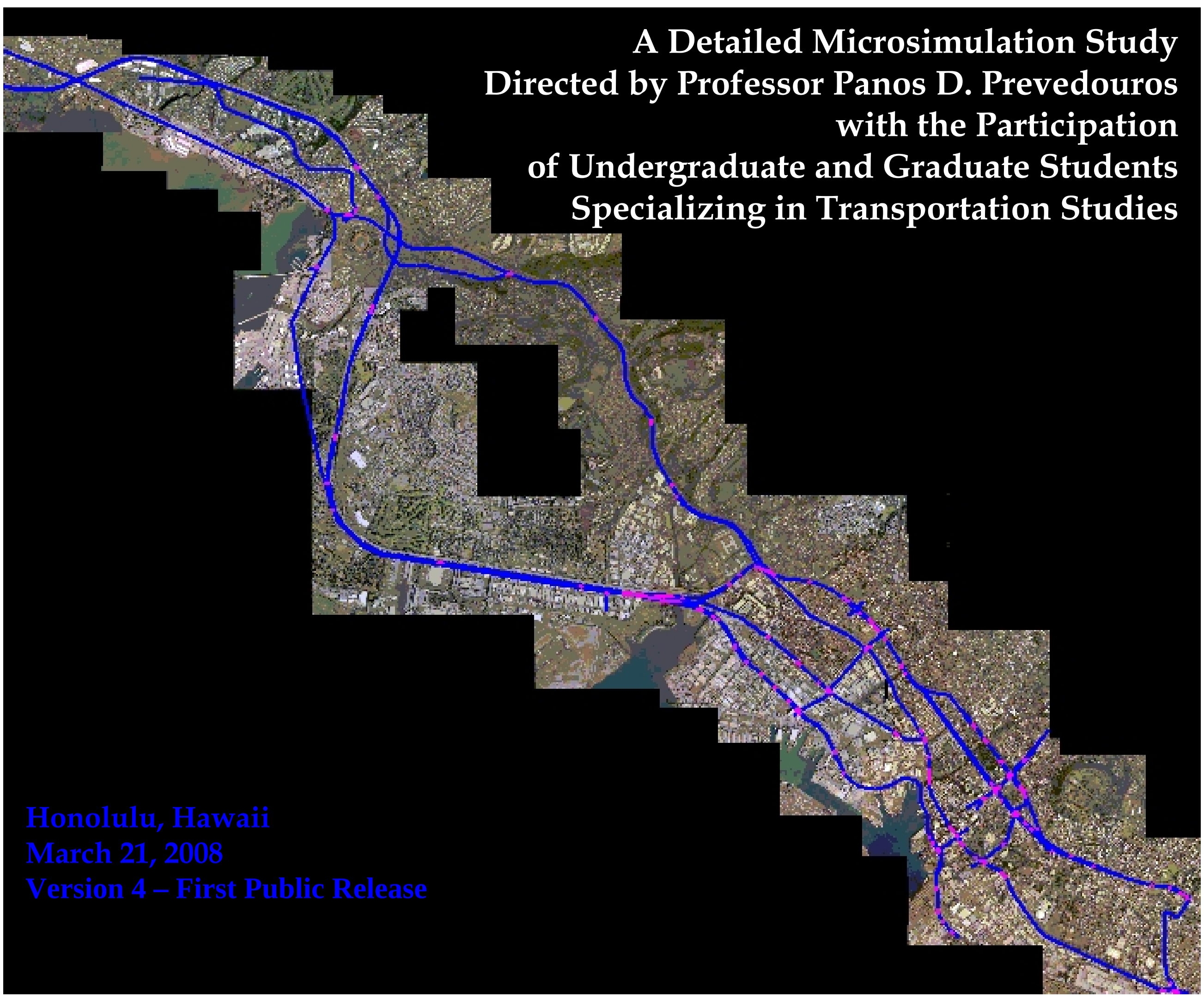
UNIVERSITY OF HAWAII AT MANOA

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TRAFFIC AND TRANSPORTATION LABORATORY

Transportation Alternatives Analysis for Mitigating Traffic Congestion between Leeward Oahu and Honolulu



