	1218	19	18	789	57
Hourly Exit Rate	89	18	63	21	20	22	39	1218	19	18	789	57
Input Volume	95	20	63	20	20	20	37	1221	20	20	789	55
% of Volume	94	88	100	102	98	107	106	100	93	88	100	103
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0
Density (ft/veh)												
Occupancy (veh)	2	0	0	0	0	0	1	15	0	0	10	1

18: HP Hwy & Olowalu Town Access 1/Mauka Access 1 Performance by movement

Movement	All
Denied Delay (hr)	0.1
Denied Del/Veh (s)	0.2
Total Delay (hr)	9.5
Total Del/Veh (s)	14.3
Stop Delay (hr)	5.1
Stop Del/Veh (s)	7.7
Total Stops	795
Stop/Veh	0.33
Travel Dist (mi)	874.4
Travel Time (hr)	30.2
Avg Speed (mph)	29
Fuel Used (gal)	27.1
Fuel Eff. (mpg)	32.2
HC Emissions (g)	550
CO Emissions (g)	14987
NOx Emissions (g)	1900
Vehicles Entered	2376
Vehicles Exited	2373
Hourly Exit Rate	2373
Input Volume	2383
% of Volume	100
Denied Entry Before	0
Denied Entry After	0
Density (ft/veh)	818
Occupancy (veh)	30

20: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	2.3	2.3
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.5	0.5
Total Stops	2	2
Stop/Veh	0.04	0.04
Travel Dist (mi)	8.4	8.4
Travel Time (hr)	0.3	0.3
Avg Speed (mph)	24	24
Fuel Used (gal)	0.4	0.4
Fuel Eff. (mpg)	22.2	22.2
HC Emissions (g)	3	3
CO Emissions (g)	136	136
NOx Emissions (g)	10	10
Vehicles Entered	55	55
Vehicles Exited	55	55
Hourly Exit Rate	55	55
Input Volume	62	62
% of Volume	89	89
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

25: External Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.5	0.5
Total Del/Veh (s)	1.9	1.9
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	202.6	202.6
Travel Time (hr)	5.0	5.0
Avg Speed (mph)	41	41
Fuel Used (gal)	5.5	5.5
Fuel Eff. (mpg)	36.9	36.9
HC Emissions (g)	128	128
CO Emissions (g)	3002	3002
NOx Emissions (g)	456	456
Vehicles Entered	879	879
Vehicles Exited	875	875
Hourly Exit Rate	875	875
Input Volume	883	883
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	5	5

28: HP Hwy & Ehehene St Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.4	0.0	0.0	0.0	0.4
Denied Del/Veh (s)	0.2	4.1	1.3	1.8	0.0	0.0	0.8
Total Delay (hr)	0.1	0.0	0.6	0.0	0.0	0.6	1.3
Total Del/Veh (s)	63.2	13.3	1.8	1.1	8.7	2.4	2.2
Stop Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Stop Del/Veh (s)	61.5	13.4	0.0	0.0	4.3	0.0	0.2
Total Stops	4	8	0	0	1	0	13
Stop/Veh	1.00	1.00	0.00	0.00	1.00	0.00	0.01
Travel Dist (mi)	0.3	0.6	253.1	0.6	0.5	292.8	547.9
Travel Time (hr)	0.1	0.1	6.7	0.0	0.0	7.2	14.0
Avg Speed (mph)	4	11	40	35	33	41	40
Fuel Used (gal)	0.0	0.0	6.7	0.0	0.0	7.1	13.9
Fuel Eff. (mpg)	14.5	27.2	38.0	43.3	46.7	41.0	39.5
HC Emissions (g)	0	0	142	0	0	174	315
CO Emissions (g)	2	3	2986	3	1	3134	6128
NOx Emissions (g)	0	0	520	0	0	634	1155
Vehicles Entered	4	8	1156	3	1	889	2061
Vehicles Exited	4	8	1156	3	1	886	2058
Hourly Exit Rate	4	8	1156	3	1	886	2058
Input Volume	5	6	1162	2	2	886	2063
% of Volume	80	128	100	150	50	100	100
Denied Entry Before	0	0	1	0	0	0	1
Denied Entry After	0	0	0	0	0	0	0
Density (ft/veh)							484
Occupancy (veh)	0	0	6	0	0	7	14

29: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.4	0.4
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.3	0.3
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.9	0.9
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	20	20
Fuel Used (gal)	0.1	0.1
Fuel Eff. (mpg)	12.7	12.7
HC Emissions (g)	1	1
CO Emissions (g)	40	40
NOx Emissions (g)	2	2
Vehicles Entered	17	17
Vehicles Exited	17	17
Hourly Exit Rate	17	17
Input Volume	17	17
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

32: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.3	0.3
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.1	0.1
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.3	0.3
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	23	23
Fuel Used (gal)	0.0	0.0
Fuel Eff. (mpg)	17.7	17.7
HC Emissions (g)	0	0
CO Emissions (g)	10	10
NOx Emissions (g)	1	1
Vehicles Entered	4	4
Vehicles Exited	4	4
Hourly Exit Rate	4	4
Input Volume	4	4
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

33: HP Hwy & Transfer Station Performance by movement

Movement	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.0	0.0	2.7	0.2	0.1
Total Delay (hr)	0.0	1.9	0.0	0.0	0.1	2.0
Total Del/Veh (s)	18.4	5.3	6.5	8.8	0.4	3.4
Stop Delay (hr)	0.0	0.1	0.0	0.0	0.0	0.1
Stop Del/Veh (s)	18.7	0.2	0.0	7.9	0.0	0.2
Total Stops	2	16	0	7	0	25
Stop/Veh	1.00	0.01	0.00	0.54	0.00	0.01
Travel Dist (mi)	0.1	540.3	1.5	2.2	140.7	684.8
Travel Time (hr)	0.0	14.2	0.0	0.1	3.3	17.6
Avg Speed (mph)	5	38	33	24	43	39
Fuel Used (gal)	0.0	18.2	0.0	0.1	3.9	22.2
Fuel Eff. (mpg)	22.4	29.7	31.6	35.8	35.9	30.9
HC Emissions (g)	0	410	0	0	93	503
CO Emissions (g)	0	11451	13	22	2308	13794
NOx Emissions (g)	0	1446	2	2	340	1789
Vehicles Entered	2	1281	4	13	860	2160
Vehicles Exited	2	1272	4	13	859	2150
Hourly Exit Rate	2	1272	4	13	859	2150
Input Volume	2	1288	5	12	861	2168
% of Volume	100	99	80	106	100	99
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0
Density (ft/veh)						548
Occupancy (veh)	0	14	0	0	3	18

34: External Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.4	0.4
Total Del/Veh (s)	1.0	1.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	223.7	223.7
Travel Time (hr)	5.4	5.4
Avg Speed (mph)	42	42
Fuel Used (gal)	6.3	6.3
Fuel Eff. (mpg)	35.7	35.7
HC Emissions (g)	142	142
CO Emissions (g)	3546	3546
NOx Emissions (g)	517	517
Vehicles Entered	1272	1272
Vehicles Exited	1272	1272
Hourly Exit Rate	1272	1272
Input Volume	1287	1287
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	5	5

Total Network Performance

Denied Delay (hr)	0.8
Denied Del/Veh (s)	1.1
Total Delay (hr)	28.4
Total Del/Veh (s)	36.4
Stop Delay (hr)	12.3
Stop Del/Veh (s)	15.8
Total Stops	1887
Stop/Veh	0.67
Travel Dist (mi)	4558.4
Travel Time (hr)	135.8
Avg Speed (mph)	34
Fuel Used (gal)	136.9
Fuel Eff. (mpg)	33.3
HC Emissions (g)	2915
CO Emissions (g)	74821
NOx Emissions (g)	10281
Vehicles Entered	2679
Vehicles Exited	2669
Hourly Exit Rate	2669
Input Volume	17807
% of Volume	15
Denied Entry Before	1
Denied Entry After	0
Density (ft/veh)	540
Occupancy (veh)	135

Arterial Level of Service: NB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Ehehene St	28	1.8	20.7	0.2	42
	9	2.8	29.6	0.3	41
	4	1.1	11.2	0.1	39
RIRO Access 3	1	0.9	16.5	0.2	43
Mauka Access 2	5	10.9	30.1	0.2	29
Mauka Access 1	18	14.8	44.2	0.4	31
Transfer Station	33	5.5	39.2	0.4	39
Total		37.7	191.5	1.9	36

Arterial Level of Service: SB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Transfer Station	33	0.4	13.7	0.2	45
Olowalu Town Access	18	10.3	43.7	0.4	35
Olowalu Town Access	5	12.4	42.2	0.4	32
RIRO Access 3	1	3.2	22.9	0.2	38
	4	4.1	20.1	0.2	35
	9	3.2	12.8	0.1	34
Ehehene St	28	2.4	28.8	0.3	42
Total		36.0	184.1	1.9	36

Intersection: 1: HP Hwy & RIRO Access 3

Movement	EB
Directions Served	R
Maximum Queue (ft)	31
Average Queue (ft)	10
95th Queue (ft)	33
Link Distance (ft)	1088
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: HP Hwy

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	118	129
Average Queue (ft)	22	22
95th Queue (ft)	78	78
Link Distance (ft)	994	994
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: HP Hwy & Olowalu Town Access 2/Mauka Access 2

Movement	EB	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	SB
Directions Served	L	L	T	R	L	T	L	L	T	T	R	L
Maximum Queue (ft)	134	170	52	40	58	39	57	82	240	253	33	46
Average Queue (ft)	37	93	12	3	15	12	16	38	118	122	4	13
95th Queue (ft)	104	152	36	21	43	33	42	72	214	225	20	39
Link Distance (ft)			1046	1046		1036			1214	1214		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400	400			250		400	400			250	250
Storage Blk Time (%)										0		
Queuing Penalty (veh)										0		

Intersection: 5: HP Hwy & Olowalu Town Access 2/Mauka Access 2

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	224	229	65
Average Queue (ft)	76	86	17
95th Queue (ft)	174	185	44
Link Distance (ft)	1896	1896	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			600
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Intersection: 18: HP Hwy & Olowalu Town Access 1/Mauka Access 1

Movement	EB	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	SB
Directions Served	L	L	T	R	L	T	L	L	T	T	R	L
Maximum Queue (ft)	80	118	55	30	65	59	36	65	317	353	134	41
Average Queue (ft)	13	52	10	2	22	19	6	33	119	125	5	10
95th Queue (ft)	45	101	35	16	54	50	25	65	254	266	58	31
Link Distance (ft)			1001	1001		736			1896	1896		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	500	500			250		400	400			200	250
Storage Blk Time (%)									0	2		
Queuing Penalty (veh)									0	0		

Intersection: 18: HP Hwy & Olowalu Town Access 1/Mauka Access 1

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	194	192	40
Average Queue (ft)	83	94	12
95th Queue (ft)	159	172	34
Link Distance (ft)	2146	2146	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			600
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 28: HP Hwy & Ehehene St

Movement	WB	WB	SB
Directions Served	L	R	L
Maximum Queue (ft)	26	26	16
Average Queue (ft)	4	5	1
95th Queue (ft)	19	20	9
Link Distance (ft)	407		
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		100	200
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 33: HP Hwy & Transfer Station

Movement	WB	SB
Directions Served	R	L
Maximum Queue (ft)	17	38
Average Queue (ft)	1	7
95th Queue (ft)	10	27
Link Distance (ft)	205	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		250
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 1

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:57	4:57	4:57	4:57	4:57	4:57
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	63	63	63	63	63	63
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	3651	3628	3678	3572	3629	3633
Vehs Exited	3631	3578	3628	3490	3569	3580
Starting Vehs	177	182	174	160	150	168
Ending Vehs	197	232	224	242	210	218
Denied Entry Before	2	3	1	1	1	1
Denied Entry After	5	2	0	0	0	1
Travel Distance (mi)	6265	6170	6167	6023	6087	6142
Travel Time (hr)	227.0	211.9	213.9	204.7	199.6	211.4
Total Delay (hr)	80.5	67.6	69.1	63.5	56.6	67.4
Total Stops	4080	3993	3924	3686	3575	3851
Fuel Used (gal)	201.8	195.8	197.8	191.5	192.9	196.0

Interval #0 Information Seeding

Start Time	4:57
End Time	5:00
Total Time (min)	3

Volumes adjusted by PHF, Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	892	883	934	820	904	885
Vehs Exited	849	875	906	796	850	855
Starting Vehs	177	182	174	160	150	168
Ending Vehs	220	190	202	184	204	197
Denied Entry Before	2	3	1	1	1	1
Denied Entry After	0	2	0	0	1	1
Travel Distance (mi)	1540	1530	1586	1389	1507	1510
Travel Time (hr)	50.7	51.0	55.8	42.7	48.8	49.8
Total Delay (hr)	14.9	15.2	18.3	10.1	13.5	14.4
Total Stops	929	983	1124	679	816	905
Fuel Used (gal)	48.5	47.9	50.9	43.0	46.8	47.4

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	934	884	826	877	899	884
Vehs Exited	922	865	851	857	909	880
Starting Vehs	220	190	202	184	204	197
Ending Vehs	232	209	177	204	194	198
Denied Entry Before	0	2	0	0	1	1
Denied Entry After	1	3	1	0	0	1
Travel Distance (mi)	1587	1495	1371	1495	1522	1494
Travel Time (hr)	56.9	50.2	43.8	46.7	48.7	49.2
Total Delay (hr)	19.8	15.2	11.4	11.7	12.9	14.2
Total Stops	1069	957	708	770	828	868
Fuel Used (gal)	50.8	47.8	42.8	46.6	47.7	47.1

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	960	943	966	974	982	963
Vehs Exited	935	939	937	918	947	933
Starting Vehs	232	209	177	204	194	198
Ending Vehs	257	213	206	260	229	230
Denied Entry Before	1	3	1	0	0	1
Denied Entry After	0	3	3	3	3	2
Travel Distance (mi)	1610	1602	1630	1576	1614	1606
Travel Time (hr)	62.3	58.4	55.9	54.1	53.7	56.9
Total Delay (hr)	24.5	20.8	17.8	17.3	15.9	19.3
Total Stops	1104	1105	1059	1080	997	1067
Fuel Used (gal)	52.8	51.6	52.8	50.3	52.0	51.9

Interval #4 Information

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	865	918	952	901	844	895
Vehs Exited	925	899	934	919	863	909
Starting Vehs	257	213	206	260	229	230
Ending Vehs	197	232	224	242	210	218
Denied Entry Before	0	3	3	3	3	2
Denied Entry After	5	2	0	0	0	1
Travel Distance (mi)	1529	1542	1580	1564	1444	1532
Travel Time (hr)	57.0	52.4	58.5	61.2	48.4	55.5
Total Delay (hr)	21.3	16.3	21.6	24.4	14.3	19.6
Total Stops	978	948	1033	1157	934	1010
Fuel Used (gal)	49.7	48.5	51.2	51.6	46.3	49.5

1: HP Hwy & RIRO Access 3 Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Delay (hr)	0.1	0.4	2.7	0.0	3.1
Total Del/Veh (s)	12.5	0.9	7.0	6.9	4.0
Stop Delay (hr)	0.1	0.0	0.4	0.0	0.5
Stop Del/Veh (s)	12.2	0.0	1.1	1.3	0.6
Total Stops	15	0	60	1	76
Stop/Veh	1.00	0.00	0.04	0.04	0.03
Travel Dist (mi)	3.2	269.7	333.4	5.6	611.9
Travel Time (hr)	0.2	6.4	10.3	0.2	17.1
Avg Speed (mph)	19	42	32	28	36
Fuel Used (gal)	0.1	7.7	13.8	0.2	21.8
Fuel Eff. (mpg)	33.4	35.1	24.2	26.4	28.1
HC Emissions (g)	0	197	321	1	520
CO Emissions (g)	10	4782	10407	97	15297
NOx Emissions (g)	1	694	1061	7	1763
Vehicles Entered	15	1385	1361	23	2784
Vehicles Exited	15	1387	1372	23	2797
Hourly Exit Rate	15	1387	1372	23	2797
Input Volume	15	1400	1372	22	2809
% of Volume	98	99	100	102	100
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0
Density (ft/veh)					337
Occupancy (veh)	0	6	10	0	17

2: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	4.8	4.8
Travel Time (hr)	0.2	0.2
Avg Speed (mph)	27	27
Fuel Used (gal)	0.2	0.2
Fuel Eff. (mpg)	24.6	24.6
HC Emissions (g)	1	1
CO Emissions (g)	66	66
NOx Emissions (g)	5	5
Vehicles Entered	23	23
Vehicles Exited	23	23
Hourly Exit Rate	23	23
Input Volume	22	22
% of Volume	102	102
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

3: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.1	0.1
Total Del/Veh (s)	1.0	1.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.3	0.3
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	77.1	77.1
Travel Time (hr)	3.0	3.0
Avg Speed (mph)	26	26
Fuel Used (gal)	3.2	3.2
Fuel Eff. (mpg)	24.2	24.2
HC Emissions (g)	28	28
CO Emissions (g)	1083	1083
NOx Emissions (g)	99	99
Vehicles Entered	368	368
Vehicles Exited	364	364
Hourly Exit Rate	364	364
Input Volume	365	365
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	3	3

4: HP Hwy Performance by movement

Movement	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.5	17.6	18.1
Total Del/Veh (s)	1.3	46.1	23.6
Stop Delay (hr)	0.0	14.4	14.4
Stop Del/Veh (s)	0.0	37.8	18.8
Total Stops	0	1092	1092
Stop/Veh	0.00	0.80	0.40
Travel Dist (mi)	171.7	270.0	441.7
Travel Time (hr)	4.4	23.7	28.0
Avg Speed (mph)	39	11	16
Fuel Used (gal)	4.5	8.8	13.3
Fuel Eff. (mpg)	38.0	30.8	33.3
HC Emissions (g)	107	127	235
CO Emissions (g)	2197	2816	5013
NOx Emissions (g)	379	306	685
Vehicles Entered	1384	1369	2753
Vehicles Exited	1385	1338	2723
Hourly Exit Rate	1385	1338	2723
Input Volume	1400	1368	2768
% of Volume	99	98	98
Denied Entry Before	0	0	0
Denied Entry After	0	0	0
Density (ft/veh)			98
Occupancy (veh)	4	24	28

5: HP Hwy & Olowalu Town Access 2/Mauka Access 2 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	3.2	0.6	0.2	2.7	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	3.3	0.2	0.1	0.2	0.3	0.0	2.0	3.9	0.0	0.2	8.0	0.6
Total Del/Veh (s)	54.3	36.0	2.1	44.1	48.9	0.8	45.8	11.4	3.6	39.3	22.8	12.2
Stop Delay (hr)	3.1	0.2	0.0	0.2	0.3	0.0	1.8	1.8	0.0	0.2	3.3	0.1
Stop Del/Veh (s)	51.0	32.7	0.6	43.0	47.6	0.0	41.5	5.3	0.8	30.6	9.3	2.8
Total Stops	215	15	12	18	19	0	141	371	5	18	488	67
Stop/Veh	0.99	0.75	0.09	0.95	0.90	0.00	0.89	0.30	0.26	1.00	0.39	0.35
Travel Dist (mi)	42.6	3.9	26.4	3.7	4.2	4.3	37.8	291.8	4.5	6.5	464.2	70.8
Travel Time (hr)	5.0	0.3	1.0	0.4	0.5	0.2	3.0	10.5	0.1	0.4	18.5	2.5
Avg Speed (mph)	9	12	25	9	8	19	12	28	31	18	25	28
Fuel Used (gal)	2.0	0.2	0.7	0.2	0.2	0.1	1.3	7.3	0.1	0.3	17.8	2.6
Fuel Eff. (mpg)	21.6	25.6	37.2	20.6	20.6	31.2	29.7	39.8	48.2	24.3	26.0	27.5
HC Emissions (g)	9	1	8	0	0	0	10	174	0	2	416	18
CO Emissions (g)	324	21	190	14	15	11	337	3665	15	103	12307	1209
NOx Emissions (g)	30	2	23	1	1	1	37	560	3	8	1327	87
Vehicles Entered	213	19	136	19	21	22	157	1218	19	17	1238	188
Vehicles Exited	214	20	136	19	21	23	158	1216	19	18	1232	189
Hourly Exit Rate	214	20	136	19	21	23	158	1216	19	18	1232	189
Input Volume	212	20	140	20	20	20	160	1226	20	20	1238	185
% of Volume	101	98	97	93	102	112	99	99	93	88	100	102
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0
Density (ft/veh)												
Occupancy (veh)	5	0	1	0	0	0	3	10	0	0	18	2

