HONOLULU'S ZIPPER LANE: A MOVEABLE BARRIER HOV APPLICATION

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ABSTRACT

As a consequence of its narrow, linear nature and its high-density land use pattern, the primary urban corridor of the city of Honolulu, Hawaii is one of the most congested in the nation. The H-1 interstate highway and several parallel major arterials serve the corridor. Among the Transportation System Management (TSM) actions implemented within the corridor over the years are a 2+ concurrent-flow HOV lane along a portion of the H-1 and several coned peak-period lanes on the arterial system.

A feasibility study conducted in 1995 recommended the addition of a morning peak-period contra-flow lane paralleling the 2+ concurrent-flow lane for buses, vanpools and carpools carrying three or more persons. Safety concerns motivated the consideration of a moveable barrier system. The "Zipper Lane" was opened to traffic in the fall of 1998.

This paper describes the background, design and operational characteristics of the system and, by assembling data from a variety of existing sources, provides a quick assessment of the new facility. Varying opinions about proper usage are also described.

INTRODUCTION

The island of Oahu where Honolulu is located constitutes a single local jurisdiction with an elected mayor and a nine-member city council. The de facto population of the island (which includes visitors) is about 1,000,000 persons.

Figure 1 illustrates the urbanized areas on Oahu in yellow and shows the high-density Primary Urban Center (PUC) at the southern part of the island where the CBD is located. In 1990, the PUC contained 52% of the population and 77% of Oahu's total employment. Mountains (the Koolau Range) bound this corridor to the north and the ocean to the south. Central Oahu contained 16% of the population and 9% of the total employment, and East Honolulu had 5.5% of the resident population but only 1.3% of the jobs. The suburban areas across the Koolaus included 14% of the residents and 6.5% of the total employment. The Ewa Plain (i.e., the region in the southwest corner) is slated for future growth as the Second City of Kapolei. Its population and employment are projected to grow, respectively, from 5 and 2.5% in 1990 to 12 and 11% in 2020. Total population and employment are expected to increase by 28% and 37% during the same period. Thus the PUC is expected to remain the major locus of both population and employment for the foreseeable future [1].

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Figure 1: City & County of Honolulu (Island of Oahu)

The areas coded in pink represent areas under the jurisdiction of the military. Of these, 2,000 of the 3,300 acres occupied by the Barbers Point Naval Air Station in the Ewa Plain at the southwest corner are being converted to civilian use. The figure also shows the highway system that includes interstate (and defense) highways H-1, H-2 and H-3 (shown in purple), major state highways (heavy black) and local streets and roadways. One of the last segments of the interstate system to be completed, H-3 was fully opened in December 1997.

As a result of the linear development pattern, high density and geographical constraints, the roadway system within the PUC is one of the most congested areas in the nation [2].

CONGESTION MITIGATION ACTIONS

It has been reported [e.g., Ref. 3] that peak-period coned contra-flow lanes had first been applied in Honolulu as early as 1952 along an arterial street within the PUC. The practice was extended to suburban routes during the 1970s, a period that witnessed a major emphasis on Transportation System Management (TSM) approaches to capacity...
enhancement. The first official "TSM Element" of Oahu's regional transportation plan, issued in response to joint regulations by the Federal Highway Administration (FHWA) and the Urban Mass Transportation Administration (UMTA, now FTA, Federal Transit Administration), included reversible lanes among the various applicable actions [4]. A major adjunct strategy, however, was the introduction, as it was the case throughout the U.S., of the idea of high occupancy vehicle (HOV) lanes, whether contra-flow or concurrent. The first exclusive-bus contra-flow lane on Oahu was opened in 1973 along the single major arterial highway in East Honolulu that transitions to H-1 (Fig. 1). Express bus service was provided to the University of Hawaii at Manoa (UH in Fig. 1) and the Honolulu CBD [6].