A Detailed Microsimulation Study
Directed by Professor Panos D. Prevedouros
with the Participation
of Undergraduate and Graduate Students
Specializing in Transportation Studies

Honolulu, Hawaii
March 21, 2008
Version 4 – First Public Release

History of Major Report Versions

Version **1**: First round of simulations from H-1/H-2 merge to Punahou/Kalakaua screen line; model parameter calibration.
Version **2**: Finalized simulations of base, rail, HOT and underpass alternatives.
Version **3**: Added simulations with network expanded to Ewa: Fort Weaver Road to Punahou/Kalakaua screen line.
Version **3.3**: Added work on separate detailed evaluation of five underpasses.
Version **4**: Supplemental results on energy consumption estimates – First public release.
Version **5**: Supplemental information from a questionnaire survey.

About the study supervising professor and lead author

Panos D. Prevedouros, Ph.D. is Professor of Traffic and Transportation Engineering, at the Department of Civil and Environmental Engineering of the University of Hawaii at Manoa. He is the developer and coordinator, of UH's Traffic and Transportation Laboratory (TTL).

Dr. Prevedouros is a member of several national committees on transportation and he chairs the Freeway Simulation Subcommittee of the Transportation Research Board (TRB), a unit of the National Academy of Engineering. In August 2006 he became the president of the Hawaii Highway Users Alliance.

He is the co-author of *Transportation Engineering and Planning* published by Prentice-Hall and author of over 100 research reports and technical papers. He is the 2005 recipient of the Van Wagoner Award of the Institute of Transportation Engineers.

In June 2006 Dr. Prevedouros co-organized the 1st International Symposium on Freeway Operations in Athens, Greece, and he's currently organizing the 2nd Symposium on Freeway Operations in Honolulu to occur in June 2009. These conferences are a joint production of the TRB and the U.S. Department of Transportation along with several local public and private sponsors.

Dr. Prevedouros served in the Transit Advisory Task Force in 2006 and in the Technology Selection Expert Panel in 2008 of the City Council of Honolulu.

Dr. Prevedouros' extensive expertise is available at: www.eng.hawaii.edu/~panos

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Abstract

The rail system currently under consideration for the Honolulu Fixed Guideway project will cost over $5 billion, reducing total travel time by an average of 6% and delivering worse traffic congestion than today's H-1 freeway after completion. Is this the most cost effective solution for Oahu's traffic congestion problem?

A comprehensive study: To address this question, Dr. Panos D. Prevedouros at the University of Hawaii's Department of Civil and Environmental Engineering together with 16 students prepared Hawaii's largest-ever simulation study of five different congestion relief alternatives. Over 100 pages of research and gigabytes of data summarize the following key findings:

Rail transit (Cost: $5 Billion): Using data from the city-generated Alternatives Analysis and simulating a commute from the H1/H2 merge to Aloha tower, a rail transit line would reduce H-1 congestion approximately 3%, reducing drive times from 34 to 33 minutes. A rail commuter would make the same trip in approximately 41 minutes. Note that rail takes longer than driving.

HOT lanes (Cost: $1 Billion): The proposed HOT lanes facility is a reversible two- or three-lane highway on which buses and vehicles with 5 passengers or more travel for free at an average speed of 60mph (vs. rail's average 25mph). Unused capacity on HOT lanes is made available to private vehicles via an electronically computed toll which adjusts the price to keep lanes full but free flowing. Average toll price during peak commute times is estimated to be $3.50 per vehicle. HOT lanes need less or no tax subsidy; similar systems across the nation are privately funded.

HOT lanes would reduce H-1 congestion by 35%, reducing drive times from 34 to 22 minutes. An express bus commuter would make the same trip in 12.7 minutes. The greatest benefit of HOT lanes would accrue to those who never use them; they would pay no added taxes or tolls yet would experience dramatically reduced congestion.

Pearl Harbor Tunnel (Cost: $3-5 billion): A reversible 2-lane tunnel under the entrance of Pearl Harbor would connect to the Nimitz Viaduct. Drive times from Ewa to downtown would be reduced from 65 to 11 minutes and the load reduction on Ft. Weaver Road and H-1 Fwy. would bring those commuter times down from 65 to 40 minutes. The toll would have to be at least three times higher than for the HOT lanes to pay for the large cost of this option.