5: HP Hwy & Olowalu Town Access 2/Mauka Access 2 Performance by movement

Movement	All
Denied Delay (hr)	0.2
Denied Del/Veh (s)	0.2
Total Delay (hr)	18.8
Total Del/Veh (s)	20.4
Stop Delay (hr)	11.0
Stop Del/Veh (s)	11.9
Total Stops	1369
Stop/Veh	0.41
Travel Dist (mi)	960.6
Travel Time (hr)	42.5
Avg Speed (mph)	23
Fuel Used (gal)	32.7
Fuel Eff. (mpg)	29.3
HC Emissions (g)	638
CO Emissions (g)	18213
NOx Emissions (g)	2081
Vehicles Entered	3267
Vehicles Exited	3265
Hourly Exit Rate	3265
Input Volume	3284
% of Volume	99
Denied Entry Before	0
Denied Entry After	0
Density (ft/veh)	502
Occupancy (veh)	42

6: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	1.1	1.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.4	0.4
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	12.0	12.0
Travel Time (hr)	0.6	0.6
Avg Speed (mph)	19	19
Fuel Used (gal)	0.5	0.5
Fuel Eff. (mpg)	26.6	26.6
HC Emissions (g)	1	1
CO Emissions (g)	57	57
NOx Emissions (g)	6	6
Vehicles Entered	56	56
Vehicles Exited	57	57
Hourly Exit Rate	57	57
Input Volume	62	62
% of Volume	93	93
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	1	1

7: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.1	0.1
Total Del/Veh (s)	0.9	0.9
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.3	0.3
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	43.3	43.3
Travel Time (hr)	1.7	1.7
Avg Speed (mph)	26	26
Fuel Used (gal)	1.8	1.8
Fuel Eff. (mpg)	23.8	23.8
HC Emissions (g)	24	24
CO Emissions (g)	775	775
NOx Emissions (g)	78	78
Vehicles Entered	215	215
Vehicles Exited	215	215
Hourly Exit Rate	215	215
Input Volume	221	221
% of Volume	97	97
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	2	2

9: Bend Performance by approach

Approach	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	1.2	2.4	3.6
Total Del/Veh (s)	3.2	6.4	4.8
Stop Delay (hr)	0.0	0.5	0.5
Stop Del/Veh (s)	0.0	1.4	0.7
Total Stops	0	42	42
Stop/Veh	0.00	0.03	0.02
Travel Dist (mi)	461.0	160.4	621.4
Travel Time (hr)	11.6	6.0	17.6
Avg Speed (mph)	40	27	35
Fuel Used (gal)	11.3	11.2	22.5
Fuel Eff. (mpg)	40.9	14.3	27.6
HC Emissions (g)	265	284	549
CO Emissions (g)	4560	10248	14808
NOx Emissions (g)	964	905	1869
Vehicles Entered	1379	1337	2716
Vehicles Exited	1380	1331	2711
Hourly Exit Rate	1380	1331	2711
Input Volume	1397	1367	2764
% of Volume	99	97	98
Denied Entry Before	0	0	0
Denied Entry After	0	0	0
Density (ft/veh)	151	106	136
Occupancy (veh)	12	6	18

18: HP Hwy & Olowalu Town Access 1/Mauka Access 1 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	3.4	0.3	0.1	4.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	1.5	0.2	0.0	0.4	0.2	0.0	1.2	5.5	0.1	0.1	6.4	0.1
Total Del/Veh (s)	47.7	34.1	1.5	50.5	49.5	1.1	52.4	14.5	10.2	20.5	17.1	4.3
Stop Delay (hr)	1.4	0.2	0.0	0.3	0.2	0.0	1.0	1.7	0.0	0.1	3.0	0.0
Stop Del/Veh (s)	45.3	31.0	0.3	48.2	46.2	0.0	45.4	4.5	0.9	15.2	8.1	1.5
Total Stops	101	16	7	24	16	0	73	386	2	19	538	41
Stop/Veh	0.91	0.73	0.08	0.92	0.94	0.00	0.89	0.28	0.08	0.86	0.40	0.34
Travel Dist (mi)	20.5	4.2	16.5	3.5	2.3	2.8	30.4	501.6	8.8	9.2	558.2	50.0
Travel Time (hr)	2.3	0.4	0.6	0.5	0.3	0.1	2.0	17.1	0.3	0.4	18.9	1.4
Avg Speed (mph)	9	12	26	7	7	26	15	29	30	26	30	36
Fuel Used (gal)	0.9	0.2	0.4	0.2	0.1	0.1	1.2	17.7	0.3	0.2	14.3	1.3
Fuel Eff. (mpg)	22.6	25.8	38.9	18.6	20.6	43.0	24.7	28.3	31.8	40.7	39.1	39.4
HC Emissions (g)	4	1	5	1	0	0	17	417	2	1	315	16
CO Emissions (g)	132	24	109	29	15	5	625	12101	105	35	6647	595
NOx Emissions (g)	13	2	14	2	1	1	58	1357	9	7	1077	62
Vehicles Entered	108	22	89	25	17	21	81	1345	24	22	1335	119
Vehicles Exited	107	22	89	25	16	21	80	1351	24	22	1335	119
Hourly Exit Rate	107	22	89	25	16	21	80	1351	24	22	1335	119
Input Volume	111	20	85	20	20	20	87	1348	20	20	1342	114
% of Volume	96	107	105	122	78	102	92	100	117	107	99	105
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0
Density (ft/veh)												
Occupancy (veh)	2	0	1	0	0	0	2	17	0	0	19	1

18: HP Hwy & Olowalu Town Access 1/Mauka Access 1 Performance by movement

Movement	All
Denied Delay (hr)	0.1
Denied Del/Veh (s)	0.2
Total Delay (hr)	15.7
Total Del/Veh (s)	17.5
Stop Delay (hr)	8.1
Stop Del/Veh (s)	9.0
Total Stops	1223
Stop/Veh	0.38
Travel Dist (mi)	1208.1
Travel Time (hr)	44.3
Avg Speed (mph)	27
Fuel Used (gal)	36.8
Fuel Eff. (mpg)	32.8
HC Emissions (g)	779
CO Emissions (g)	20422
NOx Emissions (g)	2602
Vehicles Entered	3208
Vehicles Exited	3211
Hourly Exit Rate	3211
Input Volume	3210
% of Volume	100
Denied Entry Before	0
Denied Entry After	0
Density (ft/veh)	558
Occupancy (veh)	44

20: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	2.2	2.2
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.4	0.4
Total Stops	2	2
Stop/Veh	0.03	0.03
Travel Dist (mi)	10.5	10.5
Travel Time (hr)	0.4	0.4
Avg Speed (mph)	24	24
Fuel Used (gal)	0.5	0.5
Fuel Eff. (mpg)	22.4	22.4
HC Emissions (g)	3	3
CO Emissions (g)	160	160
NOx Emissions (g)	12	12
Vehicles Entered	67	67
Vehicles Exited	68	68
Hourly Exit Rate	68	68
Input Volume	62	62
% of Volume	111	111
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

25: External Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.8	0.8
Total Del/Veh (s)	2.1	2.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	306.8	306.8
Travel Time (hr)	7.7	7.7
Avg Speed (mph)	40	40
Fuel Used (gal)	8.4	8.4
Fuel Eff. (mpg)	36.3	36.3
HC Emissions (g)	205	205
CO Emissions (g)	4867	4867
NOx Emissions (g)	706	706
Vehicles Entered	1330	1330
Vehicles Exited	1326	1326
Hourly Exit Rate	1326	1326
Input Volume	1373	1373
% of Volume	97	97
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	8	8

28: HP Hwy & Ehehene St Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.9	0.0	0.0	0.0	0.9
Denied Del/Veh (s)	0.1	4.0	2.3	3.5	0.0	0.0	1.2
Total Delay (hr)	0.5	0.0	1.0	0.0	0.0	1.1	2.6
Total Del/Veh (s)	254.6	25.2	2.6	1.3	24.9	2.9	3.4
Stop Delay (hr)	0.5	0.0	0.0	0.0	0.0	0.0	0.5
Stop Del/Veh (s)	252.5	24.7	0.0	0.0	21.9	0.0	0.7
Total Stops	7	5	0	0	2	0	14
Stop/Veh	1.00	1.00	0.00	0.00	0.67	0.00	0.01
Travel Dist (mi)	0.6	0.4	300.7	0.4	0.9	440.3	743.3
Travel Time (hr)	0.5	0.1	8.6	0.0	0.0	10.9	20.2
Avg Speed (mph)	1	7	39	34	20	40	39
Fuel Used (gal)	0.1	0.0	8.3	0.0	0.0	10.9	19.4
Fuel Eff. (mpg)	4.3	18.6	36.2	43.1	35.6	40.4	38.4
HC Emissions (g)	0	0	191	0	0	287	478
CO Emissions (g)	11	4	3771	2	3	5211	9001
NOx Emissions (g)	0	0	678	0	1	1005	1684
Vehicles Entered	7	5	1374	2	3	1332	2723
Vehicles Exited	7	5	1374	2	3	1324	2715
Hourly Exit Rate	7	5	1374	2	3	1324	2715
Input Volume	7	3	1394	2	3	1366	2775
% of Volume	97	167	99	100	100	97	98
Denied Entry Before	0	0	1	0	0	0	1
Denied Entry After	0	0	1	0	0	0	1
Density (ft/veh)							341
Occupancy (veh)	1	0	8	0	0	11	19

29: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.5	0.5
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.3	0.3
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.5	0.5
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	19	19
Fuel Used (gal)	0.0	0.0
Fuel Eff. (mpg)	12.4	12.4
HC Emissions (g)	0	0
CO Emissions (g)	23	23
NOx Emissions (g)	2	2
Vehicles Entered	10	10
Vehicles Exited	10	10
Hourly Exit Rate	10	10
Input Volume	11	11
% of Volume	89	89
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

32: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.5	0.5
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.3	0.3
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.4	0.4
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	23	23
Fuel Used (gal)	0.0	0.0
Fuel Eff. (mpg)	17.1	17.1
HC Emissions (g)	0	0
CO Emissions (g)	11	11
NOx Emissions (g)	1	1
Vehicles Entered	5	5
Vehicles Exited	5	5
Hourly Exit Rate	5	5
Input Volume	5	5
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

33: HP Hwy & Transfer Station Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	2.4	0.3	0.2
Total Delay (hr)	0.0	0.0	2.3	0.0	0.0	0.3	2.7
Total Del/Veh (s)	47.8	14.2	5.7	9.8	11.8	0.7	3.3
Stop Delay (hr)	0.0	0.0	0.1	0.0	0.0	0.0	0.2
Stop Del/Veh (s)	46.3	14.4	0.2	0.0	11.0	0.0	0.2
Total Stops	2	7	18	0	6	0	33
Stop/Veh	1.00	1.00	0.01	0.00	0.75	0.00	0.01
Travel Dist (mi)	0.1	0.3	606.4	1.0	1.3	240.9	849.9
Travel Time (hr)	0.0	0.0	16.1	0.0	0.1	5.8	22.1
Avg Speed (mph)	3	7	38	32	21	42	39
Fuel Used (gal)	0.0	0.0	20.8	0.0	0.0	6.8	27.7
Fuel Eff. (mpg)	11.3	27.1	29.1	28.4	36.4	35.4	30.6
HC Emissions (g)	0	0	511	0	0	165	676
CO Emissions (g)	0	1	13835	10	9	4108	17963
NOx Emissions (g)	0	0	1767	1	1	590	2360
Vehicles Entered	2	7	1446	2	8	1472	2937
Vehicles Exited	2	7	1434	2	8	1470	2923
Hourly Exit Rate	2	7	1434	2	8	1470	2923
Input Volume	2	6	1446	2	9	1469	2934
% of Volume	100	112	99	100	86	100	100
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0
Density (ft/veh)							439
Occupancy (veh)	0	0	16	0	0	6	22

34: External Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.4	0.4
Total Del/Veh (s)	1.0	1.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	249.8	249.8
Travel Time (hr)	6.0	6.0
Avg Speed (mph)	42	42
Fuel Used (gal)	7.1	7.1
Fuel Eff. (mpg)	35.4	35.4
HC Emissions (g)	177	177
CO Emissions (g)	4274	4274
NOx Emissions (g)	626	626
Vehicles Entered	1422	1422
Vehicles Exited	1419	1419
Hourly Exit Rate	1419	1419
Input Volume	1435	1435
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	6	6

Total Network Performance

Denied Delay (hr)	1.4
Denied Del/Veh (s)	1.3
Total Delay (hr)	66.1
Total Del/Veh (s)	62.6
Stop Delay (hr)	35.3
Stop Del/Veh (s)	33.4
Total Stops	3851
Stop/Veh	1.01
Travel Dist (mi)	6142.2
Travel Time (hr)	211.4
Avg Speed (mph)	29
Fuel Used (gal)	196.0
Fuel Eff. (mpg)	31.3
HC Emissions (g)	4315
CO Emissions (g)	112032
NOx Emissions (g)	14580
Vehicles Entered	3633
Vehicles Exited	3580
Hourly Exit Rate	3580
Input Volume	24098
% of Volume	15
Denied Entry Before	1
Denied Entry After	1
Density (ft/veh)	347
Occupancy (veh)	210

Arterial Level of Service: NB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Ehehene St	28	2.6	22.4	0.2	40
	9	3.2	30.0	0.3	40
	4	1.3	11.3	0.1	39
RIRO Access 3	1	0.9	16.5	0.2	43
Mauka Access 2	5	11.4	30.6	0.2	29
Mauka Access 1	18	15.8	45.4	0.4	30
Transfer Station	33	5.8	39.4	0.4	39
Total		41.0	195.7	1.9	36

Arterial Level of Service: SB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Transfer Station	33	0.7	14.1	0.2	44
Olowalu Town Access	18	17.1	50.4	0.4	30
Olowalu Town Access	5	21.7	51.5	0.4	26
RIRO Access 3	1	6.0	25.6	0.2	34
	4	46.0	61.9	0.2	11
	9	6.4	16.1	0.1	27
Ehehene St	28	2.9	29.5	0.3	41
Total		100.9	249.1	1.9	27

Intersection: 1: HP Hwy & RIRO Access 3

Movement	EB
Directions Served	R
Maximum Queue (ft)	40
Average Queue (ft)	11
95th Queue (ft)	36
Link Distance (ft)	1088
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: HP Hwy

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	657	662
Average Queue (ft)	308	316
95th Queue (ft)	646	660
Link Distance (ft)	994	994
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: HP Hwy & Olowalu Town Access 2/Mauka Access 2

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	L	T	R	L	T	R	L	L	T	T	R
Maximum Queue (ft)	147	188	46	74	58	56	9	104	128	273	276	29
Average Queue (ft)	60	107	11	16	15	15	0	46	67	134	143	4
95th Queue (ft)	135	170	33	57	42	42	7	89	111	240	253	19
Link Distance (ft)			1046	1046		1036	1036			1214	1214	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400	400			250			400	400			250
Storage Blk Time (%)											1	
Queuing Penalty (veh)											0	

Intersection: 5: HP Hwy & Olowalu Town Access 2/Mauka Access 2

Movement	SB	SB	SB	SB
Directions Served	L	T	T	R
Maximum Queue (ft)	100	435	450	106
Average Queue (ft)	14	163	179	31
95th Queue (ft)	59	350	363	75
Link Distance (ft)		1896	1896	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	250			600
Storage Blk Time (%)		4		
Queuing Penalty (veh)		1		

Intersection: 18: HP Hwy & Olowalu Town Access 1/Mauka Access 1

Movement	EB	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	SB
Directions Served	L	L	T	R	L	T	L	L	T	T	R	L
Maximum Queue (ft)	118	132	58	64	77	52	78	91	353	364	88	46
Average Queue (ft)	20	61	11	8	25	17	23	45	134	143	3	13
95th Queue (ft)	67	113	38	39	64	48	60	79	273	289	47	36
Link Distance (ft)			1001	1001		736			1896	1896		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	500	500			250		400	400			200	250
Storage Blk Time (%)									0	3	0	
Queuing Penalty (veh)									0	1	0	

Intersection: 18: HP Hwy & Olowalu Town Access 1/Mauka Access 1

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	338	344	57
Average Queue (ft)	176	198	21
95th Queue (ft)	298	321	47
Link Distance (ft)	2146	2146	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			600
Storage Blk Time (%)	2		
Queuing Penalty (veh)	0		

Intersection: 28: HP Hwy & Ehehene St

Movement	WB	WB	SB	B9
Directions Served	L	R	L	T
Maximum Queue (ft)	55	25	28	130
Average Queue (ft)	13	4	3	5
95th Queue (ft)	41	17	15	95
Link Distance (ft)	407			600
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (ft)		100	200	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 33: HP Hwy & Transfer Station

Movement	WB	WB	SB
Directions Served	L	R	L
Maximum Queue (ft)	25	22	27
Average Queue (ft)	2	5	6
95th Queue (ft)	12	19	23
Link Distance (ft)	205	205	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			250
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 2

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	63	63	63	63	63	63
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	3901	3869	3963	3853	3885	3895
Vehs Exited	3825	3801	3904	3799	3823	3831
Starting Vehs	158	151	145	166	164	156
Ending Vehs	234	219	204	220	226	217
Denied Entry Before	3	1	0	0	1	1
Denied Entry After	0	2	1	0	1	1
Travel Distance (mi)	5766	5727	5780	5668	5681	5724
Travel Time (hr)	221.3	220.3	222.2	217.9	217.7	219.9
Total Delay (hr)	21.3	22.0	22.1	21.6	21.3	21.7
Total Stops	892	925	849	894	931	895
Fuel Used (gal)	178.7	177.8	180.1	177.1	177.7	178.3

Interval #0 Information Seeding

Start Time	6:57
End Time	7:00
Total Time (min)	3

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	7:15
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	1027	1000	965	941	961	974
Vehs Exited	974	925	895	924	913	925
Starting Vehs	158	151	145	166	164	156
Ending Vehs	211	226	215	183	212	207
Denied Entry Before	3	1	0	0	1	1
Denied Entry After	2	1	1	0	1	1
Travel Distance (mi)	1493	1438	1395	1398	1415	1428
Travel Time (hr)	57.4	54.7	53.6	53.8	54.2	54.7
Total Delay (hr)	5.8	4.9	5.2	5.2	5.3	5.3
Total Stops	214	210	209	238	256	225
Fuel Used (gal)	46.6	44.5	43.2	43.5	44.1	44.4

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	960	906	985	999	1022	974
Vehs Exited	954	918	993	953	1008	964
Starting Vehs	211	226	215	183	212	207
Ending Vehs	217	214	207	229	226	219
Denied Entry Before	2	1	1	0	1	1
Denied Entry After	0	1	0	0	1	0
Travel Distance (mi)	1447	1378	1448	1453	1506	1446
Travel Time (hr)	55.6	52.3	55.7	56.2	58.0	55.6
Total Delay (hr)	5.4	4.9	5.5	5.8	5.9	5.5
Total Stops	250	189	218	242	253	230
Fuel Used (gal)	44.8	42.2	44.4	45.2	47.2	44.8

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	951	994	1051	946	921	969
Vehs Exited	951	992	1032	970	936	977
Starting Vehs	217	214	207	229	226	219
Ending Vehs	217	216	226	205	211	209
Denied Entry Before	0	1	0	0	1	0
Denied Entry After	0	0	0	0	1	0
Travel Distance (mi)	1390	1473	1506	1391	1324	1417
Travel Time (hr)	53.3	56.7	58.1	53.2	50.3	54.3
Total Delay (hr)	5.0	5.8	6.0	5.2	4.6	5.3
Total Stops	211	274	234	192	190	218
Fuel Used (gal)	42.9	46.0	47.2	44.0	41.3	44.3

Interval #4 Information

Start Time	7:45
End Time	8:00
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	963	969	962	967	981	967
Vehs Exited	946	966	984	952	966	962
Starting Vehs	217	216	226	205	211	209
Ending Vehs	234	219	204	220	226	217
Denied Entry Before	0	0	0	0	1	0
Denied Entry After	0	2	1	0	1	1
Travel Distance (mi)	1436	1438	1431	1427	1437	1434
Travel Time (hr)	55.0	56.6	54.8	54.7	55.2	55.3
Total Delay (hr)	5.1	6.5	5.6	5.3	5.4	5.6
Total Stops	217	252	188	222	232	222
Fuel Used (gal)	44.4	45.1	45.3	44.4	45.1	44.8

2: Bend Performance by approach

Approach	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	2.1	0.1	2.2
Total Del/Veh (s)	6.2	0.2	3.5
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0
Total Stops	0	0	0
Stop/Veh	0.00	0.00	0.00
Travel Dist (mi)	507.1	18.3	525.3
Travel Time (hr)	19.2	1.6	20.8
Avg Speed (mph)	26	11	25
Fuel Used (gal)	14.3	1.7	16.0
Fuel Eff. (mpg)	35.5	10.7	32.8
HC Emissions (g)	264	38	302
CO Emissions (g)	3834	912	4746
NOx Emissions (g)	628	130	758
Vehicles Entered	1234	1026	2260
Vehicles Exited	1237	1025	2262
Hourly Exit Rate	1237	1025	2262
Input Volume	1250	1048	2298
% of Volume	99	98	98
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

