

An analysis of the I-680S HOT lane project

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Date: 10 October, 2007

The I-680S HOT lane project will convert the 14-mile HOV section from Hwy 84 in the north to Hwy 237 in the south into a HOT (HOV+Toll) lane. Currently the 2+ HOV restrictions apply only during the peak period: 5-9AM, 3-7PM, M-F. By contrast, the HOT lane would operate 24/7, including weekends.

It is claimed that the toll revenue will pay for

- Operating and maintaining the toll facility;
- Building the I-680 northbound HOV lane and other HOV facilities;
- Transit service in the I-680 corridor.

But public opposition to the 24/7 HOT operation is likely to force its rollback to the current HOV hours. If that happens, the limited 'excess' capacity in the HOV lane during peak hours will so restrict toll revenues that they will not cover operating expenses, let alone recover capital costs. Even if 24/7 operation is imposed, the revenues will be insufficient to generate the claimed surplus.

Annual cost

Based on publications on the MTC website, the annual cost of the proposed HOT lane comprises:

- Capital cost (at \$2.2M / mile) of \$30.8M or \$3 M /year, for a 10-year payback;
- O&M cost (at \$70K / mile /year) of \$0.98M/year. So

Total annual cost is estimated at \$3.98 M /year.

Public opposition to 24/7 operation

Today, during weekday off-peak periods and during weekends, motorists drive free on all four lanes of I-680S.

After HOT conversion, during off-peak hours the free lanes will shrink from four to three, which will then carry more than three-quarters of the traffic. The free lanes will become more congested and more than 75 percent of all off-peak travelers will experience longer travel times.¹ They will become angry. Their anger will be fuelled by the adjacent underutilized HOT lane on which they could previously drive freely. The anger will turn to protest. As with the similar experience of Minnesota's I-394 HOT lane conversion described below, Caltrans may be forced to roll back the 24/7 HOT lane operation to peak hours.

¹ In fact, most toll-paying travelers are worse off as well; only toll-paying travelers with a very high value of travel time (likely to be those with very high incomes) will be better off than in the current system. The off-period tolled lane will justifiably be called a Lexus lane, whose lower travel time is achieved by imposing a larger travel cost on the vast majority of travelers.

We estimate the revenue that would be generated during the peak period. ‘Excess’ capacity in Bay Area HOV lanes on average is at most 100 veh/hour during the 8-hour weekday peak period.² Allowing more vehicles into the HOV lane will slow traffic, degrading operations, which is not permitted under SAFETE-LU legislation.³ So Peak period tolled trips are at most $100 \times 8 \times 260 = 208,000$ trips / year. At an average toll of \$3 per trip, this will yield \$624,000 per year, covering only 64% of the annual operating expenditures. If the HOT lane operation is forced back to peak hours, the I-680S HOT lane conversion will prove to be a very poor decision.

The Minnesota I-394 experience

A recent attempt in the U.S. to convert a part-time free lane into a 24/7 tolled lane was on I-394 in Minnesota, beginning May 2005. In June 2005, that attempt was rolled back to a slightly expanded weekday HOV peak period, following public opposition provoked by the worsening of congestion in the free lanes during the off-peak periods.

At the end of one full-year of operation, I-394 HOT lane revenues amounted to \$865,000 or 85% of its annual operating cost. The toll varied from \$0.50 to \$8, and 16% of the revenues came from rental fees for the MnPASS tags (similar to Bay Area’s Fastrak tag). In a wide-ranging study on tolling Levinson and Odlyzko note, “the MnPass HOT Lanes in the Twin Cities did not recover system operating costs after more than a year in operation, though this was promised to happen shortly. It appears likely that they will never recover capital costs of investing in the additional infrastructure required to implement the system [1, p.10].” The I-394 MnPASS Technical Evaluation final report cautions: “Stakeholders should carefully consider any possible impacts of future MnPASS expansion, especially in situations that may serve to alter the hours of availability of a previous open general purpose lane [2, p.ES-6].”

The optimistic scenario for I-680S HOT lane

We can estimate the toll revenues that would result under the assumption that a 24/7 HOT lane operation is imposed. We have already estimated the revenue during the peak period. We consider the off-peak period. We suppose there is virtually no tolled traffic between 7PM in the evening and 5AM in the morning. Eliminating the peak period 5-9AM and 3-7PM leaves six hours (9AM-3PM) as the potential toll collecting period. We attempt to estimate the potential toll-paying vehicles during this period.

