

HOT Tips

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Abstract

Accumulating empirical evidence supports these conclusions: (i) A 2+HOT facility will not recover its operating cost, let alone its capital cost. (ii) A two-lane 3+HOT facility can recover its operating cost, especially if the general-purpose lanes are allowed to become congested.

Empirical evidence notwithstanding, support for a new 2+HOT facility is assured by the three-step recipe followed in the 2+HOT I-394 and I-680S projects: (1) Assert that the facility will yield large excess revenues in the future for use to improve transit. (2) When it is necessary to admit that revenues won't live up to expectations, claim that the project was not meant to recover capital costs in the first place. (3) When operating costs are not recovered, suggest collateral benefits such as lower congestion and accident rate.

1 Requiem for 2+HOV

California's 1,171-mile HOV system, by far the largest in the country, was intended to increase the people-moving capacity of the freeway system by encouraging carpooling; reduce overall congestion; provide travel time savings to HOV users; increase system efficiency by allowing HOVs to bypass congestion; and decrease emissions (Legislative Analyst's Office (2000)). The 2+HOV system has not met these goals.¹ Unsurprisingly, goals for the planned large expansion of the HOV system are reduced to improving travel times and reducing delay—encouraging carpooling and decreasing emissions have been dropped (California Transportation Commission, p.2). But the reduced goals cannot be met either.²

Already at the 11th International Conference on HOV Systems held in 2002, speakers were troubled by two phenomena—under-utilization and congestion—evidenced by peak period volumes below 800 vehicles per hour and, at the same time, speed below 45 mph in many HOV facilities. Enthusiastic proponents exhorted “we have to market, market, market the [HOV] program (Federal Highway Administration, 2003, p.28),” implying the public needed re-education. More sophisticated voices called for abandoning the HOV slogan and replacing it by a new one: *managed lanes*—a catchall category denoting priority access for express trips, buses, commercial vehicles, zero emission vehicles, high energy efficiency vehicles, tolled vehicles and HOVs. 2+HOVs gained a new lease on life as 2+HOTs.

2 Rebirth as 2+HOT

A 2+HOT lane is a re-branded 2+HOV lane, with tolled SOVs allowed access alongside free 2+HOVs. Proposals for 2+HOT lanes in California invariably cite three cases, I-394 in Minnesota, and I-15 and SR-91 in California. But these cases are all trapped between the two horns of the 2+HOV dilemma: under-utilization and congestion.

I-394

Consultants made enthusiastic forecasts. They “predicted that the I-394 MnPASS project had the ability to raise enough revenue to cover the operating and capital costs of the project within a 3- to 5-year period, and might generate excess or net revenue of about a million dollars per year after that (Munnich, Jr. et al., 2007, p.51).” But “revenue is much lower than expected. When the project was modeled it was estimated revenue would start in the range \$2M to \$2.5M maturing at \$3M to \$3.5M. Annual revenue in fact is running at just under half forecast—at just a bit over \$1M. [...] Setting up the HOT lanes cost \$10.7M. Operations cost some \$1.8M in the first year. Enforcement is costing about \$200K/yr. It had been hoped that revenues would cover operating costs but at present they are running \$1m/yr short (Tollroads News (2007)).” There are 17,000 tolled trips per week, priced at \$1 on average. I-394 MnPASS opened in May, 2005; by October 2007, only 9,650 transponders were leased.

I-394 MnPASS cannot meet operating cost because of under-utilization. “Average trip times are 10.6mins in the free lanes versus 10.1mins in the toll/HOV lanes. Just a half minute difference! With measured average speeds of over 60mph over six peak hours (6am to 9am outbound and 3pm to 6pm inbound) congestion is just not bad enough in the free lanes to generate major revenues in the toll lanes alongside (Tollroads News (2007)).”