In 1976, the lane was opened to carpools, initially carrying 4 or more people. Partly as the result of public opposition the legal definition of carpools was reduced over the years to 2 or more persons. Since then a variety of TSM and what came to be known as TDM (Transportation Demand Management) actions have been either considered, analyzed or implemented [e.g., Ref. 7]. Among them were concurrent HOV lanes for buses, carpools and vanpools on portions of interstate routes H-1 and H-2. The first publicly supported vanpool program on Oahu was started in 1976 on an experimental basis as an energy-saving measure [7] but only lasted through the "energy crises" of the time [8]. A state and federally subsidized vanpool program was revived in 1994 through a private provider under contract with the HDOT [9]. Subsidized vanpool services are also provided by the Leeward Oahu Transportation Management Association (LOTMA), a non-profit entity supported by several major landowners and developers in the leeward area of Oahu [10]. LOTMA also offers carpool matching and subscription bus services.

The latest regional transportation plan for Oahu was issued in 1995. It identifies short-term and long-term (to the year 2020) strategies and actions to guide "the development of an integrated intermodal transportation system that facilitates the efficient movement of people and goods [1]." Among these is an integrated HOV lane system, including the addition of contra-flow and median HOV lanes along H-1 to the then existing peak-period concurrent flow HOV lanes.

FEASIBILITY STUDY

A feasibility study for a contra-flow/shoulder lane combination was being undertaken at the same time by the HDOT [11]. The study took an inventory of existing conditions and indicated that the segment of H-1 between H-2 (Waiawa Interchange) and Keehi Interchange (see Fig. 1) had been originally designed as an eight-lane facility meeting interstate standards (i.e., 12-foot lanes, adequate shoulders etc.). The Keehi Interchange (a major morning peak bottleneck) is very complex and leads to a number of arterial streets connecting to the Honolulu CBD.

Some years before, the segment from H-2 to the interchange with the (future) H-3 (Halawa interchange) was re-striped for ten 11-foot lanes, and the right shoulders in each
direction were used as a.m. and p.m. peak-period travel lanes respectively. The median lanes in each direction were designated for 2+ HOV peak-period operation all the way to the Keehi Interchange. A 35 to 40% violation rate in the concurrent-flow HOV lanes was partly explained as the result of a lack of a safe area to which violators could be directed. The left-shoulder had been narrowed (to as little as 2 feet at some places) to provide the extra lanes discussed earlier. Prudently, police officers were unwilling to exacerbate traffic congestion by stopping violators in order to issue citations, several attempts to initiate enforcement via photographic evidence having been rebuffed by the state legislature out of concern for the protection of privacy.

Volume counts indicated an Average Daily Volume of 215,000 vehicles, representing a 60% increase during a ten-year period due to population growth in Central and Leeward Oahu. The peak-period level of service (LOS) was found to be F at several locations in the inbound (but not the outbound) direction. Moreover, the a.m. directional split was estimated at 70/30, whereas during the evening peak the split was almost 50/50 at several spots. Based on these findings the study proceeded to investigate two alternative contra-flow lane schemes for the morning period only. The project was considered to be a short-term measure because, according to preliminary travel demand forecasts conducted as part of the regional transportation plan update, the expected growth on the Ewa Plain was expected to balance the directional flows. The study estimated that the contra-flow lane would result in travel-time savings of 10-20 minutes.

ALTERNATIVES

The two contra-flow schemes were:

1. Use of plastic pylons manually inserted in pre-installed sleeves for a bus and vanpool only lane because of the higher visibility of these types of vehicles from the perspective of drivers in opposite direction

2. Use of the proprietary concrete Quickchange Moveable Barrier (QMB) system for positive separation between the two traffic directions

Parenthetically, a memorandum issued on March 25, 1994 by the Executive Director of FHWA [12] had declared the QMB system to have been "acceptably crash tested" and to have "performed successfully in field use." It also states that, through actual deployment in several states over a period of 6 years, the QMB was found to be applicable to reversible lanes and to safety barrier applications in work zones

Because of its proprietary nature and the need for sole-source procurement, the QMB was determined to be eligible for federal aid if classified as experimental or in the absence of an "equally suitable alternative."