Four underpasses throughout urban Honolulu (Cost: $50M): One of the most cost-effective projects: introducing free-flowing underpasses in four of Honolulu's busiest intersections delivers a substantial reduction in urban traffic congestion. Overall impact on travel times are nearly equal to rail's performance, at a 99% cost savings.

Rail is the worst global warmer. Excluding New York City, transit averages 310 grams of carbon emissions per passenger mile, compared with 307 for the average 2006 model car and 147 grams from a Toyota Prius. Fuel efficiency trends clearly indicate that vehicles in 2030 will be largely non-polluting, whereas rail will still be drawing its power from today's fossil-fueled power plants.

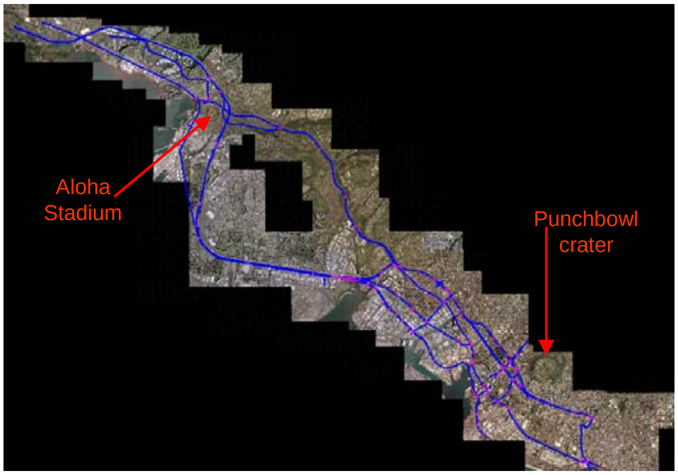
Bleak outlook. Rail's immense construction costs and operating losses will preclude the use of funding for other transportation solutions. This combined with rail's dismal performance will perpetuate Oahu's unacceptable levels of traffic congestion for residents and visitors alike.

Executive Summary

Traffic conditions on Oahu are poor along most commuter routes for at least four hours on any typical weekday. Despite the relatively small population, the density of traffic on its major thoroughfares approaches the jam capacity of parking lots. Many segments on the H-1 freeway and primary arterials operate at or under 20 mph for extended periods along the peak direction and access to Waikiki and the Ala Moana areas is slow during most daylight hours. The worst conditions are observed on the H-1 freeway between Kunia Interchange and the University Avenue Interchange.

For the third or fourth time in recent memory, some public officials are looking into 19th century technology, rail, to "solve" traffic congestion, although when pressed with facts that rail has not relieved congestion anywhere in the U.S. they sidestep the critical demand for traffic congestion relief and present rail transit as a desirable "transportation alternative." However, smaller sums of public funds can provide a much better outcome in terms of improvement to traffic conditions, and many of the non-rail alternatives are more sustainable and have a smaller carbon footprint, that is, they are superior in terms of energy and pollution for the planet.

Based on the process so far, it is quite obvious that Honolulu has not learned much from experiences elsewhere. In the 2006 Alternative Analysis (AA), the City and County of Honolulu's Department of Transportation Services evaluated alternatives which would provide congestion relief along the corridor between Kapolei and Downtown Honolulu. The alternatives examined were sufficiently manipulated to conclude that the Rail Transit Alternative would be the recommended Locally Preferred Alternative (LPA.) The Environmental Impact Statement (EIS) phase of the federally-mandated NEPA process began in December 2005; the chosen alternative, currently called "a fixed guideway," is being reviewed to determine its potential impacts.