3: Olowalu Access 2 & HP Hwy Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.1	0.0	0.0	0.1
Denied Del/Veh (s)	0.5	0.0	0.0	0.2
Total Delay (hr)	0.6	0.1	0.3	1.1
Total Del/Veh (s)	3.9	0.6	2.8	2.1
Stop Delay (hr)	0.1	0.0	0.0	0.1
Stop Del/Veh (s)	0.5	0.0	0.1	0.2
Total Stops	66	0	0	66
Stop/Veh	0.11	0.00	0.00	0.04
Travel Dist (mi)	29.3	123.7	58.6	211.5
Travel Time (hr)	1.9	4.4	2.5	8.8
Avg Speed (mph)	16	28	23	24
Fuel Used (gal)	0.8	3.9	1.5	6.2
Fuel Eff. (mpg)	36.6	32.0	38.0	34.1
HC Emissions (g)	7	59	14	81
CO Emissions (g)	238	1289	397	1924
NOx Emissions (g)	24	170	41	234
Vehicles Entered	580	832	405	1817
Vehicles Exited	578	830	404	1812
Hourly Exit Rate	578	830	404	1812
Input Volume	585	856	400	1841
% of Volume	99	97	101	98
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

4: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.4	0.4
Total Del/Veh (s)	3.3	3.3
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	26.2	26.2
Travel Time (hr)	1.6	1.6
Avg Speed (mph)	16	16
Fuel Used (gal)	2.0	2.0
Fuel Eff. (mpg)	13.4	13.4
HC Emissions (g)	27	27
CO Emissions (g)	1177	1177
NOx Emissions (g)	95	95
Vehicles Entered	404	404
Vehicles Exited	404	404
Hourly Exit Rate	404	404
Input Volume	400	400
% of Volume	101	101
Denied Entry Before	0	0
Denied Entry After	0	0

5: External Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.3	0.3
Total Del/Veh (s)	0.6	0.6
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	118.5	118.5
Travel Time (hr)	4.2	4.2
Avg Speed (mph)	28	28
Fuel Used (gal)	3.9	3.9
Fuel Eff. (mpg)	30.6	30.6
HC Emissions (g)	42	42
CO Emissions (g)	1201	1201
NOx Emissions (g)	116	116
Vehicles Entered	1511	1511
Vehicles Exited	1509	1509
Hourly Exit Rate	1509	1509
Input Volume	1540	1540
% of Volume	98	98
Denied Entry Before	0	0
Denied Entry After	0	0

6: HP Hwy & Mauka Access 2 Performance by movement

Movement	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.3	0.0	0.4
Total Del/Veh (s)	0.7	0.7	0.6	0.7
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.1	0.1	0.1
Total Stops	0	2	0	2
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	3.3	163.1	6.2	172.6
Travel Time (hr)	0.2	6.0	0.3	6.4
Avg Speed (mph)	21	27	23	27
Fuel Used (gal)	0.1	5.8	0.2	6.0
Fuel Eff. (mpg)	56.0	28.3	34.3	28.8
HC Emissions (g)	0	91	2	93
CO Emissions (g)	12	2220	56	2288
NOx Emissions (g)	1	269	5	275
Vehicles Entered	63	1615	60	1738
Vehicles Exited	64	1612	60	1736
Hourly Exit Rate	64	1612	60	1736
Input Volume	60	1623	60	1743
% of Volume	107	99	100	100
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

7: HP Hwy & O-turn 2E Performance by movement

Movement	EBL	NBT	All
Denied Delay (hr)	0.1	0.0	0.1
Denied Del/Veh (s)	1.3	0.0	0.3
Total Delay (hr)	0.3	0.6	0.9
Total Del/Veh (s)	2.6	1.8	2.0
Stop Delay (hr)	0.3	0.0	0.3
Stop Del/Veh (s)	2.3	0.0	0.6
Total Stops	107	2	109
Stop/Veh	0.27	0.00	0.07
Travel Dist (mi)	4.0	327.6	331.7
Travel Time (hr)	0.7	11.6	12.3
Avg Speed (mph)	7	28	27
Fuel Used (gal)	0.3	9.5	9.8
Fuel Eff. (mpg)	13.6	34.5	33.9
HC Emissions (g)	2	183	186
CO Emissions (g)	64	3121	3185
NOx Emissions (g)	9	492	501
Vehicles Entered	396	1242	1638
Vehicles Exited	396	1243	1639
Hourly Exit Rate	396	1243	1639
Input Volume	395	1250	1645
% of Volume	100	99	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

8: HP Hwy & O-turn 2E Performance by movement

Movement	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.2	0.8	1.0
Total Del/Veh (s)	3.9	2.4	2.6
Stop Delay (hr)	0.1	0.2	0.3
Stop Del/Veh (s)	1.2	0.7	0.8
Total Stops	58	127	185
Stop/Veh	0.29	0.10	0.13
Travel Dist (mi)	20.2	116.2	136.4
Travel Time (hr)	1.0	5.2	6.2
Avg Speed (mph)	19	23	22
Fuel Used (gal)	0.8	5.2	5.9
Fuel Eff. (mpg)	26.6	22.5	23.1
HC Emissions (g)	9	80	88
CO Emissions (g)	298	2392	2690
NOx Emissions (g)	29	255	284
Vehicles Entered	197	1212	1409
Vehicles Exited	195	1210	1405
Hourly Exit Rate	195	1210	1405
Input Volume	202	1239	1441
% of Volume	97	98	98
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

9: O-turn 2W Performance by movement

Movement	NBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.2	0.6	0.8
Total Del/Veh (s)	3.4	1.4	1.7
Stop Delay (hr)	0.0	0.0	0.1
Stop Del/Veh (s)	0.3	0.1	0.1
Total Stops	13	32	45
Stop/Veh	0.06	0.02	0.03
Travel Dist (mi)	30.8	215.4	246.2
Travel Time (hr)	1.3	7.9	9.2
Avg Speed (mph)	23	27	27
Fuel Used (gal)	0.9	6.5	7.4
Fuel Eff. (mpg)	35.3	33.0	33.3
HC Emissions (g)	8	105	113
CO Emissions (g)	179	2048	2227
NOx Emissions (g)	25	293	319
Vehicles Entered	206	1476	1682
Vehicles Exited	206	1471	1677
Hourly Exit Rate	206	1471	1677
Input Volume	202	1486	1688
% of Volume	102	99	99
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

10: HP Hwy & O-turn 2W Performance by movement

Movement	WBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.3	0.4
Total Del/Veh (s)	2.2	1.0	1.2
Stop Delay (hr)	0.1	0.0	0.1
Stop Del/Veh (s)	1.8	0.0	0.3
Total Stops	74	1	75
Stop/Veh	0.36	0.00	0.06
Travel Dist (mi)	3.6	212.1	215.7
Travel Time (hr)	0.3	7.4	7.7
Avg Speed (mph)	10	29	28
Fuel Used (gal)	0.2	6.2	6.3
Fuel Eff. (mpg)	19.9	34.5	34.1
HC Emissions (g)	2	63	64
CO Emissions (g)	48	1172	1220
NOx Emissions (g)	6	179	185
Vehicles Entered	206	998	1204
Vehicles Exited	205	998	1203
Hourly Exit Rate	205	998	1203
Input Volume	202	1024	1226
% of Volume	101	97	98
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

11: HP Hwy & O-turn 1E Performance by movement

Movement	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.4	0.6	1.0
Total Del/Veh (s)	5.0	2.2	2.8
Stop Delay (hr)	0.1	0.2	0.3
Stop Del/Veh (s)	1.4	0.6	0.8
Total Stops	58	95	153
Stop/Veh	0.21	0.09	0.12
Travel Dist (mi)	37.3	138.6	175.8
Travel Time (hr)	1.8	5.6	7.4
Avg Speed (mph)	21	25	24
Fuel Used (gal)	1.3	5.2	6.5
Fuel Eff. (mpg)	28.3	26.9	27.2
HC Emissions (g)	11	75	85
CO Emissions (g)	387	2000	2386
NOx Emissions (g)	41	229	269
Vehicles Entered	272	1025	1297
Vehicles Exited	272	1025	1297
Hourly Exit Rate	272	1025	1297
Input Volume	267	1052	1319
% of Volume	102	97	98
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

12: O-turn 1E & HP Hwy Performance by movement

Movement	EBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.2	0.5	0.7
Total Del/Veh (s)	2.6	1.4	1.6
Stop Delay (hr)	0.2	0.0	0.2
Stop Del/Veh (s)	2.2	0.0	0.3
Total Stops	101	1	102
Stop/Veh	0.37	0.00	0.06
Travel Dist (mi)	4.8	304.2	309.0
Travel Time (hr)	0.5	10.8	11.3
Avg Speed (mph)	10	28	27
Fuel Used (gal)	0.3	8.9	9.2
Fuel Eff. (mpg)	18.6	34.1	33.7
HC Emissions (g)	2	173	174
CO Emissions (g)	56	2995	3051
NOx Emissions (g)	8	467	475
Vehicles Entered	272	1428	1700
Vehicles Exited	272	1418	1690
Hourly Exit Rate	272	1418	1690
Input Volume	267	1443	1710
% of Volume	102	98	99
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

13: O-turn 1 W Performance by movement

Movement	NBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.5	0.6
Total Del/Veh (s)	2.9	1.2	1.3
Stop Delay (hr)	0.0	0.1	0.1
Stop Del/Veh (s)	0.4	0.1	0.2
Total Stops	8	39	47
Stop/Veh	0.07	0.02	0.03
Travel Dist (mi)	12.7	164.9	177.6
Travel Time (hr)	0.6	6.1	6.7
Avg Speed (mph)	22	27	27
Fuel Used (gal)	0.4	5.3	5.6
Fuel Eff. (mpg)	35.2	31.2	31.5
HC Emissions (g)	3	76	79
CO Emissions (g)	69	1711	1779
NOx Emissions (g)	10	227	236
Vehicles Entered	119	1607	1726
Vehicles Exited	119	1604	1723
Hourly Exit Rate	119	1604	1723
Input Volume	127	1629	1756
% of Volume	94	98	98
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

14: HP Hwy & O-turn 1 W Performance by movement

Movement	WBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.1	0.3	0.4
Total Del/Veh (s)	2.8	1.2	1.4
Stop Delay (hr)	0.1	0.0	0.1
Stop Del/Veh (s)	2.4	0.0	0.3
Total Stops	56	0	56
Stop/Veh	0.47	0.00	0.05
Travel Dist (mi)	2.1	312.7	314.7
Travel Time (hr)	0.2	10.9	11.1
Avg Speed (mph)	9	29	28
Fuel Used (gal)	0.1	8.9	9.0
Fuel Eff. (mpg)	19.8	35.1	34.9
HC Emissions (g)	1	89	90
CO Emissions (g)	28	1555	1583
NOx Emissions (g)	4	252	255
Vehicles Entered	119	985	1104
Vehicles Exited	118	987	1105
Hourly Exit Rate	118	987	1105
Input Volume	127	1004	1131
% of Volume	93	98	98
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

15: HP Hwy & Olowalu Access 1 Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.3	0.0	0.0	0.1
Total Delay (hr)	0.3	0.1	0.1	0.6
Total Del/Veh (s)	3.0	0.5	2.0	1.4
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.3	0.0	0.1	0.1
Total Stops	33	0	0	33
Stop/Veh	0.08	0.00	0.00	0.02
Travel Dist (mi)	26.1	92.1	22.6	140.8
Travel Time (hr)	1.4	3.3	1.0	5.7
Avg Speed (mph)	19	28	23	25
Fuel Used (gal)	0.7	2.9	0.6	4.2
Fuel Eff. (mpg)	37.1	31.6	39.7	33.6
HC Emissions (g)	7	42	5	55
CO Emissions (g)	269	930	178	1376
NOx Emissions (g)	23	121	15	159
Vehicles Entered	401	901	230	1532
Vehicles Exited	400	902	228	1530
Hourly Exit Rate	400	902	228	1530
Input Volume	398	920	238	1556
% of Volume	101	98	96	98
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

16: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.2	0.2
Total Del/Veh (s)	3.2	3.2
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	18.2	18.2
Travel Time (hr)	1.0	1.0
Avg Speed (mph)	18	18
Fuel Used (gal)	1.2	1.2
Fuel Eff. (mpg)	15.4	15.4
HC Emissions (g)	16	16
CO Emissions (g)	679	679
NOx Emissions (g)	56	56
Vehicles Entered	228	228
Vehicles Exited	228	228
Hourly Exit Rate	228	228
Input Volume	238	238
% of Volume	96	96
Denied Entry Before	0	0
Denied Entry After	0	0

17: RIRO Access & HP Hwy Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.2	0.0	0.2
Total Del/Veh (s)	0.6	0.6	0.1	0.6
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0	0.0
Total Stops	0	0	0	0
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	1.4	136.3	3.1	140.8
Travel Time (hr)	0.1	4.8	0.1	4.9
Avg Speed (mph)	20	29	26	28
Fuel Used (gal)	0.0	4.1	0.1	4.2
Fuel Eff. (mpg)	62.0	33.3	45.2	33.6
HC Emissions (g)	0	66	1	67
CO Emissions (g)	4	1277	11	1292
NOx Emissions (g)	0	189	2	191
Vehicles Entered	30	1034	23	1087
Vehicles Exited	30	1035	23	1088
Hourly Exit Rate	30	1035	23	1088
Input Volume	32	1052	25	1109
% of Volume	94	98	92	98
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

18: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	1.3	1.3
Travel Time (hr)	0.1	0.1
Avg Speed (mph)	20	20
Fuel Used (gal)	0.1	0.1
Fuel Eff. (mpg)	13.5	13.5
HC Emissions (g)	3	3
CO Emissions (g)	90	90
NOx Emissions (g)	8	8
Vehicles Entered	23	23
Vehicles Exited	23	23
Hourly Exit Rate	23	23
Input Volume	25	25
% of Volume	92	92
Denied Entry Before	0	0
Denied Entry After	0	0

19: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.4	0.4
Total Del/Veh (s)	1.5	1.5
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	1	1
Stop/Veh	0.00	0.00
Travel Dist (mi)	136.5	136.5
Travel Time (hr)	5.1	5.1
Avg Speed (mph)	27	27
Fuel Used (gal)	4.3	4.3
Fuel Eff. (mpg)	31.4	31.4
HC Emissions (g)	85	85
CO Emissions (g)	1676	1676
NOx Emissions (g)	250	250
Vehicles Entered	1031	1031
Vehicles Exited	1032	1032
Hourly Exit Rate	1032	1032
Input Volume	1049	1049
% of Volume	98	98
Denied Entry Before	0	0
Denied Entry After	0	0

20: HP Hwy Performance by movement

Movement	NBT	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.3	0.3
Total Del/Veh (s)	1.0	1.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	166.7	166.7
Travel Time (hr)	5.9	5.9
Avg Speed (mph)	28	28
Fuel Used (gal)	5.2	5.2
Fuel Eff. (mpg)	32.0	32.0
HC Emissions (g)	106	106
CO Emissions (g)	2093	2093
NOx Emissions (g)	289	289
Vehicles Entered	1241	1241
Vehicles Exited	1242	1242
Hourly Exit Rate	1242	1242
Input Volume	1250	1250
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0

21: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.5	0.5
Total Del/Veh (s)	1.7	1.7
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	132.8	132.8
Travel Time (hr)	5.0	5.0
Avg Speed (mph)	27	27
Fuel Used (gal)	4.0	4.0
Fuel Eff. (mpg)	33.4	33.4
HC Emissions (g)	77	77
CO Emissions (g)	1276	1276
NOx Emissions (g)	213	213
Vehicles Entered	1032	1032
Vehicles Exited	1029	1029
Hourly Exit Rate	1029	1029
Input Volume	1049	1049
% of Volume	98	98
Denied Entry Before	0	0
Denied Entry After	0	0

23: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	1.4	1.4
Total Del/Veh (s)	4.7	4.7
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	121.2	121.2
Travel Time (hr)	5.4	5.4
Avg Speed (mph)	22	22
Fuel Used (gal)	2.5	2.5
Fuel Eff. (mpg)	47.8	47.8
HC Emissions (g)	50	50
CO Emissions (g)	779	779
NOx Emissions (g)	108	108
Vehicles Entered	1029	1029
Vehicles Exited	1027	1027
Hourly Exit Rate	1027	1027
Input Volume	1049	1049
% of Volume	98	98
Denied Entry Before	0	0
Denied Entry After	0	0

24: Performance by movement

Movement	NBT	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.7	0.7
Total Del/Veh (s)	1.9	1.9
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	137.5	137.5
Travel Time (hr)	5.3	5.3
Avg Speed (mph)	26	26
Fuel Used (gal)	4.0	4.0
Fuel Eff. (mpg)	34.3	34.3
HC Emissions (g)	76	76
CO Emissions (g)	1187	1187
NOx Emissions (g)	180	180
Vehicles Entered	1240	1240
Vehicles Exited	1241	1241
Hourly Exit Rate	1241	1241
Input Volume	1250	1250
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0

26: Bend Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.2	0.2
Total Del/Veh (s)	0.6	0.6
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	45.7	45.7
Travel Time (hr)	1.8	1.8
Avg Speed (mph)	26	26
Fuel Used (gal)	1.3	1.3
Fuel Eff. (mpg)	35.2	35.2
HC Emissions (g)	25	25
CO Emissions (g)	371	371
NOx Emissions (g)	59	59
Vehicles Entered	1239	1239
Vehicles Exited	1240	1240
Hourly Exit Rate	1240	1240
Input Volume	1250	1250
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0

27: HP Hwy & Ehehene Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.6	0.0	0.0	0.0	0.6
Denied Del/Veh (s)	0.1	0.1	1.7	3.3	0.0	0.0	0.9
Total Delay (hr)	0.1	0.0	0.8	0.0	0.0	1.3	2.3
Total Del/Veh (s)	90.1	21.7	2.5	1.8	17.8	4.6	3.6
Stop Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Stop Del/Veh (s)	88.5	21.8	0.0	0.0	13.6	0.0	0.2
Total Stops	4	7	0	0	1	0	12
Stop/Veh	1.00	1.00	0.00	0.00	1.00	0.00	0.01
Travel Dist (mi)	0.2	0.3	241.2	0.6	0.4	417.5	660.2
Travel Time (hr)	0.1	0.1	9.5	0.0	0.0	15.5	25.3
Avg Speed (mph)	1	5	27	25	21	27	27
Fuel Used (gal)	0.0	0.0	7.1	0.0	0.0	13.2	20.4
Fuel Eff. (mpg)	5.9	19.1	33.8	34.9	28.9	31.6	32.3
HC Emissions (g)	0	0	133	0	0	275	409
CO Emissions (g)	2	2	2177	2	2	5081	7267
NOx Emissions (g)	0	0	339	0	0	731	1071
Vehicles Entered	4	7	1222	3	1	1024	2261
Vehicles Exited	3	7	1227	3	1	1015	2256
Hourly Exit Rate	3	7	1227	3	1	1015	2256
Input Volume	5	6	1244	2	2	1046	2305
% of Volume	60	117	99	150	50	97	98
Denied Entry Before	0	0	1	0	0	0	1
Denied Entry After	0	0	1	0	0	0	1

28: Performance by movement

Movement	NBT	SET	SER	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0	0.0
Total Delay (hr)	0.1	0.0	1.0	1.2
Total Del/Veh (s)	0.4	5.5	3.7	1.9
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0	0.0
Total Stops	0	0	0	0
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	26.0	0.0	34.6	60.6
Travel Time (hr)	1.0	0.0	3.0	4.0
Avg Speed (mph)	26	11	12	15
Fuel Used (gal)	0.7	0.0	1.0	1.7
Fuel Eff. (mpg)	35.3	31.4	34.2	34.7
HC Emissions (g)	14	0	19	33
CO Emissions (g)	202	0	326	527
NOx Emissions (g)	32	0	40	72
Vehicles Entered	1239	1	1026	2266
Vehicles Exited	1239	1	1026	2266
Hourly Exit Rate	1239	1	1026	2266
Input Volume	1251	1	1048	2300
% of Volume	99	100	98	99
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

29: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.3	0.3
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.2	0.2
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.2	0.2
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	19	19
Fuel Used (gal)	0.0	0.0
Fuel Eff. (mpg)	11.8	11.8
HC Emissions (g)	0	0
CO Emissions (g)	9	9
NOx Emissions (g)	1	1
Vehicles Entered	4	4
Vehicles Exited	4	4
Hourly Exit Rate	4	4
Input Volume	4	4
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

30: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	3.8	3.8
Travel Time (hr)	0.2	0.2
Avg Speed (mph)	20	20
Fuel Used (gal)	0.3	0.3
Fuel Eff. (mpg)	14.3	14.3
HC Emissions (g)	4	4
CO Emissions (g)	163	163
NOx Emissions (g)	13	13
Vehicles Entered	60	60
Vehicles Exited	60	60
Hourly Exit Rate	60	60
Input Volume	60	60
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