Caltrans had conducted crash tests in accordance with the vehicle trajectory requirements issued by the National Cooperative Highway Research program [13]. These tests

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b rights owned by Barrier Systems Inc., Carson City, Nevada
involved two large (4,370 and 4,300 lb.) and two small (2,000 and 1,890 lb.) cars. The large cars were travelling respectively at 59.3 and 59.4 mph and 24 and 16-degree impact angles. The two small cars approached at 15.5 and 20.5 degrees at 57.7 and 58.6 mph [14].

The QMB system consists of two parts: units having a modified New Jersey-type cross-section with a T-shaped top (Fig. 2), and a Transport and Transfer Vehicle (TTV, Fig. 3). The units are connected with high strength steel pins that can be inserted in prefabricated hinges to form a continuous barrier and the TTV moves the assemblage laterally between stored and deployed positions. Note that, as it is moved from one side to the other, the barrier offers protection to the transfer machine from vehicles approaching from either direction. Using an inverted conveyor assembly, the transfer machine lifts the connected barrier units from the underside of the T-shaped top and transfers them along an S-shaped path along guides and rollers from one side to the other. In the Honolulu application, the resemblance of this motion to the common fastening device imparted to the contra-flow lane the name *Zipper Lane*, although the HDOT preferred the double-entendre *ZipLane*.

Weighing about 1500 pounds, each barrier unit is 3.28 feet long, 24 inches wide at the base and 32 inches high. Interspersed in the chain, special hydraulically adjustable steel units (not shown) are employed to adjust for differences in the length of the stored and deployed barrier, particularly on curved alignments. The transfer machines are customized for each application to allow for localized variations in the required lateral movement, grades and the like. The accurate placement of the barrier unit chain is controlled by a computerized guidance system that automatically steers and rotates the transfer machine.
The HDOT feasibility study estimated the cost of the pylon and QMB options at $6.6 and $16.4 million respectively. An estimated $4.5 and $5.0 million respectively was needed for traffic elements, crossover construction and widening of a portion of H-1 to accommodate the contra-flow operation. The difference in deployment costs was attributed to the acquisition of the QMB system, mobilization, and contingency costs. The study also estimated that the annual operating costs would be the same for both options, i.e., between $500,000 and $800,000. Thus, the basic choice was between cost of deployment and safety in the form of positive separation. Obviously, the HDOT opted for the safety benefits.

In their review of the feasibility study, the Honolulu Department of Transportation Services (DTS) and Oahu Transit Services (OTS), that operates the city's bus system (known as "TheBus") under a management contract with the city, expressed a preference to extending the HOV lane beyond the Keehi Interchange bottleneck. However, this would require major long-term modifications to the interchange and to the receiving arterial streets.
THE ZIPPER LANE

Using exclusively special state funds, the HDOT issued a purchase order to Barrier Systems in June 1977 allowing for one year to build two customized transfer vehicles and about 5 months for the installation of the moveable barrier. The Zipper Lane was inaugurated on August 18, 1998. It features 47,910 feet (9.07 miles) of moveable barrier and includes three entry points and a single exit crossover as shown in Fig. 4. The lane is open to buses, vanpools and carpools carrying 3 or more persons and motorcycles. The exit crossover configuration is shown in Fig. 5.
An HOV enforcement lane and an enforcement area are located at this point. After shifting to the right side of the permanent median, the Zipper Lane continues along a 2-mile merge zone next to the pre-existing 2+ carpool lane (Figs. 5 and 6). Beyond the end

Figure 6: Merge Zone after Exit Crossover

Figure 7: End of 3+ HOV Lane
of the merge zone the 2+ lane continues on a short stretch of viaduct. Carpool-lane users can then continue in a queue-jumper configuration exiting toward a major arterial leading to the Honolulu CBD (Nimitz Highway), merge right to exit at a second Honolulu-bound arterial (Dillingham Boulevard), or continue toward the Middle Street of H-1 and Moanalua Freeway (Fig. 4).