Because of Mayor Hannemann's stated preference for the rail alternative, because of the significant drawbacks of rail transit (several of which are summarized this report,) and because other sound alternatives for congestion relief were designed to fail in the City's AA, the University of Hawaii Congestion Study (UHCS) group made a laborious attempt using detailed microsimulation to provide a fuller list of alternatives and some precise quantification of their effect on traffic congestion. Not only UHCS conducted the largest microsimulation study ever done in Hawaii but also our study of Honolulu with Vissim compares quite impressively with those conducted by major consultancies and universities in the mainland. The alternatives investigated included the following:

- **Rail** modeled as having a 6.5% or a 3.25% traffic reduction on H-1 Fwy., Kamehameha Hwy., Moanalua Fwy. The 6.5% scenario is optimistic and its results are an upper bound of what a highly successful *TheRail*[1] is likely to do to network traffic congestion.
- **Four Underpasses** which provide free-flow movement to heavy movements at four busy intersections.
- **A 2-lane or 3-lane HOT expressway** from the H-1/H-2 merge to Iwilei with a bus ramp to Fort Street Mall and a left turn underpass to Alakea St.
- A **combination** of the 2- and 3-lane HOT lanes and the four underpasses.
- **Pearl Harbor Car Ferry** system whereby a large barge transports vehicles across the mouth of Pearl Harbor with a connection to Lagoon Drive through the airport.
- **Pearl Harbor Tunnel** is a reversible 2-lane relatively short tunnel under the entrance of Pearl Harbor with cut-and-cover sections through the Honolulu International airport, priority lanes along Lagoon Drive and direct connection to the Nimitz Viaduct. Nimitz Viaduct is a 2-lane reversible "flyover" from the Keehi interchange (spaghetti junction) to Iwilei. This project has completed environmental review during the second Gov. Cayetano administration and can be put to bid at any time.

HOT expressways are primarily express high-occupancy-vehicle and public transit highways with the ability to zip traffic along at 60 miles per hour by applying a congestion-dependent toll for low occupancy vehicles so that the facility does not get inundated (and jammed) with an amount of traffic that exceeds the capacity of the facility. As a result, buses can travel 10 miles in about 10 minutes. To put this in context, a city bus would be able to travel from the Waikele Shopping Center to Aloha Tower in about 20 minutes at the height of morning rush hour. No other mass transit facility can provide such a high level of service that can actually persuade some motorists to leave their private vehicles at home and choose the express bus. On HOT expressways all buses and vanpools travel free of charge at all times.

The public, private or joint operator of the HOT lanes has the ability to set the desired level of occupancy. For example, the proposed HOT lanes on Oahu could be the *HI-5 Expressway* on which all vehicles with five or more people in them would travel for free at all times.

A 2- or 3-lane reversible highway can serve several thousand vehicles per hour. For example, a 2-lane facility can serve about 3,000 buses in one hour. But there are no 3,000 buses and large vans in all of Oahu to fill the facility. Therefore, such a highway has a lot of room available to serve low occupancy vehicles. If too many low occupancy vehicles are allowed on it, then the highway will jam, and the speed will be much less than 60 mph. How can this be controlled? With variable tolls that start at $1 for low occupancy vehicles and grow to about $5 at the height of the peak hour. In this way, fewer vehicles enter the HOT highway and its service is maintained at 60 mph. The average toll charge during the morning commute period is expected to be around $3.50 in current values.

The key to the success of a reversible HOT facility is to design proper ramps for it, as follows. Four ramps to provide access to the HOT lanes from the H-1 and H-2 freeways, and the

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[1] **Throughout the study we often call the proposed rapid rail transit alternative *TheRail*, to match existing *TheBus* and *TheBoat* monikers of Oahu's public transportation services.**

Farrington and Kamehameha highways. A ramp to Aiea and Hekaha business area. A ramp near Pearl Harbor to serve the strong employment in the area. A ramp into Aloha Stadium to serve events and use the mostly empty parking lot as a park-and-ride facility for express buses. A connection to H-3 freeway is desirable. A ramp onto Lagoon Drive to serve the airport and Mapunapuna. A ramp onto Waiakamilo Street to serve Kalihi. A ramp onto Nimitz Highway, at the point where it widens to four lanes, to serve Honolulu's center and points beyond. The HOT expressway can be configured to work in four different ways, depending on traffic loads and traffic management needs: full inbound, from Waikele to town, full outbound, from town to Waikele, during the typical weekday afternoon travel period, and split inbound and split outbound anchored at Aloha Stadium.