31: HP Hwy & Mauka Access1 Performance by movement

Movement	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.4	0.0	0.4
Total Del/Veh (s)	0.6	0.9	0.3	0.9
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.1	0.0
Total Stops	0	1	0	1
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	2.8	222.5	7.4	232.7
Travel Time (hr)	0.1	8.0	0.3	8.5
Avg Speed (mph)	20	28	25	27
Fuel Used (gal)	0.0	7.1	0.2	7.4
Fuel Eff. (mpg)	57.7	31.1	38.6	31.5
HC Emissions (g)	0	101	2	103
CO Emissions (g)	9	2231	61	2301
NOx Emissions (g)	1	294	6	301
Vehicles Entered	58	1679	55	1792
Vehicles Exited	58	1673	54	1785
Hourly Exit Rate	58	1673	54	1785
Input Volume	60	1693	60	1813
% of Volume	97	99	90	98
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

32: Conn to Transfer Sta/Transfer Station Performance by movement

Movement	EBT	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.0	1.3	0.0	1.3
Total Del/Veh (s)	9.9	14.6	3.0	0.9	3.0
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	8.8	15.0	0.0	0.0	0.0
Total Stops	3	2	3	0	8
Stop/Veh	1.00	1.00	0.00	0.00	0.01
Travel Dist (mi)	0.1	0.2	478.3	1.5	480.1
Travel Time (hr)	0.0	0.0	17.4	0.1	17.5
Avg Speed (mph)	5	14	28	27	27
Fuel Used (gal)	0.0	0.0	14.5	0.0	14.6
Fuel Eff. (mpg)	19.0	33.7	33.0	36.5	33.0
HC Emissions (g)	0	0	196	0	196
CO Emissions (g)	0	0	3690	7	3697
NOx Emissions (g)	0	0	573	1	574
Vehicles Entered	3	2	1567	5	1577
Vehicles Exited	3	2	1553	5	1563
Hourly Exit Rate	3	2	1553	5	1563
Input Volume	5	2	1584	5	1596
% of Volume	60	100	98	100	98
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

33: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	1.1	1.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.2	0.2
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	1.0	1.0
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	25	25
Fuel Used (gal)	0.1	0.1
Fuel Eff. (mpg)	19.9	19.9
HC Emissions (g)	0	0
CO Emissions (g)	21	21
NOx Emissions (g)	1	1
Vehicles Entered	8	8
Vehicles Exited	8	8
Hourly Exit Rate	8	8
Input Volume	10	10
% of Volume	80	80
Denied Entry Before	0	0
Denied Entry After	0	0

34: HP Hwy & Conn to Transfer Sta Performance by movement

Movement	SBL	SBT	All
Denied Delay (hr)	0.0	0.1	0.1
Denied Del/Veh (s)	2.7	0.2	0.2
Total Delay (hr)	0.0	0.1	0.1
Total Del/Veh (s)	0.1	0.2	0.2
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0
Total Stops	0	0	0
Stop/Veh	0.00	0.00	0.00
Travel Dist (mi)	0.2	69.7	69.9
Travel Time (hr)	0.0	2.5	2.5
Avg Speed (mph)	26	29	29
Fuel Used (gal)	0.0	2.2	2.2
Fuel Eff. (mpg)	29.9	32.0	32.0
HC Emissions (g)	0	24	24
CO Emissions (g)	3	601	604
NOx Emissions (g)	0	68	69
Vehicles Entered	3	985	988
Vehicles Exited	3	985	988
Hourly Exit Rate	3	985	988
Input Volume	5	1004	1009
% of Volume	60	98	98
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

35: External Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.7	0.7
Total Del/Veh (s)	2.6	2.6
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	210.0	210.0
Travel Time (hr)	7.8	7.8
Avg Speed (mph)	27	27
Fuel Used (gal)	6.6	6.6
Fuel Eff. (mpg)	32.0	32.0
HC Emissions (g)	128	128
CO Emissions (g)	2488	2488
NOx Emissions (g)	323	323
Vehicles Entered	1018	1018
Vehicles Exited	1011	1011
Hourly Exit Rate	1011	1011
Input Volume	1051	1051
% of Volume	96	96
Denied Entry Before	0	0
Denied Entry After	0	0

36: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	3.2	3.2
Travel Time (hr)	0.2	0.2
Avg Speed (mph)	20	20
Fuel Used (gal)	0.2	0.2
Fuel Eff. (mpg)	13.6	13.6
HC Emissions (g)	4	4
CO Emissions (g)	163	163
NOx Emissions (g)	13	13
Vehicles Entered	54	54
Vehicles Exited	54	54
Hourly Exit Rate	54	54
Input Volume	60	60
% of Volume	90	90
Denied Entry Before	0	0
Denied Entry After	0	0

Total Network Performance

Denied Delay (hr)	1.0
Denied Del/Veh (s)	0.9
Total Delay (hr)	20.7
Total Del/Veh (s)	18.4
Stop Delay (hr)	1.7
Stop Del/Veh (s)	1.5
Total Stops	895
Stop/Veh	0.22
Travel Dist (mi)	5724.5
Travel Time (hr)	219.9
Avg Speed (mph)	26
Fuel Used (gal)	178.3
Fuel Eff. (mpg)	32.1
HC Emissions (g)	2885
CO Emissions (g)	57517
NOx Emissions (g)	7954
Vehicles Entered	3895
Vehicles Exited	3831
Hourly Exit Rate	3831
Input Volume	39771
% of Volume	10
Denied Entry Before	1
Denied Entry After	1

Arterial Level of Service: SB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Conn to Transfer Sta	34	0.2	9.0	0.1	31
O-turn 1 W	14	1.2	39.2	0.3	29
Olowalu Access 1	15	0.5	12.8	0.1	30
O-turn 1E	11	0.9	17.0	0.1	29
O-turn 2W	10	1.0	26.5	0.2	29
Olowalu Access 2	3	0.6	18.5	0.2	30
Total		4.4	123.0	1.0	29

Intersection: 3: Olowalu Access 2 & HP Hwy

Movement	EB
Directions Served	R
Maximum Queue (ft)	217
Average Queue (ft)	53
95th Queue (ft)	148
Link Distance (ft)	300
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: HP Hwy & Mauka Access 2

Movement	WB
Directions Served	R
Maximum Queue (ft)	13
Average Queue (ft)	0
95th Queue (ft)	7
Link Distance (ft)	290
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: HP Hwy & O-turn 2E

Movement	EB	NB	NB	NB
Directions Served	L	T	T	T
Maximum Queue (ft)	87	18	9	9
Average Queue (ft)	49	1	0	0
95th Queue (ft)	74	9	6	7
Link Distance (ft)	46	1359	1359	1359
Upstream Blk Time (%)	7			
Queuing Penalty (veh)	14			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: HP Hwy & O-turn 2E

Movement	SB
Directions Served	L
Maximum Queue (ft)	68
Average Queue (ft)	8
95th Queue (ft)	39
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	800
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: O-turn 2W

Movement	NB	NB
Directions Served	LT	T
Maximum Queue (ft)	73	21
Average Queue (ft)	8	1
95th Queue (ft)	40	15
Link Distance (ft)	752	752
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 10: HP Hwy & O-turn 2W

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	72	4	4	7
Average Queue (ft)	38	0	0	0
95th Queue (ft)	70	3	3	6
Link Distance (ft)	58	1078	1078	1078
Upstream Blk Time (%)	2			
Queuing Penalty (veh)	4			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 11: HP Hwy & O-turn 1E

Movement	SB	SB
Directions Served	L	LT
Maximum Queue (ft)	44	78
Average Queue (ft)	8	17
95th Queue (ft)	32	57
Link Distance (ft)		687
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	800	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 12: O-turn 1E & HP Hwy

Movement	EB	NB	NB	NB
Directions Served	L	T	T	T
Maximum Queue (ft)	58	4	6	4
Average Queue (ft)	42	0	0	0
95th Queue (ft)	68	3	4	3
Link Distance (ft)	48	1084	1084	1084
Upstream Blk Time (%)	5			
Queuing Penalty (veh)	14			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 13: O-turn 1 W

Movement	NB	NB
Directions Served	LT	T
Maximum Queue (ft)	53	17
Average Queue (ft)	4	1
95th Queue (ft)	25	15
Link Distance (ft)	519	519
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 14: HP Hwy & O-turn 1 W

Movement	WB	SB
Directions Served	L	T
Maximum Queue (ft)	61	4
Average Queue (ft)	31	0
95th Queue (ft)	59	3
Link Distance (ft)	56	1614
Upstream Blk Time (%)	1	
Queuing Penalty (veh)	1	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 15: HP Hwy & Olowalu Access 1

Movement	EB
Directions Served	R
Maximum Queue (ft)	117
Average Queue (ft)	30
95th Queue (ft)	92
Link Distance (ft)	377
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 17: RIRO Access & HP Hwy

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 20: HP Hwy

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 24:

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 27: HP Hwy & Ehehene

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	36	19
Average Queue (ft)	8	1
95th Queue (ft)	32	11
Link Distance (ft)	228	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		250
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 28:

Movement	NB	B21
Directions Served	T	T
Maximum Queue (ft)	8	9
Average Queue (ft)	0	0
95th Queue (ft)	0	6
Link Distance (ft)	54	625
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 31: HP Hwy & Mauka Access1

Movement	WB
Directions Served	R
Maximum Queue (ft)	7
Average Queue (ft)	0
95th Queue (ft)	5
Link Distance (ft)	267
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 32: Conn to Transfer Sta/Transfer Station

Movement	EB	WB
Directions Served	T	TR
Maximum Queue (ft)	24	16
Average Queue (ft)	3	1
95th Queue (ft)	17	10
Link Distance (ft)	60	641
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 34: HP Hwy & Conn to Transfer Sta

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 33

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:57	4:57	4:57	4:57	4:57	4:57
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	63	63	63	63	63	63
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	5222	5163	5170	5268	5094	5185
Vehs Exited	4908	4891	4937	4932	4809	4894
Starting Vehs	179	200	228	214	206	203
Ending Vehs	493	472	461	550	491	492
Denied Entry Before	5	1	4	6	0	3
Denied Entry After	4	10	4	53	11	17
Travel Distance (mi)	7688	7609	7692	7737	7555	7656
Travel Time (hr)	402.0	396.1	374.1	437.8	414.2	404.8
Total Delay (hr)	135.5	131.7	107.6	169.1	151.9	139.2
Total Stops	5803	5605	4870	6673	6027	5795
Fuel Used (gal)	271.5	267.9	263.8	281.9	270.3	271.1

Interval #0 Information Seeding

Start Time	4:57
End Time	5:00
Total Time (min)	3

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	5:00
End Time	5:15
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	1302	1333	1255	1296	1228	1282
Vehs Exited	1128	1175	1150	1148	1097	1138
Starting Vehs	179	200	228	214	206	203
Ending Vehs	353	358	333	362	337	347
Denied Entry Before	5	1	4	6	0	3
Denied Entry After	0	4	18	9	2	7
Travel Distance (mi)	1872	1835	1878	1845	1781	1842
Travel Time (hr)	82.3	77.0	77.6	81.0	73.8	78.3
Total Delay (hr)	17.3	13.2	12.3	17.0	12.0	14.4
Total Stops	870	682	559	821	670	717
Fuel Used (gal)	62.3	60.0	60.3	61.6	57.5	60.3

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	1281	1268	1301	1312	1290	1288
Vehs Exited	1233	1223	1267	1249	1223	1241
Starting Vehs	353	358	333	362	337	347
Ending Vehs	401	403	367	425	404	399
Denied Entry Before	0	4	18	9	2	7
Denied Entry After	10	4	6	2	29	10
Travel Distance (mi)	1877	1927	1979	1943	1925	1930
Travel Time (hr)	91.1	94.3	91.6	102.2	98.3	95.5
Total Delay (hr)	25.8	27.4	22.9	34.6	31.7	28.5
Total Stops	1278	1313	1037	1755	1441	1366
Fuel Used (gal)	64.5	66.3	66.6	69.0	67.7	66.8

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1320	1298	1294	1313	1347	1315
Vehs Exited	1278	1250	1272	1256	1268	1262
Starting Vehs	401	403	367	425	404	399
Ending Vehs	443	451	389	482	483	447
Denied Entry Before	10	4	6	2	29	10
Denied Entry After	5	7	6	12	29	12
Travel Distance (mi)	1990	1948	1896	1935	1967	1947
Travel Time (hr)	110.2	107.2	94.8	116.1	116.7	109.0
Total Delay (hr)	41.3	39.3	29.2	48.9	48.4	41.4
Total Stops	1764	1666	1461	1925	1843	1733
Fuel Used (gal)	71.9	70.7	66.3	72.0	72.6	70.7

Interval #4 Information

Start Time	5:45
End Time	6:00
Total Time (min)	15

Run Number	1	2	3	4	5	Avg
Vehs Entered	1319	1264	1320	1347	1229	1294
Vehs Exited	1269	1243	1248	1279	1221	1252
Starting Vehs	443	451	389	482	483	447
Ending Vehs	493	472	461	550	491	492
Denied Entry Before	5	7	6	12	29	12
Denied Entry After	4	10	4	53	11	17
Travel Distance (mi)	1948	1899	1938	2014	1883	1936
Travel Time (hr)	118.4	117.6	110.3	138.4	125.4	122.0
Total Delay (hr)	51.1	51.8	43.2	68.6	59.8	54.9
Total Stops	1891	1944	1813	2172	2073	1976
Fuel Used (gal)	72.7	70.9	70.6	79.2	72.5	73.2

2: Bend Performance by approach

Approach	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	3.2	0.1	3.3
Total Del/Veh (s)	7.2	0.3	4.1
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0
Total Stops	0	0	0
Stop/Veh	0.00	0.00	0.00
Travel Dist (mi)	650.9	23.3	674.1
Travel Time (hr)	25.1	2.1	27.2
Avg Speed (mph)	26	11	25
Fuel Used (gal)	18.4	2.2	20.6
Fuel Eff. (mpg)	35.3	10.6	32.7
HC Emissions (g)	288	44	332
CO Emissions (g)	4154	1068	5221
NOx Emissions (g)	663	158	820
Vehicles Entered	1589	1306	2895
Vehicles Exited	1588	1306	2894
Hourly Exit Rate	1588	1306	2894
Input Volume	1581	1512	3093
% of Volume	100	86	94
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

3: Olowalu Access 2 & HP Hwy Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.7	0.0	0.0	0.8
Denied Del/Veh (s)	3.5	0.0	0.0	0.9
Total Delay (hr)	2.4	0.4	1.2	4.0
Total Del/Veh (s)	11.2	1.1	5.2	5.0
Stop Delay (hr)	1.5	0.0	0.0	1.5
Stop Del/Veh (s)	7.0	0.1	0.1	1.9
Total Stops	284	4	0	288
Stop/Veh	0.37	0.00	0.00	0.10
Travel Dist (mi)	38.5	190.3	122.2	351.0
Travel Time (hr)	4.8	6.9	5.8	17.5
Avg Speed (mph)	10	28	21	21
Fuel Used (gal)	1.6	6.2	3.2	11.1
Fuel Eff. (mpg)	23.6	30.8	37.6	31.7
HC Emissions (g)	11	89	30	130
CO Emissions (g)	325	2179	895	3399
NOx Emissions (g)	32	262	93	388
Vehicles Entered	763	1290	840	2893
Vehicles Exited	762	1286	839	2887
Hourly Exit Rate	762	1286	839	2887
Input Volume	765	1300	855	2920
% of Volume	100	99	98	99
Denied Entry Before	0	0	0	0
Denied Entry After	7	0	0	7

4: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.8	0.8
Total Del/Veh (s)	3.5	3.5
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	54.6	54.6
Travel Time (hr)	3.4	3.4
Avg Speed (mph)	16	16
Fuel Used (gal)	4.1	4.1
Fuel Eff. (mpg)	13.4	13.4
HC Emissions (g)	56	56
CO Emissions (g)	2397	2397
NOx Emissions (g)	200	200
Vehicles Entered	839	839
Vehicles Exited	839	839
Hourly Exit Rate	839	839
Input Volume	855	855
% of Volume	98	98
Denied Entry Before	0	0
Denied Entry After	0	0

5: External Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.2	0.2
Total Del/Veh (s)	0.6	0.6
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	126.1	126.1
Travel Time (hr)	4.5	4.5
Avg Speed (mph)	28	28
Fuel Used (gal)	4.1	4.1
Fuel Eff. (mpg)	30.7	30.7
HC Emissions (g)	45	45
CO Emissions (g)	1242	1242
NOx Emissions (g)	125	125
Vehicles Entered	1608	1608
Vehicles Exited	1606	1606
Hourly Exit Rate	1606	1606
Input Volume	1663	1663
% of Volume	97	97
Denied Entry Before	0	0
Denied Entry After	0	0

6: HP Hwy & Mauka Access 2 Performance by movement

Movement	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.1	0.0
Total Delay (hr)	0.0	0.5	0.0	0.5
Total Del/Veh (s)	0.8	0.8	0.7	0.8
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.1	0.1	0.1
Total Stops	0	4	0	4
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	3.2	208.0	5.8	217.0
Travel Time (hr)	0.2	7.7	0.3	8.1
Avg Speed (mph)	20	27	23	27
Fuel Used (gal)	0.1	7.5	0.2	7.7
Fuel Eff. (mpg)	55.7	27.8	33.8	28.1
HC Emissions (g)	0	99	2	101
CO Emissions (g)	11	2654	53	2717
NOx Emissions (g)	1	310	5	316
Vehicles Entered	61	2059	57	2177
Vehicles Exited	61	2057	57	2175
Hourly Exit Rate	61	2057	57	2175
Input Volume	60	2056	60	2176
% of Volume	102	100	95	100
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

7: HP Hwy & O-turn 2E Performance by movement

Movement	EBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.6	0.8	1.4
Total Del/Veh (s)	4.4	1.8	2.4
Stop Delay (hr)	0.5	0.0	0.5
Stop Del/Veh (s)	4.0	0.0	0.9
Total Stops	230	4	234
Stop/Veh	0.47	0.00	0.11
Travel Dist (mi)	7.7	417.9	425.6
Travel Time (hr)	1.1	14.9	15.9
Avg Speed (mph)	7	28	27
Fuel Used (gal)	0.5	12.3	12.8
Fuel Eff. (mpg)	15.3	34.0	33.2
HC Emissions (g)	4	200	204
CO Emissions (g)	101	3671	3772
NOx Emissions (g)	15	552	567
Vehicles Entered	485	1586	2071
Vehicles Exited	484	1581	2065
Hourly Exit Rate	484	1581	2065
Input Volume	487	1581	2068
% of Volume	99	100	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

8: HP Hwy & O-turn 2E Performance by movement

Movement	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	1.5	4.1	5.6
Total Del/Veh (s)	10.8	9.4	9.7
Stop Delay (hr)	0.9	3.0	3.9
Stop Del/Veh (s)	6.5	6.9	6.8
Total Stops	309	321	630
Stop/Veh	0.63	0.20	0.31
Travel Dist (mi)	49.7	157.9	207.6
Travel Time (hr)	3.5	9.9	13.4
Avg Speed (mph)	14	16	16
Fuel Used (gal)	2.0	7.5	9.5
Fuel Eff. (mpg)	24.4	21.1	21.8
HC Emissions (g)	18	106	124
CO Emissions (g)	649	3296	3944
NOx Emissions (g)	68	348	416
Vehicles Entered	487	1563	2050
Vehicles Exited	485	1548	2033
Hourly Exit Rate	485	1548	2033
Input Volume	487	1578	2065
% of Volume	100	98	98
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

9: O-turn 2W Performance by movement

Movement	NBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	4.4	1.1	5.5
Total Del/Veh (s)	36.5	2.4	9.3
Stop Delay (hr)	4.0	0.2	4.2
Stop Del/Veh (s)	33.0	0.5	7.1
Total Stops	325	83	408
Stop/Veh	0.75	0.05	0.19
Travel Dist (mi)	63.9	247.4	311.3
Travel Time (hr)	6.7	9.5	16.2
Avg Speed (mph)	10	26	19
Fuel Used (gal)	2.6	8.0	10.6
Fuel Eff. (mpg)	24.9	30.8	29.4
HC Emissions (g)	15	113	127
CO Emissions (g)	398	2544	2942
NOx Emissions (g)	45	337	382
Vehicles Entered	431	1691	2122
Vehicles Exited	423	1687	2110
Hourly Exit Rate	423	1687	2110
Input Volume	427	1691	2118
% of Volume	99	100	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

10: HP Hwy & O-turn 2W Performance by movement

Movement	WBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	1.2	0.8	2.1
Total Del/Veh (s)	10.4	1.8	3.5
Stop Delay (hr)	1.2	0.0	1.2
Stop Del/Veh (s)	9.9	0.0	2.0
Total Stops	278	6	284
Stop/Veh	0.66	0.00	0.13
Travel Dist (mi)	7.3	355.2	362.5
Travel Time (hr)	1.7	12.8	14.5
Avg Speed (mph)	4	28	25
Fuel Used (gal)	0.6	10.6	11.2
Fuel Eff. (mpg)	11.4	33.5	32.2
HC Emissions (g)	5	96	101
CO Emissions (g)	116	2083	2199
NOx Emissions (g)	17	289	306
Vehicles Entered	423	1673	2096
Vehicles Exited	421	1671	2092
Hourly Exit Rate	421	1671	2092
Input Volume	427	1691	2118
% of Volume	99	99	99
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