Figure 8: The Middle Street Merge

Figure 9: Zipper Lane at the Deployed Position
Figure 7 shows the end of the 3+ lane at about 7:00 a.m. This image was captured from a webpage featuring CCTV traffic surveillance cameras operated by the Honolulu Department of Transportation Services (www.eng.hawaii.edu/Trafficam). Figure 8, from the same source, depicts the Middle Street merge mentioned above that is faced by vehicles that remain on H-1.

Figure 9 illustrates and Fig. 10 depicts the Zipper Lane in its deployed configuration.

![Figure 10: Zipper Lane Deployed](image)

Figure 11 illustrates a typical entry crossover from H-1 to the contra-flow lane that involves merging with vehicles already on board. Advisory stationary signs, channelization devices and variable message displays are installed upstream of the entry point. When the QMB is not deployed, the crossover lane is gated.

At the deployed position, the Zipper Lane is 22 feet wide to allow for the contra-flow and a shoulder to accommodate disable vehicles. To provide this width, two outbound lanes are taken at stretches that have very narrow median shoulders.
The customized transfer vehicle (one of two, for redundancy's sake) measures 798 in. (66.5 ft.) in length, 140 in. (11.7 ft.) in height and 139 in (11.6 ft.) in width Fig. 12). The
vehicles are housed in a garage constructed in the space between the inbound and outbound viaducts (Fig. 7).

A ZipMobile leaves the garage at 3:30 a.m. and travels at a speed of about 5 mph as it deploys the QMB. It takes approximately 1.5 hours to reach the other end. At 8:00 a.m., it begins the journey in the opposite direction restoring the QMB next to the permanent median.

In addition to being the longest contra-flow lane QMB application [15], the Zipper Lane was also the first to use an optical guidance system that uses on-board cameras to scan a 3/4 in. wide white guide line (seen next to the QMB in Fig. 12). A computer processes camera signals to control the movement of the vehicle via hydraulic valves. Earlier models used radio antennae that picked up signals from a wire embedded in the pavement to control vehicle tracking.

**ZIPPER LANE COSTS**

According to the HDOT, the total construction and system acquisition cost was $12 million. This figure includes $1.75 million for the two transfer vehicles, $8.4 million for the barrier units, and the rest for crossover and related improvements.

Safety Systems Hawaii Inc. operates and maintains the system under a service contract in the amount of $510,000 per year plus an additional $95,000 for allowances to cover trouble calls for gates and overhead signals, ZipMobile maintenance and technical support from Barrier Systems Inc.

**ZIPPER LANE USAGE**

As mentioned earlier, the Zipper Lane was inaugurated on August 28, 1998. In what follows, an attempt is made to assemble data from various sources for a quick assessment of the system's operation.

Metered counts obtained by HDOT at a permanent count station located between the third entry and the exit crossovers between September and December 1998 reveal that the peak hour on the Zipper Lane occurs from 6:00 to 7:00 a.m. and averages between 1,300 and 1,400 vph. The total Zipper Lane count between 5:30 and 8:30 a.m. was about 2,300 vehicles.

An independent manual count, from a video-taped session at a nearby location in January 2000, by staff of the City's Department of Transportation Services showed a peak-hour volume of 1,409 vph and a total volume of 2,226 vehicles. This count identified 37 city buses in the peak-hour volume and 60 city buses within the 3-hour total.
The following table summarizes meter counts taken on three days (February 15 and 23, and March 2, 2000). The table shows per lane data (averaged over the three days) for the contra-flow Zipper Lane, the concurrent-flow 2+ HOV lane (L1), and the three general use lanes (L2, L3 and L4). L4 in the "slow" lane next to the right shoulder.

