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March 9, 2007

Department of Transportation Services
City and County of Honolulu
650 South King Street, 3rd Floor
Honolulu, Hawaii 96813
Attn: Honolulu High-Capacity Transit Corridor Project
VIA email: mkaku@honolulu.gov

Dear Mr. Kaku:

As my comments on the Scoping Information Package of March 15, 2007, I attach my Report to the Honolulu City Council Transit Advisory Task Force dated December 1, 2006.

In my opinion, the most egregious violation of FTA's rules on alternative specification and analysis was the deliberate under-engineering of the Managed Lanes (ML) Alternative to a degree that brings ridicule to prevailing planning and engineering principles. For example, FTA guideline 2.4 item 2 states that
"*Each alternative should be defined to optimize its performance.*"
[Source: http://www.fta.dot.gov/documents/Definitions_of_Alternatives.pdf]
The exact opposite was done. The Honolulu City Council did not reject a HOT expressway with express buses; the City Council rejected an alternative that was engineered to fail, and, it did fail by design. Therefore, the ML alternative must be correctly specified and fully assessed in the upcoming environmental assessment process.

Sincerely,

Panos Prevedouros, Ph.D.
Professor of Transportation Engineering

cc: Ms. Donna Turchie
Federal Transit Administration, Region IX
201 Mission Street, Room 1650
San Francisco, CA 94105
VIA email: Donna.Turchie@fta.dot.gov

HONOLULU HIGH-CAPACITY TRANSIT CORRIDOR PROJECT:

ALTERNATIVES ANALYSIS (AA) REPORT – Report to Transit Task Force

Panos D. Prevedouros, Ph.D.
Member, Honolulu Transit Task Force, and Professor of Transportation Engineering, Department of Civil and Environmental Engineering, University of Hawaii at Manoa

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This paper reviews the Alternatives Analysis report from an engineering perspective. In general, its organization tracks the organization of the report.

→ Page S-2: "Motorists experience substantial traffic congestion…" The report relies heavily on anecdotal experience of traffic congestion. It would benefit from a quantitative presentation of congestion data for major origin-destination pairs. This would allow for comparison of Honolulu's congestion to other cities. Data from the State's Congestion Management System should be cited and tabulated.

→ Page 1-1: The statements of purpose

- "improved mobility"
- "provide faster, more reliable public transportation services"
- "provide an alternative to private automobile travel"

make it clear that this is a public transit analysis – not a more comprehensive analysis of transportation issues in the subject corridor . In particular, the effects of the alternatives on freight transportation in the corridor are not considered, even though the alternatives will plainly impact freight. This Alternatives Analysis does not respond directly to the need to reduce traffic congestion on Oahu.

→ Page 1-1: Bottom: "Current a.m. peak period times for motorists from West Oahu to Downtown average between 45 and 81 minutes. By 2030, after including all of the planned roadway improvements in the ORTP, this travel time is projected to increase to between 53 and 83 minutes."

From this description, travel time will be relatively stable for 25 years into the future (45 minutes to 53 minutes , 81 minutes to 83 minutes, on average, provided the ORTP roadway improvements are implemented). .Question whether this level of inconvenience is severe enough to justify a fixed guideway project of the magnitude proposed in the Alternatives Analysis, in addition to the cost of the base improvements called for in the ORTP.

→ Page 1-9: The UH-Manoa campus is not identified here as a major public transit destination, notwithstanding the data presented on page 1-4 (20,000 students, 6,000 staff; 60% of students must drive or use transit to attend classes). If it is not a major transit destination, why is rail service to the UHM being considered?

Page 1-13, Table 1-1: The vehicle speed projection data presented here are not consistent with engineering observations. Once a street segment becomes saturated with traffic, such as the "Liliha Street" segment on the H-1 freeway, the average speed of vehicles on that segment tends to stabilize at about 15 mph. Therefore, the estimated average speed drop from 19 to 12 mph on the Liliha segment is unlikely. Rather, increased traffic will be experienced as longer periods of traffic congestion. The planning model does not seem to be able to model saturated traffic conditions correctly. This can affect speed estimates for congested roadways, and result in inaccurate travel time forecasts.