The proposed HOT expressway has two more important features: (1) A City Bus only elevated lane from the end of the HOT lanes in Iwilei to Hotel Street bus transit station which provides a full free flow speed travel for buses from the H-1/H-2 merge to the heart of downtown. This is shown in Figure 4.3. And, (2) a Bus Rapid Transit (BRT) couplet running along King and Beretania Streets with connections to Hotel St. and from there to the HOT lanes. This was proposed in 2002 instead of the ill-conceived "in-town" BRT plan of the City which was planned to operate on Kapiolani and Ala Moana Boulevards.

Urban underpasses separate the main flows of busy arterial streets without creating an interchange. They have advantages such as ability to fit within existing roadway space, can preserve several turning movements, reduce traffic conflicts as well as conflicts with pedestrians, and have the potential to dramatically reduce delays with no road widening. Underpasses are a "win-win" arrangement for both intersecting streets. The vehicles using the underpass receive in essence a constant green light and their delay is reduced to practically zero. Since a large portion of the traffic has been removed from the at-grade part of the intersection, all the rest of the vehicles receive larger shares of green resulting in substantially reduced delays. In addition, the conflicts of vehicles with pedestrians at the intersection are reduced substantially. Our traffic simulation results display substantial improvements. The largest improvement, as expected, is for the vehicles using the underpass which typically improves from level-of-service (LOS) F to LOS A. In all cases, overall intersection LOS improves by at least one level; for example, the LOS for the Pali/Vineyard intersection improves from F to C, which reflects a "day and night" difference in peak hour traffic operations.

Any transportation alternative that involves several hundred million dollars in infrastructure costs has to provide a substantial congestion relief in order to be deemed cost-effective and appropriate for public financing. First we report travel times between the H-1/H-2 merge and Aloha Tower/Alakea Street in downtown Honolulu . In the optimistic case of *TheRail* removing 6.5% of cars from H-1 and Moanalua freeways and from Kamehameha Hwy. , the result is that car travel time will be reduced from 34 to 33 minutes, a reduction of 3%. Typically changes under 5% are not noticeable in a traffic network. A rail passenger will need 41 minutes, which is 8.4 minutes longer than a car using the congested H-1 freeway. A more realistic scenario is that a rail transit system will remove about 3% of cars on the three major roadways mentioned above. In this case, rail transit does not improve travel times at all.

On the 2-lane HOT lane expressway, an express bus will make this trip in 12.7 minutes or 64% faster than today. A car that did not pay a toll but did the trip on the free route along H-1 freeway and Nimitz Hwy. will make the trip in 22.1 minutes or 35% faster than today. The 3-lane HOT lane expressway scenario shows that travel time improvement would be even higher. Good reasons for building a 3-lane reversible expressway instead of a 2-lane one are that capacity is 50% more at a cost that is about 15% more and a 3-lane facility would be more able to aid in evacuations and emergencies, as well as provide a dedicated bus lane, should this become a necessity or financing requirement.

The travel times indicate that the commute trips from Ewa to downtown are very long. If a quick ferry (barge) service is provided, then the travel time from Ewa to downtown can be reduced to about 37 minutes, or by 44%. This is feasible for up to 500 vehicles per hour, with two or three large barges. A tunnel that connects directly to Lagoon Drive will provide a rather grand travel time reduction from 65 minutes to 11 minutes. This should come as no surprise because the length of this trip becomes 23% shorter: 13.6 instead of 17.7 miles (Ewa to Iwilei), and made at free flow speeds for the entire length of it. The toll tunnel has the potential to remove a substantial amount of traffic from Ft. Weaver Road and the H-1 Fwy., therefore, the trip along those free routes is also expected to be reduced significantly, to about 40.3 minutes.

	TOTAL TRAVEL TIME
Rail: 3.25% traffic reduction	-6%
Four Underpasses	-5%
3-lane HOT and Four Underpasses	-34%
Pearl Harbor Tunnel	-15%

KEY			
KEY	small change; likely not worth the cost	large improve-ment; a likely solution	very large improve-ment

In addition to travel times, (1) there are other important measures of performance such as average speed, number of stoppages and network throughput, and (2) there is a whole street network between Waikele and Moiliili. Detailed results are presented in the report. They boil down to these estimated travel time improvements. Rail transit fails to produce results that would make it at least a small solution to congestion. It is interesting that the network wide impacts of a massive $5 billion rail line are basically the same as the traffic benefits of four underpasses costing around $50 million to build.