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Zipper (L1)</th>
<th>HOV (L1)</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L2+L3+L4</th>
<th>SUM L1-L4</th>
</tr>
</thead>
<tbody>
<tr>
<td>5:00-6:00 a.m.</td>
<td>359</td>
<td>1,098</td>
<td>1,580</td>
<td>1,422</td>
<td>1,396</td>
<td>4,398</td>
<td>5,496</td>
</tr>
<tr>
<td>6:00-7:00 a.m.</td>
<td>1,522</td>
<td>1,625</td>
<td>2,020</td>
<td>1,752</td>
<td>1,598</td>
<td>5,370</td>
<td>6,995</td>
</tr>
<tr>
<td>7:00-8:00 a.m.</td>
<td>666</td>
<td>1,497</td>
<td>1,984</td>
<td>1,755</td>
<td>1,527</td>
<td>5,266</td>
<td>6,763</td>
</tr>
<tr>
<td>3-HR TOTAL</td>
<td>2,547</td>
<td>4,220</td>
<td>5,584</td>
<td>4,929</td>
<td>4,521</td>
<td>15,034</td>
<td>19,254</td>
</tr>
</tbody>
</table>

(*) Zipper Lane opens at 5:30 a.m.

The table shows substantial Zipper Lane and concurrent-HOV lane usage during its peak hour. The measured Zipper Lane volumes appear to be somewhat higher than those obtained earlier. Whether this represents a trend is difficult to discern at this time. The high peak volume counts in lane L2 portend capacity limitations and warrant more detailed analysis.

A limited information was available with respect to the passenger carrying performance of the facility. A regular vehicle classification and vehicle-occupancy count program that would have helped a before-after comparison is not currently in place. However, a vehicle classification session was conducted on September 25, 1998 that showed the following distribution of vehicles using the Zipper Lane: 93.6% passenger cars, 2.3% motorcycles, 2.0% city buses, 1.0% school buses, 1.0% vanpools and 0.3% other. Assuming an occupancy violation rate of 25% and average violator occupancy of 1.5 persons per vehicle, 40 persons per city bus, 25 persons per school bus and 8 persons per vanpool leads to a conservative estimate of 5,254 Zipper Lane users during the peak hour. More accurate estimates would require additional data collection in the field.

Based on the available data, it is not possible to ascertain effects (if any) related to HOV formation, route and departure-time shifts and the like.

**TRAVEL TIME COMPARISONS**

As part of a senior-level civil engineering semester project conducted in the fall of 1998 [16], a total of 10 sets of travel time runs using the average car method were conducted in November 1998. Each set of runs involved the simultaneous deployment of three test vehicles traversing respectively the Zipper Lane, the concurrent HOV lane and the unrestricted lanes along the QMB installation. The drivers were instructed to stay tuned to a radio station that broadcasts occasional traffic reports. Summaries of eight of the ten sets are given in the table below. The first two sets of runs were practice, route familiarization and reconneaisance exercises. Four run sets began at Crossover #1 and the remaining four entered the system at the location of Crossover #3. All runs ended in
the 3+ HOV lane extension of the Zipper Lane, about 2 miles beyond the exit Crossover (see Fig. 4). The table shows the respective travel times per section.

In general, the table suggests that, barring unusual circumstances during early starts (i.e., before 6:00 a.m.), the contra-flow lane offers only a minor travel time advantage over the other lanes. A reasonable explanation of this finding may be the fact that the addition of extra capacity (the Zipper Lane) has spread out the lane distribution of the traffic demand sufficiently to permit essentially free-flow speeds during this period. Significant differences appear on the segment between Crossover #3 and the end of the moveable barrier during the peak hour. Runs 4, 7, 10 that began at either 6:00 or 6:30 a.m. illustrate this. For late starts (i.e., 7:00 a.m. or later), it appears that the advantage is more or less lost. Of interest in these instances is what happens in the merge zone that lies beyond the QMB exit crossover which, as depicted in Fig. 7, acts as a queue-jumper, particularly for
Zipper Lane users. This effect, however, does not place the HOVs clearly beyond the bottleneck. In this segment, regular lane users appear to have a distinct disadvantage as illustrated by Runs 5 and 7. Moreover, this disadvantage appears to persist over a longer period of time for regular-lane users as contrasted with the users of the concurrent 2+ HOV lane. Run 6 that started at 7:30 a.m. and arrived at the exit Crossover around 7:40 shows much higher travel times along the last segment as compared with either the of the two concurrent-flow HOV lanes.