11: HP Hwy & O-turn 1E Performance by movement

Movement	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.5	1.6	2.1
Total Del/Veh (s)	5.9	3.3	3.7
Stop Delay (hr)	0.2	0.7	0.9
Stop Del/Veh (s)	2.3	1.5	1.6
Total Stops	64	177	241
Stop/Veh	0.21	0.10	0.12
Travel Dist (mi)	42.1	232.0	274.0
Travel Time (hr)	2.1	9.7	11.8
Avg Speed (mph)	20	24	23
Fuel Used (gal)	1.5	8.7	10.2
Fuel Eff. (mpg)	28.4	26.6	26.8
HC Emissions (g)	15	114	128
CO Emissions (g)	460	3121	3581
NOx Emissions (g)	52	367	419
Vehicles Entered	309	1718	2027
Vehicles Exited	309	1714	2023
Hourly Exit Rate	309	1714	2023
Input Volume	311	1736	2047
% of Volume	99	99	99
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

12: O-turn 1E & HP Hwy Performance by movement

Movement	EBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.2	0.7	0.9
Total Del/Veh (s)	2.2	1.5	1.6
Stop Delay (hr)	0.2	0.0	0.2
Stop Del/Veh (s)	1.8	0.0	0.3
Total Stops	96	2	98
Stop/Veh	0.31	0.00	0.05
Travel Dist (mi)	5.4	347.7	353.1
Travel Time (hr)	0.5	12.4	12.9
Avg Speed (mph)	10	28	27
Fuel Used (gal)	0.3	10.3	10.6
Fuel Eff. (mpg)	18.6	33.8	33.3
HC Emissions (g)	2	174	176
CO Emissions (g)	71	3194	3265
NOx Emissions (g)	10	478	488
Vehicles Entered	309	1632	1941
Vehicles Exited	308	1623	1931
Hourly Exit Rate	308	1623	1931
Input Volume	311	1641	1952
% of Volume	99	99	99
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

13: O-turn 1 W Performance by movement

Movement	NBL	NBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.7	0.8	1.5
Total Del/Veh (s)	9.2	1.8	2.8
Stop Delay (hr)	0.4	0.1	0.6
Stop Del/Veh (s)	6.2	0.3	1.1
Total Stops	92	67	159
Stop/Veh	0.35	0.04	0.08
Travel Dist (mi)	27.6	172.5	200.1
Travel Time (hr)	1.7	6.7	8.4
Avg Speed (mph)	16	26	24
Fuel Used (gal)	0.8	5.8	6.6
Fuel Eff. (mpg)	33.5	29.6	30.1
HC Emissions (g)	5	89	95
CO Emissions (g)	143	2107	2251
NOx Emissions (g)	19	270	290
Vehicles Entered	262	1666	1928
Vehicles Exited	259	1662	1921
Hourly Exit Rate	259	1662	1921
Input Volume	252	1709	1961
% of Volume	103	97	98
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

14: HP Hwy & O-turn 1 W Performance by movement

Movement	WBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.7	1.0	1.7
Total Del/Veh (s)	9.2	2.1	3.0
Stop Delay (hr)	0.6	0.0	0.6
Stop Del/Veh (s)	8.7	0.0	1.1
Total Stops	180	3	183
Stop/Veh	0.69	0.00	0.09
Travel Dist (mi)	4.5	555.1	559.6
Travel Time (hr)	0.9	19.7	20.7
Avg Speed (mph)	5	28	27
Fuel Used (gal)	0.3	16.3	16.7
Fuel Eff. (mpg)	13.2	34.0	33.5
HC Emissions (g)	2	143	145
CO Emissions (g)	54	2955	3009
NOx Emissions (g)	8	425	432
Vehicles Entered	259	1750	2009
Vehicles Exited	258	1754	2012
Hourly Exit Rate	258	1754	2012
Input Volume	252	1761	2013
% of Volume	102	100	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0

15: HP Hwy & Olowalu Access 1 Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.1	0.0	0.0	0.1
Denied Del/Veh (s)	0.5	0.0	0.0	0.1
Total Delay (hr)	0.9	0.3	0.5	1.7
Total Del/Veh (s)	6.7	0.8	3.3	2.5
Stop Delay (hr)	0.5	0.0	0.0	0.5
Stop Del/Veh (s)	3.3	0.0	0.1	0.7
Total Stops	180	1	0	181
Stop/Veh	0.36	0.00	0.00	0.07
Travel Dist (mi)	32.6	156.7	51.6	240.9
Travel Time (hr)	2.3	5.7	2.5	10.5
Avg Speed (mph)	15	27	21	23
Fuel Used (gal)	1.0	5.3	1.3	7.6
Fuel Eff. (mpg)	32.2	29.7	38.2	31.6
HC Emissions (g)	10	71	13	93
CO Emissions (g)	342	1836	473	2650
NOx Emissions (g)	31	215	38	283
Vehicles Entered	500	1528	526	2554
Vehicles Exited	500	1527	526	2553
Hourly Exit Rate	500	1527	526	2553
Input Volume	496	1551	507	2554
% of Volume	101	98	104	100
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

16: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.5	0.5
Total Del/Veh (s)	3.3	3.3
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	41.8	41.8
Travel Time (hr)	2.4	2.4
Avg Speed (mph)	18	18
Fuel Used (gal)	2.8	2.8
Fuel Eff. (mpg)	15.2	15.2
HC Emissions (g)	41	41
CO Emissions (g)	1602	1602
NOx Emissions (g)	139	139
Vehicles Entered	526	526
Vehicles Exited	524	524
Hourly Exit Rate	524	524
Input Volume	507	507
% of Volume	103	103
Denied Entry Before	0	0
Denied Entry After	0	0

17: RIRO Access & HP Hwy Performance by movement

Movement	EBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.5	0.0	0.5
Denied Del/Veh (s)	0.1	1.1	0.0	1.1
Total Delay (hr)	0.0	23.6	0.1	23.7
Total Del/Veh (s)	0.6	56.6	3.7	53.7
Stop Delay (hr)	0.0	22.3	0.0	22.3
Stop Del/Veh (s)	0.0	53.4	2.3	50.6
Total Stops	1	783	7	791
Stop/Veh	0.03	0.52	0.13	0.50
Travel Dist (mi)	1.5	192.6	7.3	201.4
Travel Time (hr)	0.1	30.6	0.3	31.0
Avg Speed (mph)	20	6	21	7
Fuel Used (gal)	0.0	11.1	0.2	11.3
Fuel Eff. (mpg)	62.7	17.4	34.0	17.8
HC Emissions (g)	0	116	3	119
CO Emissions (g)	5	2732	83	2820
NOx Emissions (g)	0	302	8	311
Vehicles Entered	32	1497	55	1584
Vehicles Exited	32	1426	54	1512
Hourly Exit Rate	32	1426	54	1512
Input Volume	37	1530	55	1622
% of Volume	86	93	98	93
Denied Entry Before	0	0	0	0
Denied Entry After	0	4	0	4

18: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	3.0	3.0
Travel Time (hr)	0.2	0.2
Avg Speed (mph)	20	20
Fuel Used (gal)	0.2	0.2
Fuel Eff. (mpg)	13.1	13.1
HC Emissions (g)	5	5
CO Emissions (g)	178	178
NOx Emissions (g)	15	15
Vehicles Entered	54	54
Vehicles Exited	54	54
Hourly Exit Rate	54	54
Input Volume	55	55
% of Volume	98	98
Denied Entry Before	0	0
Denied Entry After	0	0

19: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	29.8	29.8
Total Del/Veh (s)	76.4	76.4
Stop Delay (hr)	28.2	28.2
Stop Del/Veh (s)	72.3	72.3
Total Stops	1328	1328
Stop/Veh	0.95	0.95
Travel Dist (mi)	181.5	181.5
Travel Time (hr)	35.9	35.9
Avg Speed (mph)	5	5
Fuel Used (gal)	12.5	12.5
Fuel Eff. (mpg)	14.5	14.5
HC Emissions (g)	142	142
CO Emissions (g)	3317	3317
NOx Emissions (g)	373	373
Vehicles Entered	1398	1398
Vehicles Exited	1350	1350
Hourly Exit Rate	1350	1350
Input Volume	1509	1509
% of Volume	89	89
Denied Entry Before	0	0
Denied Entry After	0	0

20: HP Hwy Performance by movement

Movement	NBT	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.4	0.4
Total Del/Veh (s)	1.0	1.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	213.2	213.2
Travel Time (hr)	7.6	7.6
Avg Speed (mph)	28	28
Fuel Used (gal)	6.8	6.8
Fuel Eff. (mpg)	31.4	31.4
HC Emissions (g)	115	115
CO Emissions (g)	2430	2430
NOx Emissions (g)	321	321
Vehicles Entered	1587	1587
Vehicles Exited	1586	1586
Hourly Exit Rate	1586	1586
Input Volume	1581	1581
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

21: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	19.0	19.0
Total Del/Veh (s)	50.4	50.4
Stop Delay (hr)	12.1	12.1
Stop Del/Veh (s)	32.2	32.2
Total Stops	931	931
Stop/Veh	0.69	0.69
Travel Dist (mi)	172.1	172.1
Travel Time (hr)	24.7	24.7
Avg Speed (mph)	7	7
Fuel Used (gal)	9.9	9.9
Fuel Eff. (mpg)	17.4	17.4
HC Emissions (g)	122	122
CO Emissions (g)	2695	2695
NOx Emissions (g)	297	297
Vehicles Entered	1350	1350
Vehicles Exited	1325	1325
Hourly Exit Rate	1325	1325
Input Volume	1509	1509
% of Volume	88	88
Denied Entry Before	0	0
Denied Entry After	0	0

23: Bend Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	13.2	13.2
Total Del/Veh (s)	35.6	35.6
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	155.5	155.5
Travel Time (hr)	18.4	18.4
Avg Speed (mph)	8	8
Fuel Used (gal)	7.3	7.3
Fuel Eff. (mpg)	21.4	21.4
HC Emissions (g)	96	96
CO Emissions (g)	1799	1799
NOx Emissions (g)	179	179
Vehicles Entered	1325	1325
Vehicles Exited	1310	1310
Hourly Exit Rate	1310	1310
Input Volume	1509	1509
% of Volume	87	87
Denied Entry Before	0	0
Denied Entry After	0	0

24: Performance by movement

Movement	NBT	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.9	0.9
Total Del/Veh (s)	2.1	2.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	176.1	176.1
Travel Time (hr)	6.8	6.8
Avg Speed (mph)	26	26
Fuel Used (gal)	5.2	5.2
Fuel Eff. (mpg)	34.1	34.1
HC Emissions (g)	81	81
CO Emissions (g)	1315	1315
NOx Emissions (g)	190	190
Vehicles Entered	1587	1587
Vehicles Exited	1587	1587
Hourly Exit Rate	1587	1587
Input Volume	1581	1581
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

26: Bend Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.3	0.3
Total Del/Veh (s)	0.7	0.7
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	58.5	58.5
Travel Time (hr)	2.3	2.3
Avg Speed (mph)	26	26
Fuel Used (gal)	1.7	1.7
Fuel Eff. (mpg)	35.4	35.4
HC Emissions (g)	26	26
CO Emissions (g)	369	369
NOx Emissions (g)	58	58
Vehicles Entered	1588	1588
Vehicles Exited	1587	1587
Hourly Exit Rate	1587	1587
Input Volume	1581	1581
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0

27: HP Hwy & Ehehene Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	4.5	0.0	0.0	0.0	4.5
Denied Del/Veh (s)	0.1	0.1	10.1	16.1	0.0	0.0	5.6
Total Delay (hr)	1.4	0.3	2.4	0.0	0.1	2.0	6.1
Total Del/Veh (s)	729.1	324.0	5.3	6.1	118.3	5.5	7.6
Stop Delay (hr)	1.4	0.3	0.0	0.0	0.1	0.0	1.8
Stop Del/Veh (s)	727.0	323.7	0.0	0.0	110.9	0.0	2.2
Total Stops	7	3	0	0	3	0	13
Stop/Veh	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Travel Dist (mi)	0.3	0.1	312.4	0.3	1.3	531.2	845.6
Travel Time (hr)	1.4	0.3	17.3	0.0	0.1	20.0	39.2
Avg Speed (mph)	0	0	24	23	9	27	24
Fuel Used (gal)	0.3	0.1	11.5	0.0	0.1	16.7	28.7
Fuel Eff. (mpg)	0.8	1.9	27.1	27.0	21.8	31.8	29.4
HC Emissions (g)	0	0	165	0	0	323	489
CO Emissions (g)	18	4	2713	1	7	5704	8447
NOx Emissions (g)	0	0	476	0	1	873	1350
Vehicles Entered	7	3	1586	1	3	1303	2903
Vehicles Exited	3	3	1587	1	3	1293	2890
Hourly Exit Rate	3	3	1587	1	3	1293	2890
Input Volume	7	3	1578	2	3	1510	3103
% of Volume	43	100	101	50	100	86	93
Denied Entry Before	0	0	3	0	0	0	3
Denied Entry After	0	0	3	0	0	0	3

28: Performance by movement

Movement	NBT	SER	All
Denied Delay (hr)	0.0	1.4	1.4
Denied Del/Veh (s)	0.0	3.9	1.8
Total Delay (hr)	0.2	2.7	2.9
Total Del/Veh (s)	0.4	7.5	3.6
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0
Total Stops	0	0	0
Stop/Veh	0.00	0.00	0.00
Travel Dist (mi)	33.3	44.3	77.6
Travel Time (hr)	1.3	6.6	7.9
Avg Speed (mph)	26	9	12
Fuel Used (gal)	0.9	2.5	3.4
Fuel Eff. (mpg)	35.4	17.9	22.8
HC Emissions (g)	15	39	53
CO Emissions (g)	210	681	891
NOx Emissions (g)	33	75	108
Vehicles Entered	1588	1310	2898
Vehicles Exited	1588	1306	2894
Hourly Exit Rate	1588	1306	2894
Input Volume	1581	1512	3093
% of Volume	100	86	94
Denied Entry Before	0	0	0
Denied Entry After	0	3	3

29: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.7	0.7
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.5	0.5
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.2	0.2
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	19	19
Fuel Used (gal)	0.0	0.0
Fuel Eff. (mpg)	12.3	12.3
HC Emissions (g)	0	0
CO Emissions (g)	10	10
NOx Emissions (g)	1	1
Vehicles Entered	4	4
Vehicles Exited	4	4
Hourly Exit Rate	4	4
Input Volume	5	5
% of Volume	80	80
Denied Entry Before	0	0
Denied Entry After	0	0

30: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	3.6	3.6
Travel Time (hr)	0.2	0.2
Avg Speed (mph)	20	20
Fuel Used (gal)	0.3	0.3
Fuel Eff. (mpg)	13.9	13.9
HC Emissions (g)	4	4
CO Emissions (g)	176	176
NOx Emissions (g)	14	14
Vehicles Entered	57	57
Vehicles Exited	57	57
Hourly Exit Rate	57	57
Input Volume	60	60
% of Volume	95	95
Denied Entry Before	0	0
Denied Entry After	0	0

31: HP Hwy & Mauka Access1 Performance by movement

Movement	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.5	0.0	0.6
Total Del/Veh (s)	0.6	1.0	0.3	1.0
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.1	0.0
Total Stops	0	3	0	3
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	2.8	251.7	8.8	263.2
Travel Time (hr)	0.1	9.1	0.4	9.6
Avg Speed (mph)	20	28	25	27
Fuel Used (gal)	0.0	8.2	0.2	8.5
Fuel Eff. (mpg)	58.7	30.7	35.8	31.0
HC Emissions (g)	0	103	2	106
CO Emissions (g)	10	2441	70	2520
NOx Emissions (g)	1	310	6	316
Vehicles Entered	57	1874	64	1995
Vehicles Exited	57	1865	64	1986
Hourly Exit Rate	57	1865	64	1986
Input Volume	60	1901	60	2021
% of Volume	95	98	107	98
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

32: Conn to Transfer Sta/Transfer Station Performance by movement

Movement	EBT	WBT	WBR	NBT	NBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.1	0.1	0.0	0.0	0.0
Total Delay (hr)	0.0	0.0	0.0	1.5	0.0	1.6
Total Del/Veh (s)	10.1	17.9	11.1	3.3	2.3	3.3
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	9.1	14.1	11.4	0.0	0.0	0.1
Total Stops	7	1	8	2	0	18
Stop/Veh	1.00	1.00	1.00	0.00	0.00	0.01
Travel Dist (mi)	0.1	0.1	0.9	507.2	0.7	509.1
Travel Time (hr)	0.0	0.0	0.1	18.6	0.0	18.7
Avg Speed (mph)	5	14	15	27	27	27
Fuel Used (gal)	0.0	0.0	0.0	16.0	0.0	16.0
Fuel Eff. (mpg)	17.7	27.9	34.0	31.8	34.8	31.8
HC Emissions (g)	0	0	0	229	0	230
CO Emissions (g)	1	1	2	4679	4	4687
NOx Emissions (g)	0	0	0	683	0	684
Vehicles Entered	7	1	8	1664	2	1682
Vehicles Exited	6	1	8	1648	2	1665
Hourly Exit Rate	6	1	8	1648	2	1665
Input Volume	9	2	6	1707	2	1726
% of Volume	67	50	133	97	100	96
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0

33: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	2.0	2.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.5	0.5
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	1.1	1.1
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	25	25
Fuel Used (gal)	0.1	0.1
Fuel Eff. (mpg)	21.1	21.1
HC Emissions (g)	0	0
CO Emissions (g)	22	22
NOx Emissions (g)	2	2
Vehicles Entered	9	9
Vehicles Exited	8	8
Hourly Exit Rate	8	8
Input Volume	11	11
% of Volume	73	73
Denied Entry Before	0	0
Denied Entry After	0	0

34: HP Hwy & Conn to Transfer Sta Performance by movement

Movement	WBT	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.2	0.2
Denied Del/Veh (s)	0.0	2.0	0.5	0.5
Total Delay (hr)	0.0	0.0	0.3	0.3
Total Del/Veh (s)	2.5	0.2	0.7	0.7
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.7	0.0	0.0	0.0
Total Stops	0	0	1	1
Stop/Veh	0.00	0.00	0.00	0.00
Travel Dist (mi)	0.0	0.5	123.6	124.1
Travel Time (hr)	0.0	0.0	4.7	4.8
Avg Speed (mph)	14	25	27	27
Fuel Used (gal)	0.0	0.0	4.2	4.2
Fuel Eff. (mpg)	7.4	30.6	29.2	29.2
HC Emissions (g)	0	0	40	40
CO Emissions (g)	1	6	1156	1163
NOx Emissions (g)	0	0	129	130
Vehicles Entered	1	7	1750	1758
Vehicles Exited	1	7	1749	1757
Hourly Exit Rate	1	7	1749	1757
Input Volume	2	9	1759	1770
% of Volume	50	78	99	99
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

35: External Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	1.0	1.0
Total Del/Veh (s)	2.9	2.9
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	267.2	267.2
Travel Time (hr)	10.0	10.0
Avg Speed (mph)	27	27
Fuel Used (gal)	8.4	8.4
Fuel Eff. (mpg)	31.8	31.8
HC Emissions (g)	156	156
CO Emissions (g)	3122	3122
NOx Emissions (g)	395	395
Vehicles Entered	1295	1295
Vehicles Exited	1286	1286
Hourly Exit Rate	1286	1286
Input Volume	1516	1516
% of Volume	85	85
Denied Entry Before	0	0
Denied Entry After	0	0

36: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	3.7	3.7
Travel Time (hr)	0.2	0.2
Avg Speed (mph)	20	20
Fuel Used (gal)	0.3	0.3
Fuel Eff. (mpg)	13.3	13.3
HC Emissions (g)	4	4
CO Emissions (g)	176	176
NOx Emissions (g)	13	13
Vehicles Entered	64	64
Vehicles Exited	64	64
Hourly Exit Rate	64	64
Input Volume	60	60
% of Volume	107	107
Denied Entry Before	0	0
Denied Entry After	0	0

Total Network Performance

Denied Delay (hr)	7.5
Denied Del/Veh (s)	5.2
Total Delay (hr)	131.7
Total Del/Veh (s)	88.0
Stop Delay (hr)	78.7
Stop Del/Veh (s)	52.6
Total Stops	5795
Stop/Veh	1.08
Travel Dist (mi)	7656.1
Travel Time (hr)	404.8
Avg Speed (mph)	19
Fuel Used (gal)	271.1
Fuel Eff. (mpg)	28.2
HC Emissions (g)	3688
CO Emissions (g)	80329
NOx Emissions (g)	10327
Vehicles Entered	5185
Vehicles Exited	4894
Hourly Exit Rate	4894
Input Volume	54422
% of Volume	9
Denied Entry Before	3
Denied Entry After	17