→ ♦ Page 2-3: Bus fleet size estimated for the Managed Lane alternative is overstated, and is not consistent with national experience. Buses run 10 miles in approximately 10 minutes on HOT lanes. As a result of improved bus efficiency, either fleet size is reduced, or a given fleet size can provide a much higher service frequency.

→ Page 2-16: It is not clear from the Operating and Maintenance cost estimates presented here whether replacement costs for the rolling stock and the multitude of deteriorating pieces of equipment (switches, generators, signals, computer controls, extensive wiring and power system, etc.) of the Rail option have been included in projections of annual O&M costs. Text at pages 3-9 and 3-10 do not answer this question.

→ Page 3-2: Table 3-1: Significant trip growth is projected in two out of 25 Traffic Analysis Areas on Oahu. Specifically:

Area 11 is Honouiliuli and Ewa Beach	2005 total daily trips are 176,000
	2030 total daily trips forecast at 342,000

This is an increase of 166,000 total daily trips.

Area 12 is Kapolei, Ko'Olina, Kalaeloa	2005 total daily trips are 122,000
	2030 total daily trips forecast at 362,000

This is an increase of 240,000 total daily trips.

Trip generation for these two areas will change from 298,000 trips in 2005 to 704,000 trips in 2030, a growth of 136% in 25 years. These estimates are questionable, given Oahu's population growth of 4.8% between 1990 and 2000, the annual growth in tourism of only 0.6% per annum since 1990, continued reduction in agriculture, stability in military operations and reduced travel as baby boomers retire and draw a pension instead of going to work.

For order-of-magnitude purposes, this 704,000 transit trip projection for areas 11 and 12 should be compared with the Table 3-3 estimates for transit trips under any of the four fixed guideway alternatives – 281,900 to 294,100 – for entire Oahu. If trips in areas 11 and 12 grow by only half as much, by 68% in 25 years, then their 352,000 projected new trips would be close to the projected total number of transit trips on Oahu.

→ Page 3-4: Data in Table 3-3 in combination with Table 3-7 also provide useful order-of-magnitude comparisons:

- Year 2030 Transit trips in the "No Build" alternative are projected at 232,100.
- Year 2030 Transit trips with the Rail alternative most favorable to transit are projected at 294,100.
- Total gain in transit trips after a rail system is constructed: 62,000 transit trips.
- Year 2030 Vehicle trips are estimated at about 3,000,000 (at a 1.6 average occupancy including buses, this estimate represents 4,800,000 person trips).

- The 62,000 new transit trips reflect about 1% of person trips.

Baseline transit trip projections have been historically overstated by about 21%, as the table below indicates. The table shows actual *TheBus* trips versus forecasted *TheBus* trips in the "No Build." In other words, the base ridership in the No Build is inflated. Once the base is inflated, all transit ridership forecasts are inflated and justifiably uncertain.

Millions of *TheBus* Transit Trips per Year

Year	Actual	Forecast	Source	Difference	% Error
1990	75.6				
1991	72.8				
1992	73.0				
1993	75.6				
1994	77.3				
1995	72.7				
1996	68.9				
1997	68.6				
1998	71.8				
1999	66.2				
2000	66.6				
2001	70.4	73.0	*HART*		
2002	73.5	67.0	*Hali 2000*		
2003	69.1	88.0	*Rail 1992*		
2004	61.3	104.0	*BRT 2001*		
2005	67.4	96.0	*Rail 2006*		
Average	**70.7**	**85.6**		**14.9**	**21.1%**

From Table 3-3 it can be observed that in 2030 the number of transit trips for the No Build Alternative is 232,100, and that the number of transit trips in the best rail option is 294,100. If the Rail's trip estimate is overstated by 21%, then 294,100 become 232,339; these are about equal to the transit trips in the No Build. Thus, all of the gain in transit trips due to a rail system may be attributable to the inflated baseline forecasts.

→ ♦ Pages 3-7, 3-8: The TSM alternative is estimated to have a requirement for 6,200 parking stalls at various park-and-ride facilities, the Managed Lane alternative has the same requirement, but the 20-mile rail option is projected to require only 5700 parking stalls. A smaller parking requirement for rail compared to TSM and ML does not make sense. In the Rail alternative many riders who cannot walk to a station must drive and therefore have to park their vehicles somewhere. In the TSM and ML alternatives, the transit vehicles – buses – collect riders from their residential neighborhoods and deliver them to their destination, thereby arguably reducing the quantity of parking stalls required. This discrepancy should be clarified.