Another reason is that I-394 MnPASS was denied monopoly power: “these [revenue] estimates were developed under the assumption of two-way operation, 24 h/day, 7 days/week (24×7), with a minimum toll of \$1.00.” But the 24×7 operation was quickly abandoned as the public protested “the take away [of] the existing access to the HOV lanes during off-peak periods.” Moreover, the minimum price was reduced to \$0.50, because “the I-394 Community Task Force was particularly concerned with ability of a broad cross-section of users to access the facility (Munnich, Jr. et al., 2007, p.51).”

I-680S

California projections are more rosy. The consultant projects the conversion of the 14-mile I-680S 2+HOV lane into a 2+HOT lane will have a very profitable revenue/cost ratio of 4.7 in 2015, growing to a whopping 13.8 in 2030 (PB Americas, Inc., 2007, Table 1.9-1). Cost is defined as amortized capital cost plus O&M cost (PB Americas, Inc., 2007, p.27).

The Metropolitan Transportation Commission’s Planning Committee is very bullish on HOT lanes. Its plan for “converting existing HOV lanes to HOT lanes and expanding the HOV/HOT system where possible” is estimated to generate “net revenue of \$2 to \$4 billion between 2015 and 2045. [...] Among corridors with the highest net revenue [is I-680] (McMillan (2006)).” It is doubtful whether the I-680S 2+HOT lane will meet even its operating cost.

The 2+HOT lane will operate during current HOV hours, 5-9AM, 3-7PM, M-F.³ Table 1 gives the average speed on of HOV vs. free trips on weekdays during April 1-July 1, 2008.⁴

	5-6AM	6-7AM	7-8AM	8-9AM	3-4PM	4-5PM	5-6PM	6-7 PM
HOV	73.4	72.0	68.3	64.7	74.0	73.3	71.9	75.6
Free	72.4	70.7	65.6	55.2	72.5	71.3	66.2	73.8

Table 1: Speed on HOV vs. free lanes on I-680S, April 1-July 1, 2008. Source:PeMS (2007)

Table 1 immediately reveals that the HOV lane is *extremely under-utilized*. Only during 8-9AM does driving on the HOV lane provide a perceptible advantage 64.7 vs. 55.2 mph or a travel time of 13.0 vs. 15.2 mins; during 5-6PM the advantage is 71.9 vs. 66.2 mph or 11.7 vs. 12.7 mins. Taking I-394 revenue as a guide, one may optimistically predict 300 toll trips per hour, 8 hours/day, 5 days/week, 52 weeks/year, or 624,000 tolled trips per year at an average toll of \$1. Thus the expected annual revenue today would be \$624,000.

On the other hand, from publications on the MTC website the cost of the 2+HOT lane is:

- Capital cost (at \$2.2M/mile) of \$30.8M; and
- O&M cost (at \$70K/mile/year) of \$0.98M.

It is clear that the project cannot meet its operating cost, let alone its capital cost, which leads to this intriguing question:

Knowing the financial indefensibility of the I-680 2+HOT lane project, how does the project get approved?

The answer is the three-step recipe given in the abstract. Consultants have fulfilled Step 1 by providing an unduly optimistic forecast. Step 2, requiring disposal of the issue of unrecoverable capital cost, has also been accomplished. A footnote in the Planning Commission memo says that the I-680S project is “Being pursued as a demonstration project (McMillan (2006)).” Communication with MTC staff led to this clarification: a “demonstration project aims for toll revenue to cover its annual operating and maintenance costs only—not its capital cost, which will be funded through state and local funds.” Evidently, spending state and local funds does not need financial justification. Step 3 remains. But that is not troublesome, as it will emerge *after* the project is complete, as in the case of I-394.

I-15

This 8-mile 2-lane reversible HOV facility opened in 1988 and was converted to 2+HOT lanes in 1996. Funded by tax dollars, the I-15 2+HOT lane system is not financially viable. 77% of traffic is 2+HOV vehicles, there are only 30,000 transponders in circulation, generating a mere \$2 million in revenue per year. As might be expected, the 2+HOV lane is very under-utilized, with weekday peak period per lane volume of 900veh/hour. Nonetheless, I-15 2+HOT lane is slated for a major expansion, with four reversible *managed lanes*.