Arterial Level of Service: SB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Conn to Transfer Sta	34	0.7	9.7	0.1	29
O-turn 1 W	14	2.1	40.1	0.3	28
Olowalu Access 1	15	0.8	13.1	0.1	29
O-turn 1E	11	1.3	17.5	0.1	28
O-turn 2W	10	1.8	27.4	0.2	28
Olowalu Access 2	3	1.1	18.9	0.2	29
Total		7.7	126.7	1.0	29

Intersection: 3: Olowalu Access 2 & HP Hwy

Movement	EB	SB	SB	SB
Directions Served	R	T	T	T
Maximum Queue (ft)	333	6	20	27
Average Queue (ft)	169	0	2	2
95th Queue (ft)	332	5	23	28
Link Distance (ft)	300	757	757	757
Upstream Blk Time (%)	8			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: HP Hwy & Mauka Access 2

Movement	WB
Directions Served	R
Maximum Queue (ft)	15
Average Queue (ft)	1
95th Queue (ft)	8
Link Distance (ft)	290
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: HP Hwy & O-turn 2E

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	84	40	15
Average Queue (ft)	58	3	1
95th Queue (ft)	79	17	7
Link Distance (ft)	46	1359	1359
Upstream Blk Time (%)	23		
Queuing Penalty (veh)	111		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 8: HP Hwy & O-turn 2E

Movement	SB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	256	229	346	208
Average Queue (ft)	86	39	44	34
95th Queue (ft)	217	211	235	208
Link Distance (ft)		502	502	502
Upstream Blk Time (%)		0	0	2
Queuing Penalty (veh)		0	3	10
Storage Bay Dist (ft)	800			
Storage Blk Time (%)		0		
Queuing Penalty (veh)		0		

Intersection: 9: O-turn 2W

Movement	NB	NB	NB
Directions Served	LT	T	T
Maximum Queue (ft)	502	440	195
Average Queue (ft)	194	91	10
95th Queue (ft)	426	326	124
Link Distance (ft)	752	752	752
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 10: HP Hwy & O-turn 2W

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	78	27	24	35
Average Queue (ft)	70	1	1	1
95th Queue (ft)	82	14	10	12
Link Distance (ft)	58	1078	1078	1078
Upstream Blk Time (%)	42			
Queuing Penalty (veh)	179			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 11: HP Hwy & O-turn 1E

Movement	SB	SB	SB
Directions Served	L	LT	T
Maximum Queue (ft)	59	101	9
Average Queue (ft)	14	17	0
95th Queue (ft)	45	63	7
Link Distance (ft)		687	687
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	800		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 12: O-turn 1E & HP Hwy

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	64	6	33
Average Queue (ft)	42	0	1
95th Queue (ft)	69	4	14
Link Distance (ft)	48	1084	1084
Upstream Blk Time (%)	5		
Queuing Penalty (veh)	15		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 13: O-turn 1 W

Movement	NB	NB	NB
Directions Served	LT	T	T
Maximum Queue (ft)	235	154	28
Average Queue (ft)	60	14	1
95th Queue (ft)	165	81	21
Link Distance (ft)	519	519	519
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 14: HP Hwy & O-turn 1 W

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	75	32	4	9
Average Queue (ft)	55	1	0	0
95th Queue (ft)	78	13	3	7
Link Distance (ft)	56	1614	1614	1614
Upstream Blk Time (%)	20			
Queuing Penalty (veh)	51			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 15: HP Hwy & Olowalu Access 1

Movement	EB
Directions Served	R
Maximum Queue (ft)	240
Average Queue (ft)	93
95th Queue (ft)	199
Link Distance (ft)	377
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 17: RIRO Access & HP Hwy

Movement	EB	SB	SB	SB	SB
Directions Served	R	T	T	T	R
Maximum Queue (ft)	16	711	716	702	525
Average Queue (ft)	1	279	272	232	69
95th Queue (ft)	8	761	751	690	358
Link Distance (ft)	256	674	674	674	
Upstream Blk Time (%)		11	8	3	
Queuing Penalty (veh)		55	41	17	
Storage Bay Dist (ft)					500
Storage Blk Time (%)				14	0
Queuing Penalty (veh)				8	0

Intersection: 20: HP Hwy

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 24:

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 27: HP Hwy & Ehehene

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	121	40
Average Queue (ft)	35	4
95th Queue (ft)	115	21
Link Distance (ft)	228	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		250
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 28:

Movement	B21	B21	B19	B19	B19
Directions Served	T		T	T	
Maximum Queue (ft)	740	733	709	715	718
Average Queue (ft)	578	532	469	455	333
95th Queue (ft)	1034	1013	934	930	873
Link Distance (ft)	625	625	655	655	655
Upstream Blk Time (%)	76	28	33	27	16
Queuing Penalty (veh)	577	211	167	138	81
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 31: HP Hwy & Mauka Access1

Movement	WB	NB	NB
Directions Served	R	T	T
Maximum Queue (ft)	6	10	9
Average Queue (ft)	0	0	0
95th Queue (ft)	5	7	6
Link Distance (ft)	267	677	677
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 32: Conn to Transfer Sta/Transfer Station

Movement	EB	WB
Directions Served	T	TR
Maximum Queue (ft)	30	25
Average Queue (ft)	6	5
95th Queue (ft)	27	21
Link Distance (ft)	60	641
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 34: HP Hwy & Conn to Transfer Sta

Movement	SB
Directions Served	T
Maximum Queue (ft)	11
Average Queue (ft)	0
95th Queue (ft)	8
Link Distance (ft)	371
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 1665

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	63	63	63	63	63	63
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	3543	3514	3591	3485	3579	3542
Vehs Exited	3500	3518	3601	3428	3539	3519
Starting Vehs	147	144	179	165	139	153
Ending Vehs	190	140	169	222	179	180
Denied Entry Before	1	1	1	0	0	0
Denied Entry After	1	2	0	0	2	0
Travel Distance (mi)	5494	5421	5571	5402	5589	5496
Travel Time (hr)	179.5	175.1	183.0	177.0	181.4	179.2
Total Delay (hr)	48.0	45.5	49.4	47.3	48.0	47.6
Total Stops	3204	3117	3321	3150	3195	3197
Fuel Used (gal)	174.3	171.6	176.2	171.4	176.6	174.0

Interval #0 Information Seeding

Start Time	6:57
End Time	7:00
Total Time (min)	3

Volumes adjusted by PHF, Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	7:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	859	879	889	812	823	847
Vehs Exited	835	844	895	804	800	835
Starting Vehs	147	144	179	165	139	153
Ending Vehs	171	179	173	173	162	172
Denied Entry Before	1	1	1	0	0	0
Denied Entry After	0	1	2	0	2	1
Travel Distance (mi)	1336	1364	1373	1285	1263	1324
Travel Time (hr)	42.6	44.4	45.2	41.5	39.1	42.6
Total Delay (hr)	10.7	11.9	12.2	10.6	9.1	10.9
Total Stops	716	798	830	708	637	732
Fuel Used (gal)	41.8	44.0	43.5	40.4	38.8	41.7

Interval #2 Information

Start Time	7:15
End Time	7:30
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	868	833	854	830	903	855
Vehs Exited	849	823	841	835	879	844
Starting Vehs	171	179	173	173	162	172
Ending Vehs	190	189	186	168	186	183
Denied Entry Before	0	1	2	0	2	1
Denied Entry After	2	3	1	1	1	1
Travel Distance (mi)	1345	1297	1338	1292	1401	1335
Travel Time (hr)	43.2	40.4	43.7	41.2	45.5	42.8
Total Delay (hr)	11.1	9.5	11.5	10.3	12.1	10.9
Total Stops	727	667	824	702	802	743
Fuel Used (gal)	42.3	40.3	42.2	40.5	44.2	41.9

Interval #3 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	954	936	958	945	972	953
Vehs Exited	939	970	966	917	935	945
Starting Vehs	190	189	186	168	186	183
Ending Vehs	205	155	178	196	223	188
Denied Entry Before	2	3	1	1	1	1
Denied Entry After	3	1	1	2	2	1
Travel Distance (mi)	1456	1475	1490	1438	1486	1469
Travel Time (hr)	49.1	48.7	49.8	47.8	49.0	48.9
Total Delay (hr)	14.2	13.3	14.2	13.3	13.4	13.7
Total Stops	913	897	924	854	858	892
Fuel Used (gal)	47.1	47.1	47.8	46.1	47.7	47.1

Interval #4 Information

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	862	866	890	898	881	881
Vehs Exited	877	881	899	872	925	891
Starting Vehs	205	155	178	196	223	188
Ending Vehs	190	140	169	222	179	180
Denied Entry Before	3	1	1	2	2	1
Denied Entry After	1	2	0	0	2	0
Travel Distance (mi)	1357	1285	1371	1388	1438	1368
Travel Time (hr)	44.7	41.6	44.4	46.4	47.7	45.0
Total Delay (hr)	12.1	10.7	11.6	13.1	13.4	12.2
Total Stops	848	755	743	886	898	826
Fuel Used (gal)	43.1	40.2	42.8	44.4	45.9	43.3

1: HP Hwy & RIRO Access 3 Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Delay (hr)	0.1	0.3	1.6	0.0	2.1
Total Del/Veh (s)	8.4	0.9	5.5	5.1	3.1
Stop Delay (hr)	0.1	0.0	0.3	0.0	0.4
Stop Del/Veh (s)	8.1	0.0	1.2	1.0	0.6
Total Stops	34	0	70	2	106
Stop/Veh	1.00	0.00	0.07	0.07	0.04
Travel Dist (mi)	6.9	245.8	254.7	6.6	514.1
Travel Time (hr)	0.3	5.8	7.6	0.2	14.0
Avg Speed (mph)	21	42	33	30	37
Fuel Used (gal)	0.2	6.8	10.9	0.2	18.2
Fuel Eff. (mpg)	34.9	36.1	23.4	26.8	28.3
HC Emissions (g)	2	173	236	2	413
CO Emissions (g)	38	4092	8322	133	12585
NOx Emissions (g)	5	612	799	9	1425
Vehicles Entered	34	1263	1052	27	2376
Vehicles Exited	34	1263	1054	28	2379
Hourly Exit Rate	34	1263	1054	28	2379
Input Volume	33	1277	1039	26	2374
% of Volume	104	99	101	110	100
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0
Density (ft/veh)					412
Occupancy (veh)	0	6	8	0	14

2: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.1	0.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	5.9	5.9
Travel Time (hr)	0.2	0.2
Avg Speed (mph)	27	27
Fuel Used (gal)	0.2	0.2
Fuel Eff. (mpg)	25.3	25.3
HC Emissions (g)	2	2
CO Emissions (g)	74	74
NOx Emissions (g)	6	6
Vehicles Entered	28	28
Vehicles Exited	28	28
Hourly Exit Rate	28	28
Input Volume	26	26
% of Volume	110	110
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

3: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.1	0.1
Total Del/Veh (s)	1.0	1.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.3	0.3
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	87.0	87.0
Travel Time (hr)	3.4	3.4
Avg Speed (mph)	26	26
Fuel Used (gal)	3.6	3.6
Fuel Eff. (mpg)	24.1	24.1
HC Emissions (g)	27	27
CO Emissions (g)	1153	1153
NOx Emissions (g)	102	102
Vehicles Entered	415	415
Vehicles Exited	413	413
Hourly Exit Rate	413	413
Input Volume	409	409
% of Volume	101	101
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	3	3

4: HP Hwy Performance by movement

Movement	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.4	2.5	2.9
Total Del/Veh (s)	1.2	8.3	4.5
Stop Delay (hr)	0.0	0.7	0.7
Stop Del/Veh (s)	0.0	2.4	1.1
Total Stops	0	280	280
Stop/Veh	0.00	0.26	0.12
Travel Dist (mi)	156.7	216.4	373.1
Travel Time (hr)	3.9	7.4	11.4
Avg Speed (mph)	40	29	33
Fuel Used (gal)	4.1	5.4	9.5
Fuel Eff. (mpg)	38.4	39.8	39.2
HC Emissions (g)	96	109	206
CO Emissions (g)	1963	2748	4711
NOx Emissions (g)	344	354	698
Vehicles Entered	1264	1089	2353
Vehicles Exited	1263	1088	2351
Hourly Exit Rate	1263	1088	2351
Input Volume	1278	1072	2350
% of Volume	99	101	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0
Density (ft/veh)			241
Occupancy (veh)	4	7	11

5: HP Hwy & Olowalu Town Access 2/Mauka Access 2 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	2.9	0.6	0.3	2.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	4.9	0.2	0.2	0.3	0.3	0.0	2.1	4.3	0.0	0.2	4.4	0.7
Total Del/Veh (s)	47.4	27.2	2.5	48.2	51.2	0.7	45.4	14.2	4.1	36.9	18.9	10.3
Stop Delay (hr)	4.5	0.2	0.0	0.3	0.3	0.0	1.9	2.3	0.0	0.2	2.2	0.2
Stop Del/Veh (s)	43.2	24.2	0.7	47.1	49.7	0.0	41.1	7.7	1.3	29.4	9.4	3.3
Total Stops	347	16	24	21	20	0	148	407	7	18	323	95
Stop/Veh	0.93	0.67	0.11	0.91	0.95	0.00	0.89	0.37	0.33	0.95	0.39	0.41
Travel Dist (mi)	73.0	4.6	42.1	4.4	4.1	3.9	39.3	259.8	4.9	6.8	305.1	85.6
Travel Time (hr)	7.8	0.3	1.7	0.5	0.5	0.2	3.2	10.2	0.2	0.4	11.4	2.9
Avg Speed (mph)	10	14	25	8	8	19	12	26	30	19	27	29
Fuel Used (gal)	3.3	0.2	1.1	0.2	0.2	0.1	1.3	6.7	0.1	0.3	11.7	3.0
Fuel Eff. (mpg)	22.2	27.6	37.4	20.9	20.5	32.5	29.6	39.0	47.5	26.0	26.1	28.1
HC Emissions (g)	23	1	9	0	0	0	9	154	0	2	279	22
CO Emissions (g)	687	31	256	17	16	10	315	3247	18	107	8600	1476
NOx Emissions (g)	69	2	27	2	1	1	34	494	3	8	893	107
Vehicles Entered	365	23	217	23	21	20	165	1086	21	18	815	229
Vehicles Exited	365	23	217	22	21	20	165	1081	21	18	818	229
Hourly Exit Rate	365	23	217	22	21	20	165	1081	21	18	818	229
Input Volume	363	20	214	20	20	20	166	1098	20	20	805	223
% of Volume	101	112	101	107	102	98	100	98	102	88	102	103
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0
Density (ft/veh)												
Occupancy (veh)	8	0	2	1	1	0	3	10	0	0	11	3

5: HP Hwy & Olowalu Town Access 2/Mauka Access 2 Performance by movement

Movement	All
Denied Delay (hr)	0.3
Denied Del/Veh (s)	0.4
Total Delay (hr)	17.5
Total Del/Veh (s)	20.7
Stop Delay (hr)	12.0
Stop Del/Veh (s)	14.2
Total Stops	1426
Stop/Veh	0.47
Travel Dist (mi)	833.5
Travel Time (hr)	39.2
Avg Speed (mph)	21
Fuel Used (gal)	28.2
Fuel Eff. (mpg)	29.6
HC Emissions (g)	499
CO Emissions (g)	14779
NOx Emissions (g)	1641
Vehicles Entered	3003
Vehicles Exited	3000
Hourly Exit Rate	3000
Input Volume	2992
% of Volume	100
Denied Entry Before	0
Denied Entry After	0
Density (ft/veh)	546
Occupancy (veh)	39

6: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.9	0.9
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.4	0.4
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	13.3	13.3
Travel Time (hr)	0.7	0.7
Avg Speed (mph)	19	19
Fuel Used (gal)	0.5	0.5
Fuel Eff. (mpg)	27.1	27.1
HC Emissions (g)	1	1
CO Emissions (g)	63	63
NOx Emissions (g)	7	7
Vehicles Entered	62	62
Vehicles Exited	62	62
Hourly Exit Rate	62	62
Input Volume	62	62
% of Volume	101	101
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	1	1

7: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.1	0.1
Total Del/Veh (s)	0.9	0.9
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.4	0.4
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	46.8	46.8
Travel Time (hr)	1.8	1.8
Avg Speed (mph)	26	26
Fuel Used (gal)	1.9	1.9
Fuel Eff. (mpg)	24.1	24.1
HC Emissions (g)	26	26
CO Emissions (g)	830	830
NOx Emissions (g)	82	82
Vehicles Entered	232	232
Vehicles Exited	232	232
Hourly Exit Rate	232	232
Input Volume	243	243
% of Volume	95	95
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	2	2

9: Bend Performance by approach

Approach	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	1.0	1.3	2.3
Total Del/Veh (s)	2.9	4.3	3.5
Stop Delay (hr)	0.0	0.1	0.1
Stop Del/Veh (s)	0.0	0.4	0.2
Total Stops	0	55	55
Stop/Veh	0.00	0.05	0.02
Travel Dist (mi)	422.2	130.4	552.6
Travel Time (hr)	10.5	4.2	14.7
Avg Speed (mph)	40	31	38
Fuel Used (gal)	10.3	7.4	17.8
Fuel Eff. (mpg)	40.9	17.6	31.1
HC Emissions (g)	240	180	419
CO Emissions (g)	4197	6082	10279
NOx Emissions (g)	882	600	1481
Vehicles Entered	1262	1088	2350
Vehicles Exited	1263	1083	2346
Hourly Exit Rate	1263	1083	2346
Input Volume	1277	1072	2349
% of Volume	99	101	100
Denied Entry Before	0	0	0
Denied Entry After	0	0	0
Density (ft/veh)	167	151	162
Occupancy (veh)	11	4	15

18: HP Hwy & Olowalu Town Access 1/Mauka Access 1 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	3.2	0.5	0.3	4.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	2.7	0.2	0.1	0.3	0.2	0.0	1.3	6.8	0.1	0.1	4.1	0.1
Total Del/Veh (s)	41.2	26.6	1.8	50.6	44.2	1.1	55.3	17.7	11.8	23.9	16.2	3.7
Stop Delay (hr)	2.5	0.1	0.0	0.3	0.2	0.0	1.1	2.5	0.0	0.1	2.4	0.1
Stop Del/Veh (s)	38.0	23.7	0.3	48.5	40.7	0.0	47.9	6.5	1.2	19.8	9.6	1.6
Total Stops	205	15	12	22	17	0	77	495	2	19	377	54
Stop/Veh	0.87	0.68	0.08	1.00	0.94	0.00	0.94	0.36	0.09	0.95	0.42	0.40
Travel Dist (mi)	43.9	4.1	28.5	3.1	2.4	2.4	30.4	505.7	8.4	8.5	373.2	56.1
Travel Time (hr)	4.5	0.3	1.1	0.4	0.3	0.1	2.1	18.7	0.3	0.3	12.4	1.6
Avg Speed (mph)	10	14	25	7	8	26	15	27	28	25	30	36
Fuel Used (gal)	1.9	0.2	0.8	0.2	0.1	0.1	1.3	18.6	0.3	0.2	9.6	1.4
Fuel Eff. (mpg)	23.5	27.5	37.6	19.4	21.1	41.5	23.9	27.2	31.7	39.7	38.8	41.1
HC Emissions (g)	13	1	6	0	0	0	14	411	2	1	216	20
CO Emissions (g)	350	24	168	20	17	5	612	12692	108	31	4568	608
NOx Emissions (g)	36	2	18	2	1	1	51	1324	9	6	753	79
Vehicles Entered	230	22	154	22	17	18	80	1363	23	20	894	134
Vehicles Exited	232	21	153	22	17	18	81	1369	22	20	891	134
Hourly Exit Rate	232	21	153	22	17	18	81	1369	22	20	891	134
Input Volume	232	20	154	20	20	20	89	1372	20	20	876	134
% of Volume	100	102	99	107	83	88	91	100	107	98	102	100
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0
Density (ft/veh)												
Occupancy (veh)	4	0	1	0	0	0	2	19	0	0	12	2

18: HP Hwy & Olowalu Town Access 1/Mauka Access 1 Performance by movement

Movement	All
Denied Delay (hr)	0.2
Denied Del/Veh (s)	0.3
Total Delay (hr)	15.9
Total Del/Veh (s)	19.0
Stop Delay (hr)	9.3
Stop Del/Veh (s)	11.1
Total Stops	1295
Stop/Veh	0.43
Travel Dist (mi)	1066.8
Travel Time (hr)	42.1
Avg Speed (mph)	25
Fuel Used (gal)	34.4
Fuel Eff. (mpg)	31.0
HC Emissions (g)	685
CO Emissions (g)	19203
NOx Emissions (g)	2283
Vehicles Entered	2977
Vehicles Exited	2980
Hourly Exit Rate	2980
Input Volume	2980
% of Volume	100
Denied Entry Before	0
Denied Entry After	0
Density (ft/veh)	588
Occupancy (veh)	42