→ Page 3-11: Table 3-11 includes travel time estimates for year 2030 with Rail. Basically travel by auto is <u>equal</u>, <u>faster</u> or <u>much faster</u> than rail for all 2030 trips between:

- Aiea (Pearlridge) and Downtown
- Downtown and Ala Moana Center
- Downtown and Manoa

- Airport and Waikiki

For trips between Aiea and either Waikiki or Manoa, all Rail alternatives will provide trip times that are the same as or longer than trips by auto. The travel times by auto reflect 2030 traffic congestion conditions without rail.

→Page 3-13: The following excerpts from the performance assessment of the Managed Lane Alternative indicate that the ML alternative did not receive minimal engineering analysis support needed to develop solutions to obvious issues:

> "While bus speeds on the managed lanes are projected to be relatively high, the H-1 freeway leading up to the managed lanes is projected to become more congested when compared with the other alternatives, because cars accessing the managed lanes would increase traffic volumes in those areas."

Instead of providing new ramps from the H-1 and H-2 freeways and a ramp from Farrington Hwy. to feed the Managed Lane facility, an already congested freeway itself was used to feed the ML. The predictable result is both more congestion on H-1 freeway and underutilization of the ML.

> "Additionally, significant congestion is anticipated to occur where the managed lanes connect to Nimitz Highway at Pacific Street near Downtown."

This occurred because a (poor) choice was made to simply use the state's proposed Nimitz Viaduct (NV) project. However, NV was conceived as a shortcut between the Keehi Interchange and downtown and was never intended to serve new traffic from the Ewa plains to town. It can still be used, but it needs to be re-engineered to provide adequate off ramps to major trip destinations. The AA's ML is under-engineered in terms of off and on ramps by a magnitude of at least three (3). Three times as many ramps are needed and can be engineered. If this is done, the quote below will have no place in the AA.

> "Hence, much of the time saved on the managed lane itself would be negated by the time spent in congestion leading up to the managed lane as well as exiting the lanes at their Downtown terminus."

Based on substantial evidence of ML being under-engineered, its performance statistics of are not representative of what a new 2-lane reversible expressway can do for this corridor.

In addition, the critical function of the ML as an escape/evacuation resource (or special event, high demand reliever) was not analyzed. The ML can be designed with Aloha Stadium and H-3 freeway as its middle anchor. In off-peak times, weekends, special events and evacuations, the ML can run from Waikele to Aloha Stadium and H-3 freeway on its west half, and from Iwilei to Aloha Stadium and H-3 freeway on its east half. Also, if Windward Oahu evacuation or high demand should occur, then the ML can be dynamically configured so that the H-3 freeway discharges both toward Ewa and toward Honolulu. In short, the ML provides extensive regional traffic management possibilities, none of which were explored.

→ ♦ Page 3-20: Table 3-10 presents projections of "vehicle hours traveled," a concept that has no application to trips using transit. This table should be reformulated to show "person *hours* of travel," to make the comparisons consistent and relevant. Based on my calculations (see Appendix 1), when these data are so converted, then the hours spent traveling on Oahu with a 20-mile Rail line will be 11% longer than the No Build. All Rail alternatives will provide worse Oahu-wide person hours of travel compared to the car and bus No Build alternative. This is consistent with past experience in the U.S. where new rail systems have not reduced traffic congestion.

→ ♦ Page 3-25. The traffic estimates for the Managed Lane alternative presented in Tables 3-12 and 3-13 appear to be based on the assumption that a freeway lane may not carry more than 1,400 vehicles per hour in order for it to operate at a good level of service. This is simply not U.S. national experience for priced lanes. For example, Appendix 2 provides a multi-week, year 2006 sample of a three-lane cross-section of California's SR-91 Managed Lanes. They operate at free flow (about 60 miles per hour) while carrying a volume of more than 2,000 vehicles per hour per lane. There is no reason why this result would not apply to a two-lane Managed Lane facility on Oahu. Based on multiple research projects I have conducted for the State of Hawaii DOT, there are several 15-minute periods during which lanes on the H-1 freeway carry over 2,400 vehicles per hour (hourly equivalent), which attests to the ability of local motorists to drive at headways necessary to result to lane capacities in excess of 2,000 vehicles per hour.