ON THE LIGHTER SIDE

According to a newspaper "gossip" column entry titled "Zipping right along [17]."

_The first vehicle to enter the ZipLane on its opening day was the KSSK Prize Van. As Be-Jay Kodama drove and D. J. Jim Erickson filed reports with on-air personalities Perry & Price, the voice of Sweetie Pacarro was heard singing "Zippity Do Dah" in the background. Then a listener called to ask Perry & Price to speed up the van. Seems the woman caller was behind the van in the ZipLane. She was heading for the hospital and her water had just broken. Ah yes, "Life in the fast Lane" ..._

OPPOSITION TO EXCLUSIVE USE

Some opposition to designating the contra-flow lane for use by HOV vehicles carrying three or more people surfaced even before the system was approved. The following table quantifies the extent of this opposition by summarizing the responses of a survey administered to users and non-users of the contra-flow lane at several shopping centers within the tributary areas of the Zipper Lane [16].

<table>
<thead>
<tr>
<th>Should the Zipper Lane be opened to ...</th>
<th>Yes (%)</th>
<th>No (%)</th>
<th>No opinion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpools (2 People)?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Users</td>
<td>36</td>
<td>59</td>
<td>5</td>
</tr>
<tr>
<td>Non-users</td>
<td>79</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>Everyone?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Users</td>
<td>9</td>
<td>82</td>
<td>9</td>
</tr>
<tr>
<td>Non-users</td>
<td>12</td>
<td>62</td>
<td>25</td>
</tr>
</tbody>
</table>

The table clearly shows a strong opinion on the part of non-users and a significant response by users to reduce the occupancy requirement to 2 persons. Both groups, however, expressed strong opinions against designating the contra-flow lane as unrestricted.

A legislator from the Leeward side of Oahu introduced Senate Bill 3031 during the 1999 regular session of the Hawaii legislature to relax the usage restrictions during certain
hours of the day. The bill would add a new definition to the Hawaii Revised Statures as follows:

"Zipper Lane" means a temporary lane created with the use of an installed movable lane divider which may be used as a contra-flow, high occupancy vehicle, through traffic, or unrestricted lane.

Regarding usage, the bill provides that

Zipper lanes shall be restricted to use by vehicles as follows:

1. Between the hours of 5:00 a.m. and 7:00 a.m., vehicles carrying at least three persons;
2. Between the hours of 7:00 a.m. and 9:00 a.m., vehicles carrying at least two persons;
3. During the hours the zipper lane is in use, if an accident or emergency occurs, which is expected to take an hour or more to clear up, then the zipper lane may be used for general use. The police officer on site shall call the police dispatch, who shall notify the department of transportation, which shall post the appropriate freeway signs, and notify the media.

Additionally, the bill would amend the then current 2+ HOV requirement in the definition of HOV lanes by adding the phrase:

provided that between the hours of 7:00 a.m. and 8:00 a.m., high occupancy vehicle lanes on Interstate Route H-1 may be occupied by any vehicle regardless of the number of persons in the vehicle.

This provision would allow for the unrestricted use of the concurrent-flow 2+ HOV lane on H-1. It could conceivably, however, cover the 2-mile 3+ HOV segment of the concurrent-flow merge zone beyond the extent of the QMB as well.

The bill was deferred in 1999 and was re-introduced in January 2000. The floor debate on the bill brought forth the typical arguments for and against HOV lanes in general. Favoring unrestricted use were arguments related to inefficient utilization of HOV lanes, restriction of individual freedom, unfair redistribution of wealth from all taxpayers to the few who use it, and so forth. Favoring the status quo were basic arguments relating to the need for a long-term strategy to discourage single-occupancy vehicles (SOVs) for the sake of concomitant environmental, social and quality-of-life benefits.