20: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	2.3	2.3
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.5	0.5
Total Stops	3	3
Stop/Veh	0.05	0.05
Travel Dist (mi)	9.8	9.8
Travel Time (hr)	0.4	0.4
Avg Speed (mph)	24	24
Fuel Used (gal)	0.4	0.4
Fuel Eff. (mpg)	22.5	22.5
HC Emissions (g)	3	3
CO Emissions (g)	158	158
NOx Emissions (g)	12	12
Vehicles Entered	64	64
Vehicles Exited	64	64
Hourly Exit Rate	64	64
Input Volume	62	62
% of Volume	104	104
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

25: External Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.6	0.6
Total Del/Veh (s)	2.1	2.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	249.0	249.0
Travel Time (hr)	6.2	6.2
Avg Speed (mph)	40	40
Fuel Used (gal)	6.8	6.8
Fuel Eff. (mpg)	36.7	36.7
HC Emissions (g)	152	152
CO Emissions (g)	3671	3671
NOx Emissions (g)	540	540
Vehicles Entered	1079	1079
Vehicles Exited	1077	1077
Hourly Exit Rate	1077	1077
Input Volume	1074	1074
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	6	6

28: HP Hwy & Ehehene St Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.6	0.0	0.0	0.0	0.6
Denied Del/Veh (s)	0.1	4.5	1.8	2.4	0.0	0.0	1.0
Total Delay (hr)	0.1	0.0	0.7	0.0	0.0	0.8	1.6
Total Del/Veh (s)	58.0	20.8	2.1	0.3	18.7	2.7	2.5
Stop Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Stop Del/Veh (s)	56.3	21.0	0.0	0.0	15.1	0.0	0.2
Total Stops	4	6	0	0	1	0	11
Stop/Veh	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Travel Dist (mi)	0.3	0.5	274.6	0.7	0.5	358.0	634.5
Travel Time (hr)	0.1	0.1	7.5	0.0	0.0	8.8	16.5
Avg Speed (mph)	4	9	40	37	28	41	40
Fuel Used (gal)	0.0	0.0	7.4	0.0	0.0	8.7	16.2
Fuel Eff. (mpg)	14.3	24.3	37.2	43.3	44.5	41.0	39.2
HC Emissions (g)	0	0	168	0	0	205	374
CO Emissions (g)	2	2	3397	4	1	3718	7124
NOx Emissions (g)	0	0	602	0	0	749	1353
Vehicles Entered	4	6	1254	3	1	1082	2350
Vehicles Exited	4	6	1256	3	1	1076	2346
Hourly Exit Rate	4	6	1256	3	1	1076	2346
Input Volume	5	6	1271	2	2	1070	2356
% of Volume	80	96	99	150	50	101	100
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0
Density (ft/veh)							414
Occupancy (veh)	0	0	7	0	0	9	16

29: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.4	0.4
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.2	0.2
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.5	0.5
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	19	19
Fuel Used (gal)	0.0	0.0
Fuel Eff. (mpg)	12.8	12.8
HC Emissions (g)	0	0
CO Emissions (g)	22	22
NOx Emissions (g)	1	1
Vehicles Entered	10	10
Vehicles Exited	10	10
Hourly Exit Rate	10	10
Input Volume	10	10
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

32: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.4	0.4
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.2	0.2
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.4	0.4
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	23	23
Fuel Used (gal)	0.0	0.0
Fuel Eff. (mpg)	17.0	17.0
HC Emissions (g)	0	0
CO Emissions (g)	10	10
NOx Emissions (g)	1	1
Vehicles Entered	4	4
Vehicles Exited	4	4
Hourly Exit Rate	4	4
Input Volume	4	4
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

33: HP Hwy & Transfer Station Performance by movement

Movement	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.1	0.1
Denied Del/Veh (s)	0.1	0.0	0.0	2.5	0.2	0.1
Total Delay (hr)	0.0	2.6	0.0	0.0	0.1	2.7
Total Del/Veh (s)	7.0	5.8	5.2	13.5	0.5	3.7
Stop Delay (hr)	0.0	0.1	0.0	0.0	0.0	0.1
Stop Del/Veh (s)	7.1	0.2	0.1	12.5	0.0	0.2
Total Stops	1	15	0	5	0	21
Stop/Veh	1.00	0.01	0.00	1.00	0.00	0.01
Travel Dist (mi)	0.1	661.0	2.0	0.8	171.0	834.9
Travel Time (hr)	0.0	17.8	0.1	0.0	4.0	21.9
Avg Speed (mph)	11	37	33	20	43	38
Fuel Used (gal)	0.0	23.6	0.1	0.0	4.8	28.5
Fuel Eff. (mpg)	44.5	28.0	30.5	36.6	35.4	29.3
HC Emissions (g)	0	568	0	0	113	681
CO Emissions (g)	0	15916	20	7	2878	18821
NOx Emissions (g)	0	1959	2	1	411	2373
Vehicles Entered	1	1571	5	5	1044	2626
Vehicles Exited	1	1559	5	5	1044	2614
Hourly Exit Rate	1	1559	5	5	1044	2614
Input Volume	2	1575	5	5	1026	2613
% of Volume	50	99	100	100	102	100
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0
Density (ft/veh)						441
Occupancy (veh)	0	18	0	0	4	22

34: External Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.4	0.4
Total Del/Veh (s)	1.0	1.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	273.4	273.4
Travel Time (hr)	6.6	6.6
Avg Speed (mph)	42	42
Fuel Used (gal)	7.7	7.7
Fuel Eff. (mpg)	35.6	35.6
HC Emissions (g)	189	189
CO Emissions (g)	4539	4539
NOx Emissions (g)	671	671
Vehicles Entered	1556	1556
Vehicles Exited	1553	1553
Hourly Exit Rate	1553	1553
Input Volume	1574	1574
% of Volume	99	99
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	7	7

Total Network Performance

Denied Delay (hr)	1.3
Denied Del/Veh (s)	1.3
Total Delay (hr)	46.4
Total Del/Veh (s)	45.1
Stop Delay (hr)	22.9
Stop Del/Veh (s)	22.3
Total Stops	3197
Stop/Veh	0.86
Travel Dist (mi)	5495.6
Travel Time (hr)	179.2
Avg Speed (mph)	31
Fuel Used (gal)	174.0
Fuel Eff. (mpg)	31.6
HC Emissions (g)	3676
CO Emissions (g)	98023
NOx Emissions (g)	12676
Vehicles Entered	3542
Vehicles Exited	3519
Hourly Exit Rate	3519
Input Volume	21475
% of Volume	16
Denied Entry Before	0
Denied Entry After	0
Density (ft/veh)	410
Occupancy (veh)	178

Arterial Level of Service: NB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Ehehene St	28	2.1	21.4	0.2	41
	9	2.9	29.7	0.3	40
	4	1.2	11.2	0.1	39
RIRO Access 3	1	0.9	16.5	0.2	43
Mauka Access 2	5	14.2	33.4	0.2	26
Mauka Access 1	18	20.8	50.2	0.4	27
Transfer Station	33	6.3	40.0	0.4	38
Total		48.3	202.4	1.9	34

Arterial Level of Service: SB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Transfer Station	33	0.5	13.8	0.2	45
Olowalu Town Access	18	16.2	49.6	0.4	31
Olowalu Town Access	5	17.0	46.5	0.4	29
RIRO Access 3	1	4.3	23.6	0.2	37
	4	8.3	24.2	0.2	29
	9	4.3	13.9	0.1	32
Ehehene St	28	2.7	29.2	0.3	41
Total		53.2	200.9	1.9	33

Intersection: 1: HP Hwy & RIRO Access 3

Movement	EB
Directions Served	R
Maximum Queue (ft)	56
Average Queue (ft)	22
95th Queue (ft)	49
Link Distance (ft)	1088
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: HP Hwy

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	202	217
Average Queue (ft)	61	64
95th Queue (ft)	158	174
Link Distance (ft)	994	994
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: HP Hwy & Olowalu Town Access 2/Mauka Access 2

Movement	EB	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	SB
Directions Served	L	L	T	R	L	T	L	L	T	T	R	L
Maximum Queue (ft)	222	248	46	116	58	61	109	127	288	304	136	91
Average Queue (ft)	118	154	11	26	17	15	51	71	145	156	9	15
95th Queue (ft)	210	226	34	82	44	44	95	115	246	263	65	59
Link Distance (ft)			1046	1046		1036			1214	1214		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	400	400			250		400	400			250	250
Storage Blk Time (%)										1	0	
Queuing Penalty (veh)										0	0	

Intersection: 5: HP Hwy & Olowalu Town Access 2/Mauka Access 2

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	300	298	85
Average Queue (ft)	104	114	37
95th Queue (ft)	225	234	73
Link Distance (ft)	1896	1896	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			600
Storage Blk Time (%)	1		
Queuing Penalty (veh)	0		

Intersection: 18: HP Hwy & Olowalu Town Access 1/Mauka Access 1

Movement	EB	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	SB
Directions Served	L	L	T	R	L	T	L	L	T	T	R	L
Maximum Queue (ft)	165	195	51	79	69	52	71	100	362	380	223	50
Average Queue (ft)	57	110	11	11	23	18	25	45	161	173	10	13
95th Queue (ft)	138	171	35	50	58	48	61	83	294	309	84	38
Link Distance (ft)			1001	1001		736			1896	1896		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	500	500			250		400	400			200	250
Storage Blk Time (%)									0	6	0	
Queuing Penalty (veh)									0	1	0	

Intersection: 18: HP Hwy & Olowalu Town Access 1/Mauka Access 1

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	232	259	72
Average Queue (ft)	123	142	26
95th Queue (ft)	201	224	54
Link Distance (ft)	2146	2146	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			600
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Intersection: 28: HP Hwy & Ehehene St

Movement	WB	WB	SB
Directions Served	L	R	L
Maximum Queue (ft)	34	26	22
Average Queue (ft)	4	4	1
95th Queue (ft)	19	19	10
Link Distance (ft)	407		
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		100	200
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 33: HP Hwy & Transfer Station

Movement	WB	SB
Directions Served	R	L
Maximum Queue (ft)	17	32
Average Queue (ft)	1	4
95th Queue (ft)	9	19
Link Distance (ft)	205	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		250
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 2

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:57	4:57	4:57	4:57	4:57	4:57
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	63	63	63	63	63	63
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4
Vehs Entered	4888	4851	4816	4854	4876	4856
Vehs Exited	4647	4623	4648	4688	4629	4648
Starting Vehs	217	198	218	209	221	210
Ending Vehs	458	426	386	375	468	419
Denied Entry Before	5	1	7	18	5	7
Denied Entry After	9	5	1	14	33	12
Travel Distance (mi)	7291	7274	7228	7274	7242	7262
Travel Time (hr)	371.0	333.3	338.6	321.2	359.7	344.7
Total Delay (hr)	195.5	158.7	164.2	145.9	185.5	170.0
Total Stops	7033	6459	6633	5957	6914	6599
Fuel Used (gal)	260.7	254.9	254.7	254.6	258.5	256.7

Interval #0 Information Seeding

Start Time	4:57
End Time	5:00
Total Time (min)	3

Volumes adjusted by PHF, Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1217	1203	1162	1197	1159	1186
Vehs Exited	1144	1102	1097	1108	1135	1116
Starting Vehs	217	198	218	209	221	210
Ending Vehs	290	299	283	298	245	280
Denied Entry Before	5	1	7	18	5	7
Denied Entry After	2	6	1	3	1	2
Travel Distance (mi)	1828	1797	1735	1802	1762	1785
Travel Time (hr)	73.5	73.1	65.3	69.3	62.3	68.7
Total Delay (hr)	29.3	29.9	23.4	26.0	19.9	25.7
Total Stops	1483	1410	1388	1378	1143	1355
Fuel Used (gal)	61.7	62.1	57.5	60.8	57.7	60.0

Interval #2 Information

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1228	1156	1200	1150	1268	1201
Vehs Exited	1184	1165	1143	1164	1140	1158
Starting Vehs	290	299	283	298	245	280
Ending Vehs	334	290	340	284	373	321
Denied Entry Before	2	6	1	3	1	2
Denied Entry After	0	0	5	2	1	1
Travel Distance (mi)	1857	1776	1797	1760	1825	1803
Travel Time (hr)	79.4	74.7	76.2	71.6	82.5	76.9
Total Delay (hr)	34.8	32.1	32.9	29.2	38.5	33.5
Total Stops	1566	1348	1495	1410	1679	1501
Fuel Used (gal)	63.4	60.7	60.9	59.6	64.1	61.8

Interval #3 Information

Start Time	5:30
End Time	5:45
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1306	1288	1260	1278	1269	1281
Vehs Exited	1189	1174	1181	1199	1226	1194
Starting Vehs	334	290	340	284	373	321
Ending Vehs	451	404	419	363	416	408
Denied Entry Before	0	0	5	2	1	1
Denied Entry After	0	1	17	34	0	10
Travel Distance (mi)	1875	1861	1849	1864	1890	1868
Travel Time (hr)	101.7	85.7	96.5	84.3	101.8	94.0
Total Delay (hr)	56.4	41.1	52.0	39.5	56.3	49.0
Total Stops	2036	1755	1821	1589	2156	1873
Fuel Used (gal)	69.1	65.1	68.0	66.2	69.8	67.7

Interval #4 Information

Start Time	5:45
End Time	6:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1137	1204	1194	1229	1180	1188
Vehs Exited	1130	1182	1227	1217	1128	1179
Starting Vehs	451	404	419	363	416	408
Ending Vehs	458	426	386	375	468	419
Denied Entry Before	0	1	17	34	0	10
Denied Entry After	9	5	1	14	33	12
Travel Distance (mi)	1731	1840	1847	1848	1764	1806
Travel Time (hr)	116.4	99.8	100.5	95.9	113.2	105.2
Total Delay (hr)	75.0	55.6	56.0	51.2	70.8	61.7
Total Stops	1948	1946	1929	1580	1936	1867
Fuel Used (gal)	66.5	67.0	68.2	68.0	66.8	67.3

1: HP Hwy & RIRO Access 3 Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.1	0.0	0.1
Denied Del/Veh (s)	0.1	0.0	0.2	0.0	0.1
Total Delay (hr)	0.3	0.4	18.0	0.6	19.3
Total Del/Veh (s)	41.5	0.9	43.4	41.1	21.7
Stop Delay (hr)	0.3	0.0	14.5	0.5	15.3
Stop Del/Veh (s)	41.1	0.0	34.9	34.0	17.2
Total Stops	25	0	565	19	609
Stop/Veh	1.00	0.00	0.38	0.36	0.19
Travel Dist (mi)	5.1	315.1	358.1	12.7	691.0
Travel Time (hr)	0.5	7.5	26.4	1.0	35.4
Avg Speed (mph)	11	42	14	13	20
Fuel Used (gal)	0.2	9.1	16.9	0.6	26.7
Fuel Eff. (mpg)	25.0	34.7	21.2	22.7	25.9
HC Emissions (g)	2	217	312	3	533
CO Emissions (g)	40	5518	9888	195	15642
NOx Emissions (g)	5	775	944	14	1738
Vehicles Entered	25	1619	1484	53	3181
Vehicles Exited	24	1620	1429	51	3124
Hourly Exit Rate	24	1620	1429	51	3124
Input Volume	26	1618	1511	51	3206
% of Volume	94	100	95	100	97
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	1	0	1
Density (ft/veh)					163
Occupancy (veh)	0	7	26	1	35

2: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.2	0.2
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	10.8	10.8
Travel Time (hr)	0.4	0.4
Avg Speed (mph)	26	26
Fuel Used (gal)	0.4	0.4
Fuel Eff. (mpg)	24.9	24.9
HC Emissions (g)	3	3
CO Emissions (g)	138	138
NOx Emissions (g)	11	11
Vehicles Entered	51	51
Vehicles Exited	51	51
Hourly Exit Rate	51	51
Input Volume	51	51
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

3: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.4	0.4
Total Del/Veh (s)	1.5	1.5
Stop Delay (hr)	0.1	0.1
Stop Del/Veh (s)	0.2	0.2
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	185.0	185.0
Travel Time (hr)	7.4	7.4
Avg Speed (mph)	25	25
Fuel Used (gal)	7.7	7.7
Fuel Eff. (mpg)	24.1	24.1
HC Emissions (g)	68	68
CO Emissions (g)	2494	2494
NOx Emissions (g)	248	248
Vehicles Entered	882	882
Vehicles Exited	880	880
Hourly Exit Rate	880	880
Input Volume	883	883
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	7	7

4: HP Hwy Performance by movement

Movement	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	0.6	45.7	46.3
Total Del/Veh (s)	1.4	113.2	54.2
Stop Delay (hr)	0.0	45.4	45.4
Stop Del/Veh (s)	0.0	112.5	53.1
Total Stops	0	1370	1370
Stop/Veh	0.00	0.94	0.45
Travel Dist (mi)	200.9	281.2	482.1
Travel Time (hr)	5.1	52.0	57.2
Avg Speed (mph)	39	5	8
Fuel Used (gal)	5.4	15.5	20.9
Fuel Eff. (mpg)	37.5	18.1	23.1
HC Emissions (g)	118	134	252
CO Emissions (g)	2498	3130	5627
NOx Emissions (g)	419	245	664
Vehicles Entered	1619	1451	3070
Vehicles Exited	1619	1376	2995
Hourly Exit Rate	1619	1376	2995
Input Volume	1618	1535	3153
% of Volume	100	90	95
Denied Entry Before	0	0	0
Denied Entry After	0	0	0
Density (ft/veh)			48
Occupancy (veh)	5	52	57

5: HP Hwy & Olowalu Town Access 2/Mauka Access 2 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	4.5	2.4	1.7	2.8	0.1	0.1	0.1	0.0	0.1	0.3	0.0	0.1
Total Delay (hr)	24.3	0.4	0.6	0.3	0.2	0.0	5.0	4.0	0.0	0.2	15.3	3.3
Total Del/Veh (s)	207.1	73.9	8.5	48.1	45.2	0.7	43.7	11.7	3.8	48.9	42.5	25.7
Stop Delay (hr)	23.6	0.4	0.4	0.2	0.2	0.0	4.3	2.0	0.0	0.2	8.8	1.4
Stop Del/Veh (s)	201.1	68.2	5.8	47.1	43.8	0.0	37.7	5.8	1.3	36.6	24.7	11.1
Total Stops	558	22	94	18	17	0	349	368	7	18	824	307
Stop/Veh	1.32	1.10	0.34	0.95	0.89	0.00	0.85	0.30	0.35	1.00	0.64	0.66
Travel Dist (mi)	80.5	4.0	52.8	3.7	3.8	3.8	97.0	288.0	4.7	6.5	467.5	171.5
Travel Time (hr)	27.7	0.6	2.7	0.5	0.4	0.2	7.6	10.4	0.2	0.4	25.9	7.9
Avg Speed (mph)	3	7	21	8	9	19	13	28	31	16	18	22
Fuel Used (gal)	8.1	0.2	1.6	0.2	0.2	0.1	3.2	7.4	0.1	0.3	20.0	6.6
Fuel Eff. (mpg)	9.9	18.3	33.4	20.6	21.5	31.5	30.0	38.8	47.8	22.5	23.3	26.1
HC Emissions (g)	29	1	16	0	0	0	28	171	0	2	451	39
CO Emissions (g)	1061	44	427	14	13	10	826	3869	18	119	13176	2516
NOx Emissions (g)	84	3	46	1	1	1	96	551	3	8	1384	200
Vehicles Entered	414	20	272	19	19	20	406	1207	20	18	1260	461
Vehicles Exited	381	20	272	19	19	20	400	1205	20	18	1256	462
Hourly Exit Rate	381	20	272	19	19	20	400	1205	20	18	1256	462
Input Volume	413	20	287	20	20	20	400	1211	20	20	1264	463
% of Volume	92	98	95	93	93	98	100	100	98	88	99	100
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	5	0	3	0	0	0	0	0	0	0	0	0
Density (ft/veh)												
Occupancy (veh)	27	1	3	0	0	0	8	10	0	0	26	8

5: HP Hwy & Olowalu Town Access 2/Mauka Access 2 Performance by movement

Movement	All
Denied Delay (hr)	0.7
Denied Del/Veh (s)	0.6
Total Delay (hr)	53.7
Total Del/Veh (s)	46.0
Stop Delay (hr)	41.6
Stop Del/Veh (s)	35.7
Total Stops	2582
Stop/Veh	0.61
Travel Dist (mi)	1183.7
Travel Time (hr)	84.4
Avg Speed (mph)	14
Fuel Used (gal)	48.0
Fuel Eff. (mpg)	24.6
HC Emissions (g)	736
CO Emissions (g)	22093
NOx Emissions (g)	2378
Vehicles Entered	4136
Vehicles Exited	4092
Hourly Exit Rate	4092
Input Volume	4160
% of Volume	98
Denied Entry Before	0
Denied Entry After	8
Density (ft/veh)	254
Occupancy (veh)	84