The tables in Appendix 3 provide a sample of traffic analysis, the conclusion of which is that in 2030 and with a properly designed 3-lane Managed Lane expressway, traffic congestion on the H-1 freeway will be almost the same as in 2003 while still using the AA's growth forecasts. Congestion on H-1 freeway will be incomparably worse with any of the Rail options.

→ Page 3-27: "The travel demand forecasting model has been reviewed and updated for use on the project." Following are several common-sense observations on the forecasting model:

- Oahu has no rail service, so the existing OMPO model (done with survey data which are over one decade old) naturally has no local parameters for any type of rail service. What parameters were introduced to the model to represent rail?
- Is the model representative of today's conditions? Since the OMPO model was developed, *TheBus'* share of total trips has declined in the last 10+ years, fuel costs went up in the last 10+ years, Kapolei employment was non-existent 10+ years ago, the "bust" real estate market of the early 1990s is "booming" now, the H-3 freeway did not exist 10+ years ago, safety and security issues in metro rail systems (Tokyo, London, Madrid) did not exist, and last but not least, a huge portion of Oahu's population, the baby boomers, were not on the verge of retirement. Given these circumstances, it is at least questionable whether any model based on historical data can provide useful predictions over the Alternatives Analysis' planning horizon, 2005-2030.

All these trends affect the setting of parameters and alternative-specific constants in the model. Given all these concerns, how can a fundamentally old mode choice model with "imported" parameters give any reasonable predictions for year 2030? The model should be provided for review and its parameters should be justified.

→ Page 3-28: "External factors, such as a downturn in the economy, could affect whether the island will develop as planned." The AA's forecast is truly a best case scenario which is an unrealistic basis for multibillion dollar civil infrastructure development. Below is a partial list of possible events that would make vigorous growth unlikely. For these reasons as well as the problematic construction and operation deployment of all Rail alternatives it is essential that Risk Assessment Analysis is part of this AA (see last point in this review.)

- practically zero growth in tourism
- a sustained energy crisis will cause high airfares and a reduction in tourist arrivals
- the possibility that avian flu, SARS or similar will further threaten tourism
- the Waikiki tourism plant is old, crowded and revitalization is slow
- continued reduction in agriculture
- stability in military operations and post-Iraq military downsizing to repay the war debt
- baby boomers retiring in large numbers
- substantial loss of seniority in Hawaii's Congressional Delegation will cause a dramatic decrease in earmarked projects and funds for Hawaii

Any of these reasons can cause a substantial reduction in development or expansion which makes rail an alternative that is inferior even to the simple TSM alternative.

→ Page 3-30, Table 3-14: In this summary table, the use of percentages to indicate the magnitude of the Rail alternative's impacts exaggerate the actual effects, because the actual numbers involved are quite small (as the comments above have shown).

→ Page 4-1: The Rail alternative has the highest environmental impact and displacements. Also rail is not environmentally benign once it is built and put to use. The energy units (BTUs) to transport one person one mile from the Transportation Energy Data Book: Edition 25–2006 are:

Car	3,549 BTU
Personal Truck	4,008
Transit Bus	4,160
Rail Transit	3,228

Commuting in America III reports that 70% of the transit trips in the nation occur in the New York City metro area where subways run full or near-full for extended periods. In all cities with well utilized heavy rail systems, these rail systems are busy for about four out of 24 hours per day. Unlike cars and personal trucks that spend energy only when they operate, most rail systems run continuously and draw large amounts of energy for serving few riders. Oahu's rail energy consumption will be at least twice as high as the BTUs reported above. Rail is an inferior environmentally and energy dependency alternative for Oahu.

Two critical omissions of the Alternatives Analysis report are information on the cost of the alternatives per resident and taxpayer and the absence of any risk analysis. The latter, for example, is found in any multimillion dollar project involving private funds.

1. Some argue that financial impact analysis should have been done prior to approving the raise of the General Excise Tax from 4.00% to 4.50%. However, at that time the alleged costs were in the order of about two billion dollars with a quarter of that

coming from the FTA, leaving the local tax subsidy at $1.5 billion. The AA makes it clear that for the short, 20 mile rail system, the local contribution will be at least $3 billion. A breakdown of this cost per taxpayer and per capita is essential.