The ferry option does not have significant network impacts but it provides substantial relief for 500 vehicles per hour from Ewa and Ewa Beach to Lagoon Drive. It is therefore highly advisable that the ineffective, unreliable and expensive *TheBoat* is replaced by *TheFerry*. From a network performance standpoint the tunnel will offer a substantial relief to traffic congestion.

Twenty Year Cost per Peak Hour Commuter is a critical measure that lets the reader compare long term effectiveness (bang for the buck.) Using this cost-effectiveness criterion is easy to show the fallacy of providing alternatives such as *TheBoat*, which cost the taxpayers one million dollars to remove one driver from the road. The proposed rail transit is even worse as a cost of $4,192,000. This is the cost for serving one on (ex) car commuter over 20 years. Notably, our 20-year figure (which includes installation, operation and maintenance costs) does not include the necessary refurbishment of rail transit, which typically runs in the billions every 20 to 30 years. The Operating and Maintenance cost shown for highway alternatives include repaving and tunnel cleaning. The comparative HOT lane cost is $84,000 and the Pearl Harbor tunnel cost is $392,000. Additional important measures are compared in the table on page ix.

Last but not least, rail will likely worsen Oahu's dependency on oil. Simulation results clearly show the large benefits obtained when real solutions are implemented. Congestion reduction results in substantial savings in fuel consumption, which is a reduction on energy dependency.

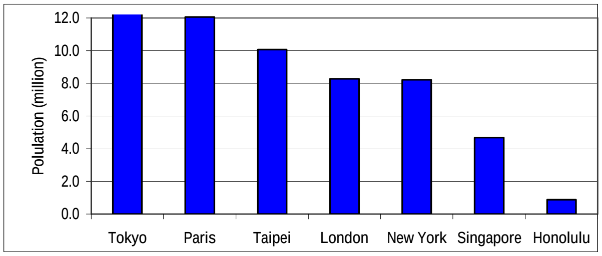
Fuel Consumption for One Peak Hour (in US gallons) Change from Base of ~97,000 gallons		
ALTERNATIVE	**Motor Fuel**	**Motor Fuel plus Diesel at HECO for Rail**
Rail: 6.5% traffic reduction	-2.6%	-0.3%
Rail: 3.25% traffic reduction	-0.4%	1.9%
HOT Lanes and Four Underpasses	-40.5%	-40.5%

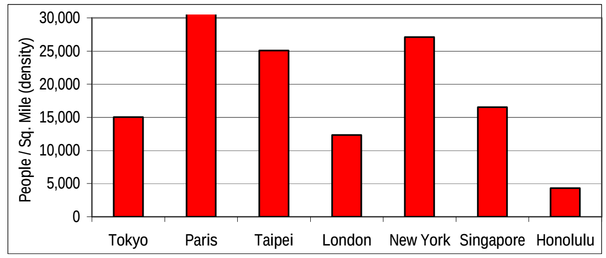
In conclusion, by all accounts, the only reason that rail may be the solution is only because a handful of elected officials say so. Simply put, Hawaii is still a place where elected officials call the solutions upfront, and then require that public and private sector professionals prove them right. This was clearly the case with the 2006 Alternatives Analysis. The increased general excise tax combined with the future tax increases to sustain *TheRail* and the worsening traffic congestion will generate a strong and perennial loss to Oahu's economy. Not only do projects such as *TheRail* and *TheBoat* not resolve congestion but they also consume most of Oahu's transportation taxes leaving little funds for highway and bottleneck improvement. The proposed rail line should be expected to have significant negative implications to the Ko'Olina and Disney resorts, the Campbell Industrial Park, Barbers Point Harbor as well as the entire leeward Oahu since highway congestion will be far worse with it in 2030 making all these places hard to access, therefore undesirable for commerce, businesses, tourists and residents alike.

A reversible HOT lane expressway from Waikele to Iwilei, combined with a handful of underpasses, traffic signal upgrades and optimization, and a Bus Rapid Transit that runs along King and Beretania Streets are the main ingredients to providing the solution to both congestion and mobility issues on Oahu at a cost that the local tax base can afford. In turn these will improve development opportunities, quality of life and social welfare.