6: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	1.0	1.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.4	0.4
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	12.1	12.1
Travel Time (hr)	0.6	0.6
Avg Speed (mph)	19	19
Fuel Used (gal)	0.5	0.5
Fuel Eff. (mpg)	26.4	26.4
HC Emissions (g)	1	1
CO Emissions (g)	58	58
NOx Emissions (g)	7	7
Vehicles Entered	57	57
Vehicles Exited	57	57
Hourly Exit Rate	57	57
Input Volume	62	62
% of Volume	93	93
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	1	1

7: External Performance by approach

Approach	WB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.1	0.1
Total Del/Veh (s)	1.1	1.1
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.3	0.3
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	99.9	99.9
Travel Time (hr)	3.9	3.9
Avg Speed (mph)	25	25
Fuel Used (gal)	4.2	4.2
Fuel Eff. (mpg)	23.7	23.7
HC Emissions (g)	58	58
CO Emissions (g)	1782	1782
NOx Emissions (g)	186	186
Vehicles Entered	497	497
Vehicles Exited	493	493
Hourly Exit Rate	493	493
Input Volume	513	513
% of Volume	96	96
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	4	4

9: Bend Performance by approach

Approach	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.0
Total Delay (hr)	1.7	2.6	4.3
Total Del/Veh (s)	3.7	6.8	5.1
Stop Delay (hr)	0.0	0.6	0.6
Stop Del/Veh (s)	0.0	1.6	0.7
Total Stops	0	23	23
Stop/Veh	0.00	0.02	0.01
Travel Dist (mi)	540.4	165.3	705.7
Travel Time (hr)	13.8	6.3	20.1
Avg Speed (mph)	39	26	35
Fuel Used (gal)	13.4	12.1	25.5
Fuel Eff. (mpg)	40.2	13.7	27.7
HC Emissions (g)	299	299	598
CO Emissions (g)	5167	11190	16356
NOx Emissions (g)	1090	944	2034
Vehicles Entered	1616	1376	2992
Vehicles Exited	1617	1372	2989
Hourly Exit Rate	1617	1372	2989
Input Volume	1615	1535	3150
% of Volume	100	89	95
Denied Entry Before	0	0	0
Denied Entry After	0	0	0
Density (ft/veh)	127	101	119
Occupancy (veh)	14	6	20

18: HP Hwy & Olowalu Town Access 1/Mauka Access 1 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Delay (hr)	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	3.2	0.5	0.2	4.2	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1
Total Delay (hr)	6.5	0.2	0.2	0.3	0.3	0.0	2.5	6.5	0.1	0.2	11.3	0.7
Total Del/Veh (s)	102.8	37.1	5.2	49.8	49.6	1.2	45.1	16.4	10.6	24.6	26.1	8.6
Stop Delay (hr)	6.3	0.2	0.2	0.3	0.3	0.0	2.1	2.2	0.0	0.1	5.6	0.2
Stop Del/Veh (s)	99.3	34.1	3.4	47.5	46.2	0.0	37.6	5.7	1.1	15.6	12.9	2.8
Total Stops	249	15	47	21	18	0	178	469	2	21	828	116
Stop/Veh	1.09	0.71	0.28	1.00	0.90	0.00	0.88	0.33	0.09	0.91	0.53	0.41
Travel Dist (mi)	42.9	3.8	31.0	3.0	2.7	2.7	74.5	526.7	8.4	9.3	637.8	115.0
Travel Time (hr)	8.3	0.3	1.4	0.4	0.4	0.1	4.5	18.8	0.3	0.4	25.6	3.6
Avg Speed (mph)	5	11	22	7	7	25	17	28	29	24	25	32
Fuel Used (gal)	2.7	0.2	0.9	0.2	0.1	0.1	3.0	18.9	0.3	0.2	17.0	2.9
Fuel Eff. (mpg)	15.7	25.0	35.8	19.3	20.3	41.6	24.6	27.8	31.3	40.2	37.5	39.4
HC Emissions (g)	13	1	10	0	0	0	35	406	2	1	350	44
CO Emissions (g)	414	23	232	23	20	7	1464	12319	103	47	7681	1465
NOx Emissions (g)	36	2	27	2	2	1	130	1337	9	7	1146	154
Vehicles Entered	225	20	166	21	19	20	199	1411	23	23	1535	277
Vehicles Exited	220	20	167	21	20	20	201	1412	23	22	1523	276
Hourly Exit Rate	220	20	167	21	20	20	201	1412	23	22	1523	276
Input Volume	220	20	172	20	20	20	212	1436	20	20	1526	281
% of Volume	100	98	97	102	98	98	95	98	112	107	100	98
Denied Entry Before	0	0	0	0	0	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0	0	0	0	0	0
Density (ft/veh)												
Occupancy (veh)	8	0	1	0	0	0	4	19	0	0	26	4

18: HP Hwy & Olowalu Town Access 1/Mauka Access 1 Performance by movement

Movement	All
Denied Delay (hr)	0.3
Denied Del/Veh (s)	0.2
Total Delay (hr)	28.8
Total Del/Veh (s)	26.0
Stop Delay (hr)	17.5
Stop Del/Veh (s)	15.8
Total Stops	1964
Stop/Veh	0.49
Travel Dist (mi)	1457.7
Travel Time (hr)	64.1
Avg Speed (mph)	23
Fuel Used (gal)	46.5
Fuel Eff. (mpg)	31.4
HC Emissions (g)	862
CO Emissions (g)	23799
NOx Emissions (g)	2852
Vehicles Entered	3939
Vehicles Exited	3925
Hourly Exit Rate	3925
Input Volume	3970
% of Volume	99
Denied Entry Before	0
Denied Entry After	0
Density (ft/veh)	386
Occupancy (veh)	64

20: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	2.3	2.3
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.6	0.6
Total Stops	3	3
Stop/Veh	0.05	0.05
Travel Dist (mi)	10.1	10.1
Travel Time (hr)	0.4	0.4
Avg Speed (mph)	24	24
Fuel Used (gal)	0.4	0.4
Fuel Eff. (mpg)	22.5	22.5
HC Emissions (g)	3	3
CO Emissions (g)	165	165
NOx Emissions (g)	12	12
Vehicles Entered	66	66
Vehicles Exited	65	65
Hourly Exit Rate	65	65
Input Volume	62	62
% of Volume	106	106
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

25: External Performance by approach

Approach	SB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.8	0.8
Total Del/Veh (s)	2.2	2.2
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	318.4	318.4
Travel Time (hr)	8.0	8.0
Avg Speed (mph)	40	40
Fuel Used (gal)	8.7	8.7
Fuel Eff. (mpg)	36.6	36.6
HC Emissions (g)	202	202
CO Emissions (g)	4834	4834
NOx Emissions (g)	704	704
Vehicles Entered	1379	1379
Vehicles Exited	1377	1377
Hourly Exit Rate	1377	1377
Input Volume	1550	1550
% of Volume	89	89
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	8	8

28: HP Hwy & Ehehene St Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	4.8	0.0	0.0	0.0	4.8
Denied Del/Veh (s)	0.1	3.6	10.7	5.7	0.0	0.0	5.8
Total Delay (hr)	1.9	0.2	2.9	0.0	0.0	1.1	6.1
Total Del/Veh (s)	870.2	164.8	6.4	3.2	57.2	2.8	7.3
Stop Delay (hr)	1.9	0.2	0.0	0.0	0.0	0.0	2.1
Stop Del/Veh (s)	867.8	163.3	0.0	0.0	55.4	0.0	2.5
Total Stops	8	4	0	0	2	0	14
Stop/Veh	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Travel Dist (mi)	0.6	0.3	352.6	0.4	0.6	455.7	810.1
Travel Time (hr)	2.0	0.2	15.6	0.0	0.0	11.3	29.1
Avg Speed (mph)	0	1	33	31	13	40	33
Fuel Used (gal)	0.5	0.1	13.2	0.0	0.0	11.2	24.9
Fuel Eff. (mpg)	1.2	5.3	26.8	35.3	31.5	40.7	32.5
HC Emissions (g)	0	0	255	0	0	272	528
CO Emissions (g)	29	6	5091	1	1	4907	10036
NOx Emissions (g)	1	0	922	0	0	976	1899
Vehicles Entered	8	4	1609	2	2	1380	3005
Vehicles Exited	4	3	1613	2	2	1375	2999
Hourly Exit Rate	4	3	1613	2	2	1375	2999
Input Volume	7	3	1612	2	2	1543	3169
% of Volume	55	100	100	100	100	89	95
Denied Entry Before	0	0	7	0	0	0	7
Denied Entry After	0	0	3	0	0	0	3
Density (ft/veh)							270
Occupancy (veh)	2	0	11	0	0	11	24

29: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.6	0.6
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.4	0.4
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.6	0.6
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	19	19
Fuel Used (gal)	0.1	0.1
Fuel Eff. (mpg)	12.3	12.3
HC Emissions (g)	0	0
CO Emissions (g)	27	27
NOx Emissions (g)	2	2
Vehicles Entered	12	12
Vehicles Exited	12	12
Hourly Exit Rate	12	12
Input Volume	11	11
% of Volume	107	107
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

32: External Performance by approach

Approach	EB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.0	0.0
Total Del/Veh (s)	0.5	0.5
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.3	0.3
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	0.3	0.3
Travel Time (hr)	0.0	0.0
Avg Speed (mph)	22	22
Fuel Used (gal)	0.0	0.0
Fuel Eff. (mpg)	17.0	17.0
HC Emissions (g)	0	0
CO Emissions (g)	9	9
NOx Emissions (g)	1	1
Vehicles Entered	4	4
Vehicles Exited	4	4
Hourly Exit Rate	4	4
Input Volume	4	4
% of Volume	100	100
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	0	0

33: HP Hwy & Transfer Station Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.2	0.2
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	1.9	0.4	0.2
Total Delay (hr)	0.1	0.0	2.7	0.0	0.1	0.7	3.6
Total Del/Veh (s)	250.6	18.0	5.7	4.7	22.0	1.3	3.6
Stop Delay (hr)	0.1	0.0	0.1	0.0	0.1	0.0	0.3
Stop Del/Veh (s)	248.7	18.1	0.2	0.1	20.3	0.0	0.3
Total Stops	2	5	19	0	8	0	34
Stop/Veh	1.00	1.00	0.01	0.00	0.80	0.00	0.01
Travel Dist (mi)	0.1	0.2	702.5	0.9	1.6	295.3	1000.5
Travel Time (hr)	0.1	0.0	18.8	0.0	0.1	7.5	26.6
Avg Speed (mph)	1	6	37	36	15	41	38
Fuel Used (gal)	0.0	0.0	24.6	0.0	0.1	9.2	33.9
Fuel Eff. (mpg)	2.8	23.4	28.5	34.4	27.8	32.2	29.5
HC Emissions (g)	0	0	571	0	0	214	785
CO Emissions (g)	2	1	16107	10	17	5902	22039
NOx Emissions (g)	0	0	1997	1	1	751	2750
Vehicles Entered	2	5	1670	2	10	1803	3492
Vehicles Exited	2	5	1664	2	10	1806	3489
Hourly Exit Rate	2	5	1664	2	10	1806	3489
Input Volume	2	6	1693	2	9	1797	3510
% of Volume	100	80	98	100	108	100	99
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0
Density (ft/veh)							366
Occupancy (veh)	0	0	19	0	0	7	26

34: External Performance by approach

Approach	NB	All
Denied Delay (hr)	0.0	0.0
Denied Del/Veh (s)	0.0	0.0
Total Delay (hr)	0.4	0.4
Total Del/Veh (s)	1.0	1.0
Stop Delay (hr)	0.0	0.0
Stop Del/Veh (s)	0.0	0.0
Total Stops	0	0
Stop/Veh	0.00	0.00
Travel Dist (mi)	293.5	293.5
Travel Time (hr)	7.0	7.0
Avg Speed (mph)	42	42
Fuel Used (gal)	8.3	8.3
Fuel Eff. (mpg)	35.4	35.4
HC Emissions (g)	200	200
CO Emissions (g)	4919	4919
NOx Emissions (g)	714	714
Vehicles Entered	1670	1670
Vehicles Exited	1668	1668
Hourly Exit Rate	1668	1668
Input Volume	1699	1699
% of Volume	98	98
Denied Entry Before	0	0
Denied Entry After	0	0
Density (ft/veh)		
Occupancy (veh)	7	7

Total Network Performance

Denied Delay (hr)	6.1
Denied Del/Veh (s)	4.5
Total Delay (hr)	163.9
Total Del/Veh (s)	116.4
Stop Delay (hr)	122.9
Stop Del/Veh (s)	87.3
Total Stops	6599
Stop/Veh	1.30
Travel Dist (mi)	7261.6
Travel Time (hr)	344.7
Avg Speed (mph)	21
Fuel Used (gal)	256.7
Fuel Eff. (mpg)	28.3
HC Emissions (g)	4829
CO Emissions (g)	130019
NOx Emissions (g)	16199
Vehicles Entered	4856
Vehicles Exited	4648
Hourly Exit Rate	4648
Input Volume	29153
% of Volume	16
Denied Entry Before	7
Denied Entry After	12
Density (ft/veh)	215
Occupancy (veh)	339

Arterial Level of Service: NB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Ehehene St	28	6.4	34.6	0.2	34
	9	3.7	30.5	0.3	39
	4	1.4	11.4	0.1	38
RIRO Access 3	1	0.9	16.6	0.2	43
Mauka Access 2	5	11.7	30.8	0.2	28
Mauka Access 1	18	18.7	48.2	0.4	28
Transfer Station	33	6.0	39.6	0.4	38
Total		49.0	211.6	1.9	34

Arterial Level of Service: SB HP Hwy

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Transfer Station	33	1.3	14.9	0.2	42
Olowalu Town Access	18	26.1	59.3	0.4	26
Olowalu Town Access	5	40.8	69.9	0.4	19
RIRO Access 3	1	41.2	60.8	0.2	14
	4	113.3	128.9	0.2	5
	9	6.8	16.4	0.1	27
Ehehene St	28	2.8	29.4	0.3	41
Total		232.4	379.8	1.9	18

Intersection: 1: HP Hwy & RIRO Access 3

Movement	EB	SB	SB
Directions Served	R	T	TR
Maximum Queue (ft)	87	870	910
Average Queue (ft)	24	229	232
95th Queue (ft)	70	863	880
Link Distance (ft)	1088	1214	1214
Upstream Blk Time (%)		0	1
Queuing Penalty (veh)		1	10
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: HP Hwy

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	997	1025
Average Queue (ft)	674	683
95th Queue (ft)	1198	1214
Link Distance (ft)	994	994
Upstream Blk Time (%)	4	6
Queuing Penalty (veh)	27	46
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: HP Hwy & Olowalu Town Access 2/Mauka Access 2

Movement	EB	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	SB
Directions Served	L	L	T	R	L	T	L	L	T	T	R	L
Maximum Queue (ft)	412	424	894	721	63	51	205	222	326	297	34	188
Average Queue (ft)	293	316	268	139	16	13	122	132	135	140	6	17
95th Queue (ft)	478	486	899	532	46	37	186	198	258	257	25	74
Link Distance (ft)			1046	1046		1036			1214	1214		
Upstream Blk Time (%)			4	0								
Queuing Penalty (veh)			0	0								
Storage Bay Dist (ft)	400	400			250		400	400			250	250
Storage Blk Time (%)	3	25	0						0	1		
Queuing Penalty (veh)	1	5	0						0	0		

Intersection: 5: HP Hwy & Olowalu Town Access 2/Mauka Access 2

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	501	501	245
Average Queue (ft)	265	269	126
95th Queue (ft)	453	458	223
Link Distance (ft)	1896	1896	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			600
Storage Blk Time (%)	17	0	
Queuing Penalty (veh)	3	0	

Intersection: 18: HP Hwy & Olowalu Town Access 1/Mauka Access 1

Movement	EB	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	SB
Directions Served	L	L	T	R	L	T	L	L	T	T	R	L
Maximum Queue (ft)	234	273	46	140	64	60	145	150	356	370	179	133
Average Queue (ft)	112	148	11	47	21	19	60	77	164	171	13	17
95th Queue (ft)	221	249	32	116	55	48	111	125	304	313	99	73
Link Distance (ft)			1001	1001		736			1896	1896		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	500	500			250		400	400			200	250
Storage Blk Time (%)									0	5	0	
Queuing Penalty (veh)									0	1	0	

Intersection: 18: HP Hwy & Olowalu Town Access 1/Mauka Access 1

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	499	505	216
Average Queue (ft)	261	276	51
95th Queue (ft)	412	433	141
Link Distance (ft)	2146	2146	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			600
Storage Blk Time (%)	8	0	0
Queuing Penalty (veh)	2	0	0

Intersection: 28: HP Hwy & Ehehene St

Movement	WB	WB	SB
Directions Served	L	R	L
Maximum Queue (ft)	124	42	16
Average Queue (ft)	43	4	2
95th Queue (ft)	132	25	13
Link Distance (ft)	407		
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		100	200
Storage Blk Time (%)	15		
Queuing Penalty (veh)	0		

Intersection: 33: HP Hwy & Transfer Station

Movement	WB	WB	SB
Directions Served	L	R	L
Maximum Queue (ft)	29	22	47
Average Queue (ft)	3	3	7
95th Queue (ft)	19	16	31
Link Distance (ft)	205	205	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			250
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 98

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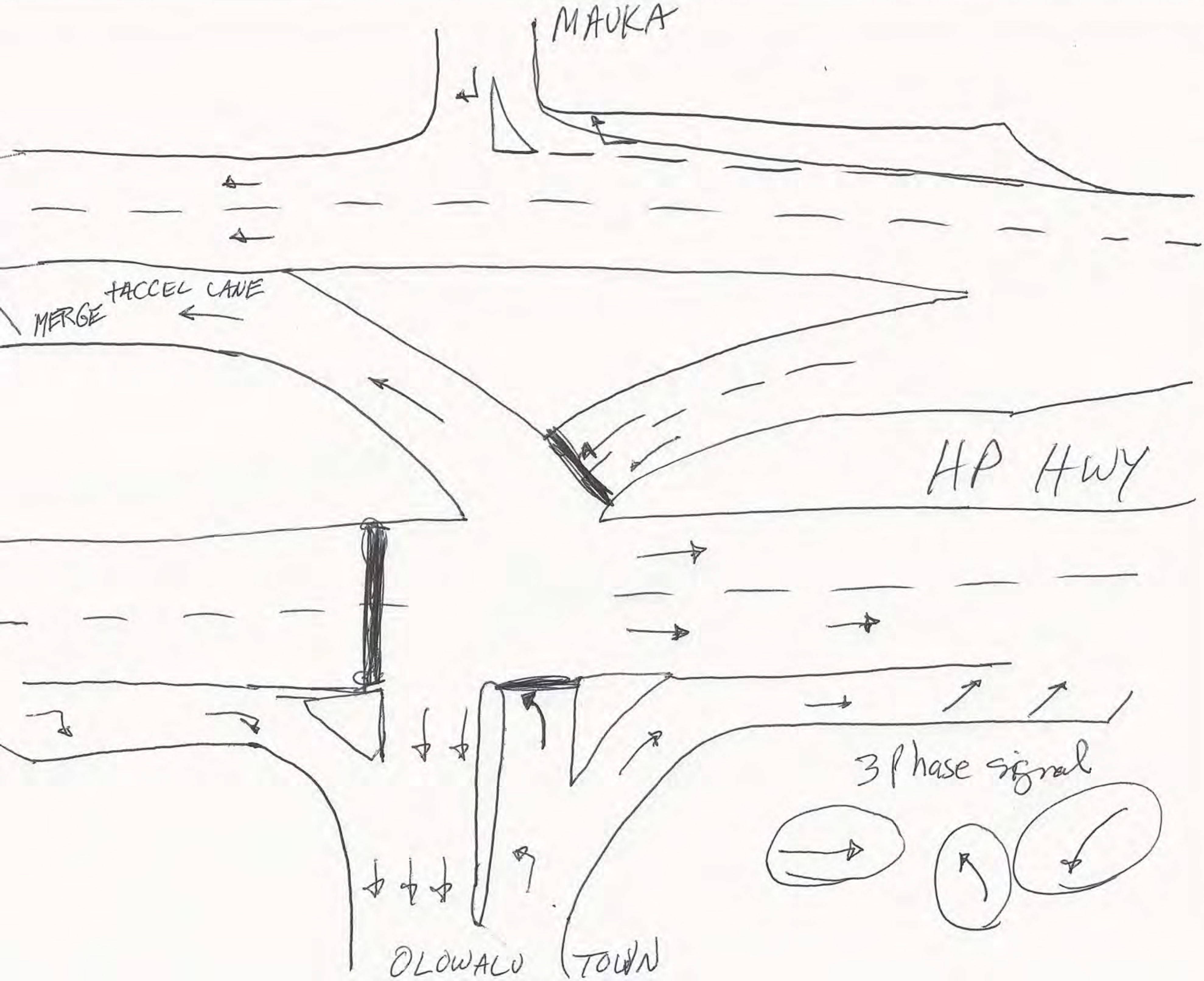

MAUKA
MERGE +ACCEL LANE
HP HWY
3 Phase signal
OLOWALU TOWN

END