2. At a minimum, risk analysis should examine the implications of a partially finished product due to a severe economic downturn or other significant impediments. Travel demand and existing congestion levels dictate that the first useful segment of a future transit system should connect the airport with the Ala Moana Shopping Center. Managed Lanes can serve this (highest demand and congestion) segment because a large part of it is the state DOT's "Nimitz Viaduct" project which has received environmental approvals. However, one cannot operate a rail system without at least one expansive rail yard. The nearest appropriate space for a rail yard identified in the AA is next to the Leeward Community College. Therefore, with any rail alternative, the lowest demand segment must be constructed first, and if conditions do no allow for it, there is the risk of developing an ineffective piece of transit infrastructure connecting LCC to Aloha Stadium.

Appendix 1. Sample Estimations in Person-Hours of Travel

The travel estimates in Table 3-10 tell a different story than the one presented. Conveniently for the rail alternatives, the AA presents "vehicle hours traveled." By using this measure, those who travel on rail conveniently disappear from the travel time calculations as if they travel at warp speed. Far from it.

Let me take the "No Build" and "20-mile Rail" estimates of the AA to demonstrate the amount of time spent for transportation with and without rail using a statistic that truly matters: Person-hours.

The No Build vehicle hours estimate is 395,000 and assuming an average vehicle occupancy of 1.6 people per vehicle (includes buses), then the 2030 estimate is:

No Build Person Hours = 395,000/1.6 = ***246,875*** (1)

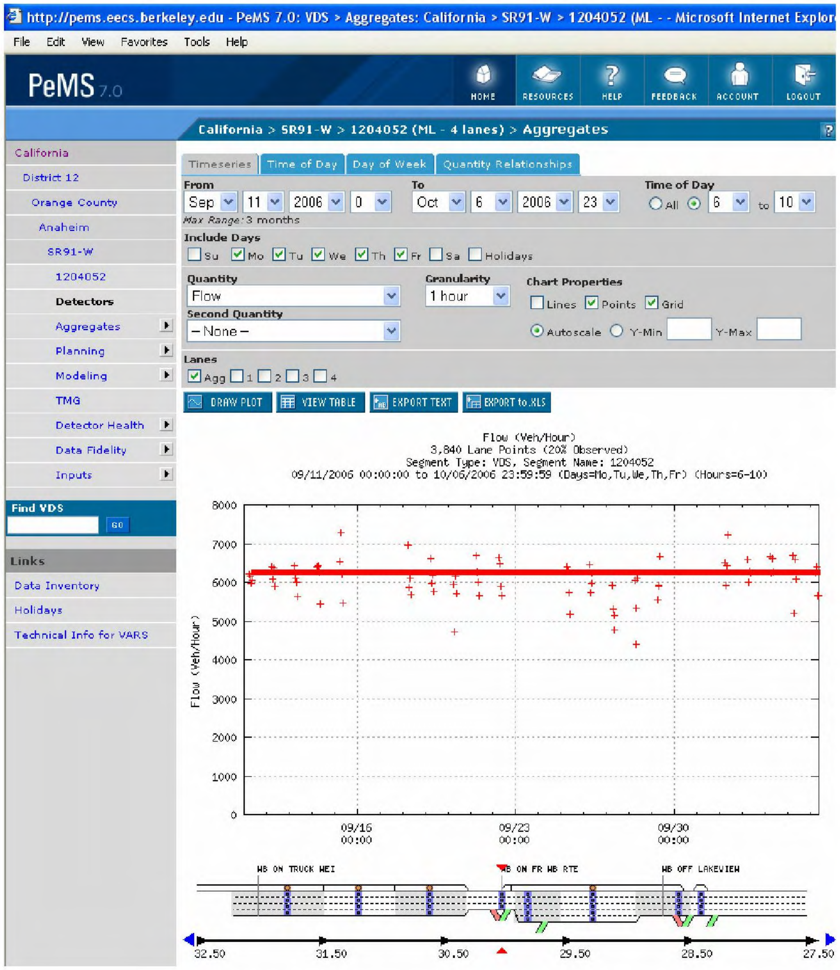
The 20-mile Rail vehicle hours estimate is 376,000 with the same average vehicle occupancy as the No Build. In addition, the 94,970 passengers in Table 3-9 are assumed to travel about half of the available rail line distance, that is, 10 miles on the average, and at the heavy rail average speed of 24 miles per hour. Their person hours of travel are, 94,970 * (10/24) = 39,571. Then the 2030 estimate is:

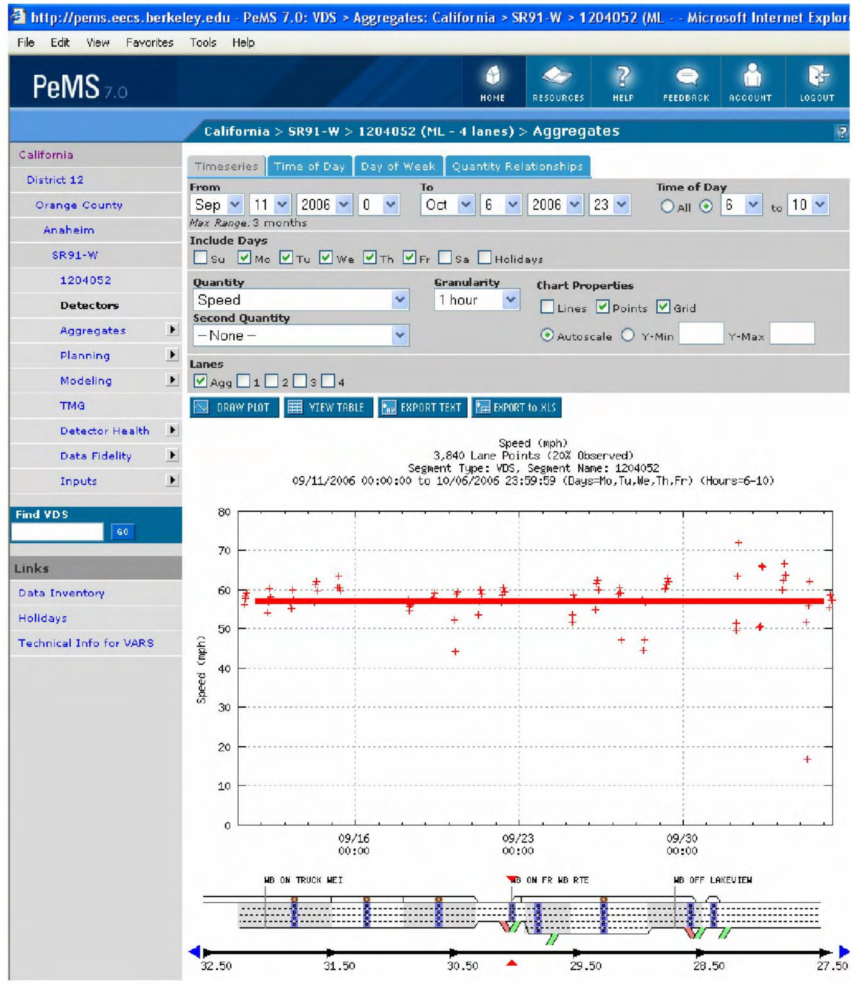
20-mile Rail Person Hours = 376,000/1.6 + 39,571 = ***274,571*** (2)

By comparing (1) and (2) it is clear that the hours spent traveling on Oahu with a 20-mile Rail line will be 11% longer than the No Build. It can be similarly proven that all Rail options will be worse than the No Build.

This outcome is not surprising because, at least in the U.S., the inability of new Rail systems to reduce traffic congestion is well established.

Appendix 2: Real Volume and Speed Operating Characteristics on California SR-91 Express Lanes





Appendix 3.a: Sample Comparisons of AA and Potential Traffic Performance

This set of estimates assumes that vehicular volume for ML is the same as the No Build. This is very conservative because in reality express buses will go from Waikele to Iwilei in 15 minutes.

	2003 Existing	2030 No Build	2030 ML wrong 2 lanes	2030 ML correct 2 lanes	2030 ML correct 3 lanes	2030 Rail (20)
H-1 Fwy	1.15	1.90	1.94	**1.76**	**1.50**	1.81
H-1 Fwy (HOV)	0.84	1.59	1.46	**0.96**	**0.96**	1.44
H-1 Fwy (Zipper)	0.89	1.29	NA	**0.85**	**0.85**	1.18
Moanalua Rd	0.97	0.60	0.57	0.57	0.57	**0.50**
Kamehameha Hwy	0.86	1.01	0.90	**0.90**	**0.90**	**0.89**
Managed Lane	NA	NA	0.79	**0.86**	**0.86**	NA

This set of estimates assumes that express buses will carry the same amount of passengers as the relatively slow and short 20 mile rail option. This is still conservative.