The related Committee Report to the President of the Senate acknowledged that

Testimony in opposition to the measure was received from the Department of Transportation, Department of Transportation Services of the City and County of Honolulu, Oahu Transit Services, Inc., Hawaii Teamsters Local 966, Leeward Oahu Transportation Management Association, and 11 private individuals. Two
petitions with numerous signatures were also received by your Committee in opposition to the measure.

As of the time of this writing, the bill appeared once again to be destined for deferral.

UNANTICIPATED EFFECTS

Over the last 20 years, the Honolulu Department of Transportation Services (DTS) was rejected twice in its attempts to implement a fixed guideway rapid transit system running along the PUC corridor. Rejection of the proposals was based on the high cost of the system and on an unwillingness to raise the local funding share though increases of the excise tax on goods and services. Around 1997, DTS, under the guidance of a new Director, embarked on a major new initiative dubbed Oahu Trans2K that was ostensibly founded on the principles of “livable communities.” The transit component of this community-based planning effort was, from the outset, based on expanding express bus services to outlying areas of the island with hub-and-spoke neighborhood circulators, and a high-frequency LRT line operating on existing surface streets. Various priority treatments (i.e., signal preemption, exclusive lanes and the like) were also contemplated.

In January 1999, the mayor of Honolulu announced that one of the transit alternatives being considered had a Bus Rapid Transit (BRT) component that involved the exclusive bus use of Zipper Lanes in both directions of the H-1 Freeway. Honolulu had joined a consortium of 10 U. S. cities that successfully competed for Federal Transit Administration (FTA) funding under a BRT demonstration program. The idea of dedicating Zipper Lanes exclusively to buses got, at best, a lukewarm reception from HDOT.

To demonstrate the concept, DTS, during the March to August 1999 time frame, started and then extended a bus route offering "frequent service, fewer stops and simply faster" service. Boasting headways as low as 7.5 minutes, the CityExpress as it is called, runs between Pearlridge (the area surrounding the H-1 and H-2 interchange, see Fig. 1) and the University of Hawaii.

A survey of University students conducted in late 1999 revealed that 10% of the student body, or approximately 1,800 students, had shifted to the CityExpress. Sixty nine percent of this market segment came from other city bus routes and the rest were attracted from the automobile [18].

On December 1, 1999, the Honolulu city council essentially endorsed the idea of considering the combination hub-and-spoke, BRT and in-town LRT as the preferred alternative in Environmental Impact studies to follow. It is doubtful that the BRT concept using QMB lanes could have surfaced and been embraced as readily without the experience that was gained from the H-1 Freeway Zipper Lane.
CONCLUSION

The lengthiest application of QMB system technology for the creation of a positively separated contra-flow lane was successfully implemented on Honolulu's busy H-1 Freeway. Consensus appears to have been reached regarding the feasibility of the facility to safely expand roadway capacity. However, widely varying opinions about the proper use of the Zipper Lane have emerged. These range from unrestricted use at one end to exclusive use by Bus Rapid Transit vehicles at the other.

Most probably, the resolution of this question will be based on broad philosophical grounds rather than on the always-debatable minutiae of narrow-focused before-and-after studies. Such studies are necessary in guiding and informing decisions but are usually not sufficient in resolving all of the issues raised. This is particularly true when attempting to view individual TSM or TDM actions in isolation from everything else that occurs within complex urban places.

Attempts to isolate the effects of individual actions lead to the following paradox. If done immediately after implementation, such studies are prone to be premature, as they do not permit the action to take full effect. If done after the passage of some time, they face an intractable entanglement of related and unrelated causes and effects.

This is the challenge of transportation professionals: In most cases, there is no clear-cut middle ground.

REFERENCES


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