

A Design for a HOT Expressway and Other Traffic Relief Projects for Oahu

By Panos D. Prevedouros, PhD, 12/21/2006 10:10:01 AM

The only effective solution to Oahu's traffic congestion on the leeward corridor is a 2- or 3-lane reversible High Occupancy and Toll (HOT) Expressway with several ramps and a handful of in-town underpasses. Such a facility will provide extensive flexibility to handle variable surges of traffic due to commuting flows, special events or emergencies.

HOT expressways are primarily express high-occupancy-vehicle and public transit highways with the ability to zip traffic along at 60 miles per hour. As a result, buses can travel 10 miles in about 10 minutes. To put this in context, imagine a city bus which can go from the Waikale 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 will actually persuade some people 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.

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



In other words, the toll enables the government or other project operator to sell unused space to low occupancy vehicles. Tolls can generate a cash flow to pay for the facility.

Instantly, this concept makes these highways appealing to investors because a steady income and a reasonable return for their upfront investment for construction can be made. There are several investment funds worldwide that specialize in tollway and HOT lane

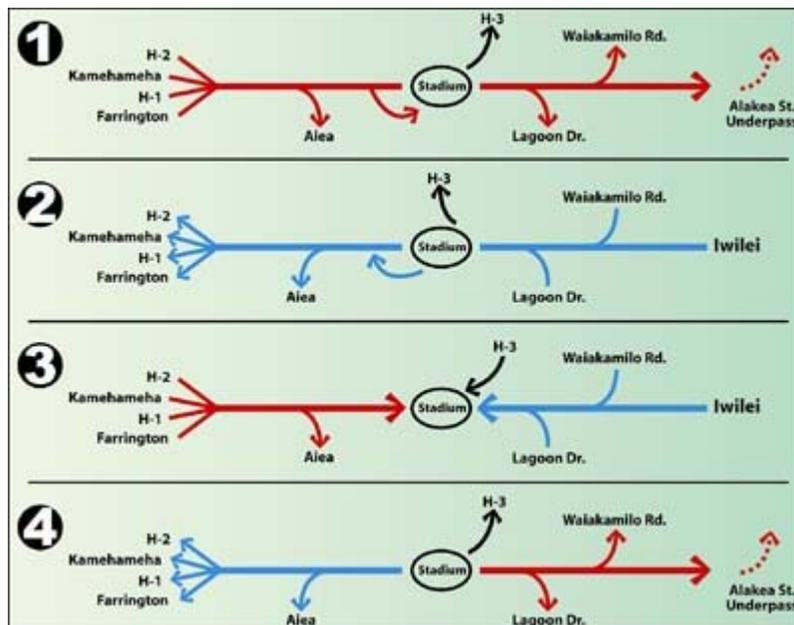
development and the U.S. federal government strongly supports PPP, or public-private partnerships. Alternatively, the tolls collected from all-public HOT expressways retire some of the bond debt, and support express bus operations; San Diego does this.

Most people want to have a choice for paying a toll and getting to town in 15 to 20 minutes. Self-employed practitioners would be happy to pay a few dollars of toll and in return get the opportunity to make an extra house call and make extra income. But even those who cannot afford to pay the toll will benefit significantly. For a three lane highway, over 4,000 low occupancy vehicles per hour can use the facility along with city buses, tour buses and vanpools. As a result, over 5,000 vehicles per

hour will vacate the H-1 freeway prior to its merge with the H-2 freeway. Those who stay on the H-1 freeway will enjoy a 10 to 15 minute savings in peak hour travel time, for free.

The key to the success of a reversible HOT facility is to design proper ramps for it. The figure below shows a design with 10 ramps. The ramps that serve as on-ramps in the morning, become off-ramps in the afternoon. This is explained later. Let's look at the ramps first.

- Four ramps to provide access to the HOT lanes from the H-1 and H-2 freeways, and the 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.
- 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.



This HOT highway can then continue into town in a flyover Skybus configuration for public transit buses only to serve major destinations such as:

Waikiki with a flyover lane which terminates near Ala Moana Shopping Center or at the Convention Center and buses continue onto surface streets, and

University of Hawaii, Manoa campus, with a flyover spur which terminates on University Avenue, mauka of Date St., and the buses continue onto surface streets to

reach the campus.

The following picture demonstrates the flexibility and multiple utility of the reversible facility to handle directional, imbalanced and emergency traffic flows.

The HOT expressway can be configured to work in four different ways, depending on traffic loads and traffic management needs. The red direction is Koko Head-bound, and the blue direction is Ewa-bound.

- Full inbound, from Waikale to town, during the typical weekday morning travel period.
- Full outbound, from town to Waikale, during the typical weekday afternoon travel period.