	2003 Existing	2030 No Build	2030 ML wrong 2 lanes	2030 ML correct 2 lanes	2030 ML correct 3 lanes	2030 Rail (20)
H-1 Fwy	1.15	1.90	1.94	**1.55**	**1.29**	1.81
H-1 Fwy (HOV)	0.84	1.59	1.46	**0.96**	**0.96**	1.44
H-1 Fwy (Zipper)	0.89	1.29	NA	**0.85**	**0.85**	1.18
Moanalua Rd	0.97	0.60	0.57	0.57	0.57	**0.50**
Kamehameha Hwy	0.86	1.01	0.90	**0.90**	**0.90**	**0.89**
Managed Lane	NA	NA	0.79	**0.86**	**0.86**	NA

(*) Kalauao Stream Koko Head bound

Highlighted cells show best 2030 V/c ratio -- lower ratio means less congestion.

ML provides the most traffic relief for the AA's highly optimistic 2030 growth rates.

With a 3-lane ML and good express buses, congestion in 2030 will be similar to 2003.

Columns without any highlighted cells contain data exactly as they appear in City's AA.

Engineered to fail: The City added a 2-lane ML and deleted the AM zipper, for a net addition of a single lane! (See Table 3-12.) This is shown above as "ML wrong". "ML correct" has the zipper lane restored.

Appendix 3.b: Detailed Traffic Volume-to-Capacity Rations for a Cross-Section in Aiea

SCREENLINE / FACILITY	Existing Conditions (2003) Facility Capacity (vph)	PB lanes	Observed Volume (vph)	Volume/ Capacity Ratio	Level of Service	2030 Facility Capacity (vph)	2030 No Build Alternative Forecast Volume (vph)	Volume/ Capacity Ratio	Level of Service	2030 Managed Lane Alternative – Two-direction Option Forecast Volume (vph)	Volume/ Capacity Ratio	Level of Service	2030 Managed Lane Alternative – Reversible Option Forecast Volume (vph)	DIFF	PB lanes	Volume/ Capacity Ratio	Level of Service
Kalauao Stream Koko Head bound																	
H-1 Fwy	9500	5	10960	1.15	F	9500	18049	1.90	F	18327	1.93	F	18419	370	5	1.94	F
H-1 Fwy (HOV)1	1900	1	1600	0.84	D	1900	3014	1.59	F	2882	1.52	F	2769	-245	1	1.46	F
H-1 Fwy (Zipper) 1	1900	1	1700	0.89	D	1900	2444	1.29	F	1677	0.88	D	NA	0	0	NA	NA
Moanalua Rd	1700		1650	0.97	E	1700	1018	0.60	B	918	0.54	A	966	-52		0.57	A
Kamehameha Hwy	3450		2960	0.86	D	3450	3498	1.01	F	3226	0.94	E	3121	-377		0.90	E
Managed Lane	4400	0	NA	NA	NA	2200	NA	NA	NA	1769	0.80	D	3457	0	2	0.79	C2
Total General Purpose Traffic	14650		15570	1.06	F	14650	22565	1.54	F	22471	1.39	F	22507			1.39	F
Total HOV Traffic	3800		3300	0.87	D	3800	5458	1.44	F	4559	1.20	F	2769			1.46	F
Total Managed Lane Traffic	NA	7	NA	NA	NA	2200	NA	NA	NA	1769	0.80	D	3457		8	0.79	C2
		correct					28023			28799			28732		wrong, should be 9		