Additional highlights of reasons why the proposed rapid transit rail system defies logic are as follows:

- Honolulu's metropolitan area population rank is very low at 56th in the nation with a population of 880,000 which includes the entire island. The smallest US metropolitan area with rapid transit is Cleveland, Ohio with a rank of 15 and population of 3,000,000.
- Light Rail by definition uses extensive lengths of at-grade alignment, whereas Honolulu's rail has no at-grade lengths and it is by definition a "heavy rail," or "rapid transit" system. The smallest US city with a light rail system is Buffalo, New York with a rank of 43 and population of 1.2 million. Buffalo's system is tiny at 6.6 miles, relative to the 28 to 34 mile proposal for Oahu.
- People often refer to large rail systems in world capitals. Here are some sample comparisons of magnitudes, starting with two island metropolitan cities: **Singapore** has a population of 4.7 million and a density of 16,392 people per square mile. **Taipei** in Taiwan has a population of 2.6 million and a density of 25,031 people per square mile. There are large metrorail systems in London, New York City, Paris and Tokyo among others. The respective densities of these cities are 12,331 for **London**, 27,083 for **New York City**, 52,921 for **Paris** and 35,559 for **Tokyo**. The density in urban **Honolulu** is 4,337 people per square mile. In terms of population, London is the least populous of these four large cities. Entire Oahu has a population eight times smaller than London. The graphs on the next page show how tiny Honolulu is in comparison.





- Rapid transit rail was built in Jan Juan, Puerto Rico and it has a dismal performance since it attracts less than one third of its projected 80,000 ridership. *TheRail* expects over 128,000 riders for Oahu's 0.9 million people, whereas the much poorer (and thus more dependent on transit) Puerto Rico of 3.8 million people generate fewer than 30,000 trips!
- In general, U.S. metrorail ridership numbers are dismal for new systems. In comparing the actual average weekday boardings in the transit agency's forecast year with the projected boardings for that year which were made at the AA/DEIS decision point, the average for all 19 projects for which data were available is 65%. Only three exceeded their projections (by between 1% and 34%), and the range among those falling short is very wide—from a low of 6% (Jacksonville people mover) to many others in the 40%-60% range, with others in the 70%-80% range. Some rail projects with fairly high percentages achieved them simply by aiming low: BART's Colma extension got 86% of what it projected, but that amounted to only 13,060 weekday boardings, for a very costly heavy-rail line; likewise for Baltimore's heavy-rail Johns Hopkins extension, averaging only 10,128 weekday boardings. For comparison, Honolulu's minimum expectation is for about 90,000 riders for its minimum operating segment of 20 miles.
- Rail is 19th century polluting technology. In the U.S., excluding the New York metro area which has an exceptionally high transit mode share compared to anywhere else in the USA, transit averages 310 grams per passenger mile, compared with 307 for the average 2006 model car and 328 for the overall car fleet in 2006. The 2007 Toyota Prius hybrid car measures at 147, and a 2008 Peugeot hybrid diesel (available in Europe) at 101. Both are comparable or better than New York metro area transit (140). However, technology is moving toward more efficient and less intensive greenhouse gas vehicles. In 2030 vehicles will be largely non-polluting, whereas rail will be a fossil energy relic.
- Based on Arizona DOT analysis, HOT lanes are roughly ten times cheaper per passenger mile than light rail which is estimated at up to 35 cents per passenger mile. Comparing this to the over 700 cents per passenger mile of *TheRail* proposal, makes it clear that a $5 billion rail project is entirely inappropriate for Honolulu.
- The failure of Sound Transit in Seattle is a luminous prediction of rail for Oahu: In 1996, officials affirmed that the construction of Sound Transit would cost $3.9 billion and be completed in 10 years. In 2007, costs skyrocketed to $15 billion with an estimated completion time of 24 years. With an expected 351,000 riders on the rail system, the cost to take one passenger vehicle off the roadway would be roughly $100,000 per person.
- This quote from the Seattle Time editorial also tells it like it is: "Consider Portland. That city opened its first light-rail line two decades ago, and has built several of them, all of which replaced bus lines. Overall, Greater Portland is no less car-dependent than Seattle. Its congestion has gotten worse, just as it has here. Many Portlanders are proud of light rail, but the last three times new light-rail plans have been on the ballot in the Portland area, the people rejected them. Maybe they learned something."
- Unlike the relative simplicity of highways, metro rail (heavy and light rail) is a complex electromechanical system with literally millions of wearing and weathering components, in addition to those destroyed by misuse or vandalism. Consider this quote from the Santa Clara Times: "At 35, BART is getting old. The transit system's board approved a 25-year road map that foresees the need to spend $11.4 billion on hardware and equipment."