- Split inbound, from Waikēle and town to Aloha Stadium and H-3 freeway, before the start of a major event at Aloha Stadium and during most weekends. This configuration also facilitates traffic to windward Oahu in case of a major problem on the Likelike and Pali highways, or other emergency.
- Split outbound, from Aloha Stadium and H-3 freeway to Waikēle and town, at the end of a major event at Aloha Stadium. This configuration will help relieve the neighborhoods adjacent to Aloha Stadium in half the current time.

Tampa, Florida has a 3-lane reversible facility with all these features, so the electronics, traffic controls and ramp gates required for these operations are already in practice.

A reversible HOT expressway will be a substantial employer of engineering and computer talent as well as field personnel in order to run efficiently and safely.

HOT facilities are at the forefront of national policy for resolving congestion. Here are some specifics as to where existing and planned HOT lanes are in the nation:

- In addition to Los Angeles and San Diego HOT lanes, Washington, D.C., metro area includes four new HOT lanes along 15 miles of the Capital Beltway in Virginia, and six new HOT lanes along 18 miles in Maryland.
- In San Francisco, the Metropolitan Commission's 2030 Plan advocates a HOT network.
- Houston's 2025 Regional Transportation Plan plans to expand the existing HOT lanes.
- The Miami-Dade 2030 Transportation Plan includes conversion of existing HOV lanes to reversible HOT lanes to provide additional capacity.
- Other areas are applying for grants provided by the U.S. DOT Value Pricing Program including the Port Authority of New York and New Jersey; San Antonio, Seattle, Atlanta, and Portland.

Traffic in town can be reduced by at least one third by (a) optimizing traffic signal operations, (b) eliminating several left turns that are accident prone and sap intersection capacity, and (c) constructing a few key underpasses to de-congest "maxed-out" or gridlocked intersections.

The nation's capital and Singapore are a treasure trove of urban underpasses. London built several "substandard" underpasses in the 1980s to help its congestion condition. Athens built nine underpasses in one year, in preparation of the 2004 Olympics. "Substandard" underpasses have a limited height that allows for regular city buses to fit, but taller vehicles do not. Lower height underpasses are much more compact and therefore easier and cheaper to construct in the limited space of existing intersections. (See reference for more information.)

These underpasses will do a lot of good:

- A left turn underpass from Nimitz Highway to Alakea Street. This can be configured to also connect to Halekauwila St. This underpass will provide continuous flow left turns and will replace both of the existing left turns with stoplights. Not only left turn wait time will drop from a couple of minutes per car to zero, but also the Ewa-bound traffic on Nimitz Hwy. will have a longer green and lesser congestion. In general, underpasses are win-win, for both intersecting streets.
- Punchbowl through traffic going under Vineyard Blvd. (A 2-lane underpass is far superior to existing 4 lanes with stoplights.) One lane can continue as a mini-tunnel and surface makai of Beretania St.
- Pali Hwy. through traffic going under Vineyard Blvd. (A 3-lane underpass with the middle lane being adjusted to serve morning and afternoon peaks is far superior to the existing 6

lanes with stoplights.) Again, one lane can continue as a mini-tunnel and surface makai of Beretania St.

- Left turn from Ala Moana Blvd. onto Atkinson Dr. (A 1-lane underpass will provide a capacity equivalent of 5 lanes with the existing traffic light.)
- Kalakaua Ave. through traffic going under Kapiolani Blvd. (A 2-lane underpass is far superior to existing 4 lanes with stoplights.)
- Kapiolani Blvd. through traffic going under Date St. (A 4-lane underpass with the middle lanes being adjusted to serve morning and afternoon peaks will be far superior to the existing 6 lanes with stoplights.)
- University Ave. through traffic going under King St. (A 2-lane underpass is far superior to existing 4 lanes with stoplights.)

All these short underpasses can be built for roughly \$100 million and reduce congestion by 25% to 50%. Their benefit in terms of delay saved (cumulative wasted time valued at minimum wage) will surpass their cost in less than three years. The benefits do not account for the resultant friendlier and safer pedestrian environment which is the product of a substantial amount of traffic going under and away from the surface crossings.

What I described above is a sample of capital-intensive 21st century solutions to Oahu's 21st century traffic congestion problems. I leave it up to non-experts to ignore all these and deploy obsolete, inflexible, hyper-expensive, heavy rail-based non-solutions to worsen Oahu's traffic problems!

Ref: Gregory Dehnert and Panos D. Prevedouros, "Reducing Congestion with Low Clearance Underpasses at Urban Intersections: Investigation and Case Study." Journal of the Institute of Transportation Engineers, Vol. 74, No. 3: 36-47, March 2004. Paper received 2005 ITE Van Wagoner Award.

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See material relating to the City's proposed rail transit on:

www.honolulutraffic.com