SCREENLINE / FACILITY	CORRECTED Reversible Option (2 lanes) Forecast Volume (vph)	correct lanes	Volume/ Capacity Ratio	Level of Service		R20 option Forecast Volume (vph)	Volume/ Capacity Ratio	CORRECTED Reversible Option (3 lanes) Forecast Volume (vph)	correct lanes	Volume/ Capacity Ratio	Level of Service
Kalauao Stream Koko Head bound											
H-1 Fwy	16695	5	1.76		10% better than PB	17209	1.81	14225	5	1.50	
H-1 Fwy (HOV)1	1828	1	0.96		34% better than PB	2740	1.44	1828	1	0.96	
H-1 Fwy (Zipper) 1	1613	1	0.85		PB mysteriously deleted zippe	2241	1.18	1613	1	0.85	
Moanalua Rd	966		0.57		~ Same as PB	853	0.50	966		0.57	
Kamehameha Hwy	3121		0.90		~ Same as PB	3059	0.89	3121		0.90	
Managed Lane	3800	2	0.86		~ Same as PB	NA	NA	6270	3	0.86	
Total General Purpose Traffic	20782					21120	1.31	18312			
Total HOV Traffic	3441					4980	1.31	3441			
Total Managed Lane Traffic	3800	9				NA	NA	6270	10		
	28023	correct						28023	correct		

Identical totals -- although the reversible ML will carry many more people and a smaller number of vehicles (lower traffic volume)

SCREENLINE / FACILITY	Existing Conditions (2003) Facility Capacity (vph)	PB lanes	Observed Volume (vph)	Volume/ Capacity Ratio	Level of Service	2030 Facility Capacity (vph)	2030 No Build Alternative Forecast Volume (vph)	Volume/ Capacity Ratio	Level of Service	2030 Managed Lane Alternative – Two-direction Option Forecast Volume (vph)	Volume/ Capacity Ratio	Level of Service	2030 Managed Lane Alternative – Reversible Option Forecast Volume (vph)	DIFF	PB lanes	Volume/ Capacity Ratio	Level of Service
Kalauao Stream Koko Head bound																	
H-1 Fwy	9500	5	10960	1.15	F	9500	18049	1.90	F	18327	1.93	F	18419	370	5	1.94	F
H-1 Fwy (HOV)1	1900	1	1600	0.84	D	1900	3014	1.59	F	2882	1.52	F	2769	-245	1	1.46	F
H-1 Fwy (Zipper) 1	1900	1	1700	0.89	D	1900	2444	1.29	F	1677	0.88	D	NA	0	0	NA	NA
Moanalua Rd	1700		1650	0.97	E	1700	1018	0.60	B	918	0.54	A	966	-52		0.57	A
Kamehameha Hwy	3450		2960	0.86	D	3450	3498	1.01	F	3226	0.94	E	3121	-377		0.90	E
Managed Lane	4400	0	NA	NA	NA	2200	NA	NA	NA	1769	0.80	D	3457	0	2	0.79	C2
Total General Purpose Traffic	14650		15570	1.06	F	14650	22565	1.54	F	22471	1.39	F	22507			1.39	F
Total HOV Traffic	3800		3300	0.87	D	3800	5458	1.44	F	4559	1.20	F	2769			1.46	F
Total Managed Lane Traffic	NA	7	NA	NA	NA	2200	NA	NA	NA	1769	0.80	D	3457		8	0.79	C2
		correct					28023			28799			28732		wrong, should be 9		

SCREENLINE / FACILITY	CORRECTED Reversible Option (2 lanes) Forecast Volume (vph)	correct lanes	Volume/ Capacity Ratio	Level of Service		R20 option Forecast Volume (vph)	Volume/ Capacity Ratio	CORRECTED Reversible Option (3 lanes) Forecast Volume (vph)	correct lanes	Volume/ Capacity Ratio	Level of Service
Kalauao Stream Koko Head bound											
H-1 Fwy	14772	5	1.55		10% better than PB	17209	1.81	12302	5	1.29	
H-1 Fwy (HOV)1	1828	1	0.96		34% better than PB	2740	1.44	1828	1	0.96	
H-1 Fwy (Zipper) 1	1613	1	0.85		PB mysteriously deleted zippe	2241	1.18	1613	1	0.85	
Moanalua Rd	966		0.57		~ Same as PB	853	0.50	966		0.57	
Kamehameha Hwy	3121		0.90		~ Same as PB	3059	0.89	3121		0.90	
Managed Lane	3800	2	0.86		~ Same as PB	NA	NA	6270	3	0.86	
Total General Purpose Traffic	18859					21120	1.31	16389			
Total HOV Traffic	3441					4980	1.31	3441			
Total Managed Lane Traffic	3800	9				NA	NA	6270	10		
	26100	correct				**26100.00**		26100	correct		