Table E.S.1. Comparison of Selected Transportation Alternatives

	TheRail	TheBoat	HOT lanes	Toll Tunnel
COST				
Capital Cost (Billion)	$5-6	Lease (in O&M)	$0.90	$3-5
Likely Local Tax Burden to Build It	$5,000,000,000	Lease (in O&M)	$400,000,000	$1,250,000,000
Tax Burden per Oahu Resident	$5,523	$6	$442	$1,381
Annual O&M Cost	$64,400,000	$6,000,000	$11,500,000	$14,300,000
Fare or Toll	$2 / Person	$2 / Person	$1-$3 / Car	$2-$6 / Car
GET Increase	Yes, from 4.1% to 4.7%	None	None	None
Property Tax Increase	40%	No	No	No
Likely Peak Hour, Peak Direction People Moved*	1,500	120	7,540	3,910
20 Year Cost per Peak Hour Commuter	**$4,192,000**	**$1,000,000**	**$83,554**	**$392,839**
Year Fully Completed (20 miles of Rail)	2018+	2007	2015	2016
Crime: Needs Transit Police	Yes	No	No	No
Uses U.S. Technology / Know How to Maintain	No/No	Yes/Yes	Yes/Yes	Yes/Yes
Funding Eligibility FHWA - FTA - PPP	No-25%-No	No-25%-No	80%-10%-50%	80%-No-50%
CONSTRUCTION				
Large Parking Lots	4 Planned Need More	Yes, 2	No	No
New Electric Power Plant	Yes	No	No	No
Stations	21-29	2	No Need	No Need
Overall Investment and Construction Risk, 10 is best	4.2	10	6.8	2.1

	TheRail	TheBoat	HOT lanes	Toll Tunnel
PERFORMANCE				
Average Speed	25 mph	20 mph	60 mph	50 mph
Kapolei to Downtown (minutes, approx.)	65	80	25	15
Waikele to Waikiki Corridor Travel Time Reduction	**-6%**	**0%**	**-34%**	**-15%**
Slow Downs or Shut Downs	Power Failure, Mech. Failure, Suicide, Strike, Crime	Mech. Failure, Strike, Crime	Very Few Crashes on Freeflow Lanes without Trucks	Very Few Crashes on Freeflow Lanes without Trucks
SERVICE TO COMMUNITY				
Affects *TheBus*	Very Negative	Mostly Neutral	Very Positive	Somewhat Positive
Support Express Routes	No	No	Yes	Yes
Serves Public Buses, Tour Buses, and Vanpools	No	No	Yes, Free	Yes
Helps Business, Tourism and Economy	No	No	Yes	Yes
Good Option for Unemployed, Seniors, Disabled	No	No	Yes	Yes
Connects to King / Beretania Bus Rapid Transit to UH?	Transfer	Transfer	Express, Direct	Express, Direct
Emergency Response	No	No	Fast and Wide-spread	Fast but Limited
OTHER CHARACTERISTICS				
Noise Pollution	Steel Wheels on Steel Rails	No Impact	Very Little Noise	Most Quiet Highway Option
Carbon Footprint (Pollution)	Very High Because Roadways Remain Clogged	Relatively Huge Consumption per Passenger Mile	Lowest Because It Resolves Congestion	Second Lowest; It Resolves Some Congestion
Future Solar, Hydrogen, Battery Technologies	Old, Fixed Technology	Old, Fixed Technology	Markets and People Adapt	Markets and People Adapt

(*) TheRail and *TheBoat* number of people include those who were drivers. Those who switched to rail from vanpools and *TheBus* are not counted because they were not significant contributors to traffic congestion.

(**) All figures in approximate year 2005 to 2007 time frame.