SR-91

The ten-mile 91 Express Lanes toll facility in Orange County is the star of the HOT lanes, with \$49.8 million revenue in 2007, collected through 176,818 transponders. The reason is simple: 91 Express Lanes facility is run as a monopoly.

As a monopoly it does not want free riders. 3+HOVs are free, except during the only peak period, M-F, 4-6PM, in the eastbound direction, when they must pay 50% of the toll. At all other times, the facility is extremely under-utilized. But as befits a monopoly, the toll is high even when per lane volumes are well below 800 vehicles per hour.

SR-91 Express Lane is really a tolled facility, with 3+HOVs permitted when demand is well below capacity. HOVs account for only 21% of all trips.

3 Conclusion

Re-branded as HOT lanes or managed lanes, 2+HOVs will survive for a few more years, at which time it will be impossible to hide their financial infeasibility. (Operational inefficiency need not ever be discovered.) At that point, at least two outcomes are possible. One outcome is represented by 91 Express Lanes: transform the facility into a monopoly, resulting in the expulsion of 2+HOVs, with a token presence of 3+HOVs for good public relations. Another outcome is for the transportation authority to take its public responsibility seriously and manage the entire freeway system well. The two outcomes are incompatible: 91 Express Lanes makes money during the super-peak period, precisely because the general-purpose lanes are mismanaged. If those lanes were properly managed, 91 Express Lanes would not be able to sustain its revenue stream.

Notes

¹An extensive statistical study of California's HOV system concludes (Kwon and Varaiya (2008)): (1) HOV lanes are underutilized: 81% of HOV detectors measure flows below 1,400 vehicles per hour per lane (vphpl) during the PM peak hour. (2) Many HOV lanes experience degraded operations: 18% of all HOV miles during the AM peak hour and 32% during the PM peak hour have speeds below 45 mph for more than 10 percent of weekdays. (3) HOV lanes suffer a 20% capacity penalty, achieving a maximum flow of 1,600 vphpl at 45 mph vs. maximum flow above 2,000 vphpl at 60 mph in general purpose (GP) lanes. (4) HOV lanes offer small travel time savings. The mean savings over a random 10-mile route on an HOV lane vs. the adjacent GP lane is 1.7 minutes and the median is 0.7 minutes; however, HOV travel times are more reliable. (5) Travel time savings do not provide a statistically significant carpooling incentive: carpooling is declining and overwhelmingly only serves 'fampools'.

²Again, as Kwon and Varaiya (2008) show: A system with one HOV lane and three GP lanes carries the same number of persons per hour as a system with four GP lanes; and HOV lanes reduce overall congestion slightly only when the general purpose lanes are allowed to become congested.

³As with the case of I-394, I-680S consultants assume a 24x7 operation (PB Americas, Inc., 2007, p.13), although they recognize the I-394 enforced reversal to part-time operation. Fortunately, they have a new reason for 24x7 operation: "Full time operation of HOT lanes could minimize driver confusion (PB Americas, Inc., 2006, p.4)", ignoring the fact that I-394 drivers have not been confused (Munnich, Jr. et al., 2007, p.51).

⁴The speeds are calculated as follows. MTC provides travel times for ETC-equipped vehicles on the 16.65-mile route on I-680S starting at Hwy 84 in the north to Berryessa Rd in the south. This route includes the proposed 2+HOT 14-mile lane from Hwy 84 to Hwy 237. The individual travel times do not distinguish HOV and non-HOV vehicles. We take the lowest 20th percentile to be the HOV travel time and the median to be the free travel time. Dividing the 16.65-mile trip length by the travel time gives speed.

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