As noted in footnote 2 there are no functioning detectors on the I-680S HOV lane. However, there is one detector in Fremont at Mission Blvd. (VDS400566) for which some data are available. Based on these data we estimate (see Appendix) between 1688 and 2532 vehicles per weekday and between 6446 and 9669 per two-day weekend. This gives an annual count of between 773,000 and 1,116,000 toll-paying vehicles, depending

² There are no functioning loop detectors on the existing I-680S HOV lane, so there are no data on volumes or speeds. However, the HOV lane in the parallel I-880S near Fremont (VDS400941) shows speeds dropping below 30 mph during 8-10AM at flows under 1,400 mph. These data are available on the PeMS website [3].

³ SAFETE-LU prohibits non-HOV vehicles in the HOV lane if it is ‘degraded’, i.e., its speed drops below 45 mph. If traffic on the I-680S HOV lane is similar to that on I-880S, it may already be degraded.

on the toll. At an average toll of \$1 (this is the average toll on I-394), this yields a revenue of between \$773,000 and \$1,116,000. Together with the peak-period estimate of \$624,000 (at a \$3 toll), the

Total estimated revenue of 24/7 HOT lane operation is between \$1.3 and \$1.7 million.

This would slightly the operating cost but not the capital cost. Thus, even in the unlikely case of a 24/7 operation, the I-680S HOT lane project appears not to be economically viable.

Why the I-680 HOT lane project is not economically viable

The largest tolls are charged during the peak period. Poole discusses two HOT lane models, exemplified by California’s I-15 HOT lane in San Diego and Orange County’s STR-91 HOT lane, respectively [4].

I-15, like the proposed I-680S HOT lane project, permits 2+ HOVs free access. The small excess capacity of a 2+HOV lane means that the high toll charge is levied on a very small volume, so this model raises revenues that usually do not meet operating costs.

By contrast, on SR-91 free HOV access is not permitted or limited to 3+ or 4+ vehicles. The high peak-hour tolls are levied on the high peak hour volume. As Poole shows, this model raises revenues that come close to meeting total costs and hence provide funds for additional lanes.

References

- [1] D.Levinson and A. Odlyzko, “Too expensive to meter: The influence of transaction costs in transportation and communication.” Paper presented at the Royal Society Discussion Meeting on ‘Networks: modelling and control’, London, September 24, 2007.
- [2] Cambridge Systematics, Inc. *I-394 MnPASS Technical Evaluation, Final Report*, prepared for the Minnesota Department of Transportation, November 2006.
- [3] PeMS website. <http://pems.eecs.berkeley.edu>
- [4] R.W. Poole, Jr. Pricing and Fiscal Implications of Different Approaches to HOT Lanes, forthcoming *ITE Journal*.

Appendix Estimating potential off-peak toll-paying vehicles

VDS 400566 is located in Fremont at Mission Blvd. On 1 October, 2007, the hourly volume and average speed in Lane 1 (HOT lane in off-peak) and Lane 2 are given in the following table.

	Lane 1 Veh/hour	Lane 1 mph	Lane 2 Veh/hour	Lane 2 mph
9-10AM	1059	59.6	1081	56.9
10-11 AM	561	59.5	596	53.6
11-12PM	424	59.9	477	51.2
12-1PM	428	59.9	492	51.1
1-2PM	426	59.9	524	51.6
2-3PM	479	61.6	551	55.4
Total	3377		3721	

As expected, the largest volume occurs immediately after the AM peak period. Both lanes are free flowing. If we assume, that if the free lane (Lane 2) is under free flow, between 50 and 75 percent of vehicles in Lane 1 are potentially toll-paying, we arrive at a weekday off-peak potential of 1688-2532 vehicles. Over 260 weekdays in the year, this gives a volume of 438,000-658,000 vehicles.

The corresponding data for Saturday, 6 October, 2007 are given in the following table. (The data for Sunday, 7 October, 2007 are very similar.) The volumes are slightly larger than during weekdays, as are the average speeds. Again assuming that between 50 and 75 percent of vehicles in Lane 1 are potentially toll-paying, we arrive at a weekend potential of 6446-9669 vehicles. Over 52 weekends in the year, this gives a volume of 335,000-502,000 vehicles.

	Lane 1 1Veh/hour	Lane 1 mph	Lane 2 Veh/hour	Lane 2 mph
9-10AM	417	73.2	440	69.7
10-11AM	523	74.9	540	73.6
11-12PM	574	75.4	602	74.2
12-1PM	618	75.6	631	74.3
1-2PM	596	76	652	74.6
2-3PM	583	76	628	73.5
3-4PM	592	75.4	642	71.7
4-5PM	612	74.6	693	69.8
5-6PM	598	73.9	650	71.7
6-7PM	551	73.4	589	72.4
7-8PM	454	72.8	520	9.3
8-9PM	328	73.6	397	68.5
Total	6446		6984	

Adding the weekday off-peak and weekend volumes gives between 773,000 and 1,116,000 vehicles.