

# HOV Lessons from the Dulles Toll Road

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In what appeared to be a replay of the Santa Monica Freeway Diamond Lane debacle several years ago, high-occupancy vehicle (HOV) diamond lane operations on the Dulles Toll Road in Fairfax County, Virginia, were stopped after one month of controversial operation in 1992, and the lanes were opened to all traffic. The decision to halt operation of the HOV lanes, at least temporarily, occurred during two congressional races and involved thousands of angry, petitioning commuters bogged down in Level of Service (LOS) F conditions during most of the 2.5-hour morning peak period. Commuters often spent a half hour or longer on the 14-mile route.



Outbound car pools in Dulles Toll Road lane, Fairfax, Virginia.

## History Repeats Itself

The Santa Monica Freeway Diamond Lane experience is recalled because it was the most controversial and well-publicized case where already congested lanes were taken from general traffic for HOV use. It was also an early (1976) major diamond lane HOV demonstration project—one that should have resulted in important lessons learned for planners of all future HOV projects. It was a complete failure from a public relations and political perspective, but in the few weeks before it was shut down, data show that it was an operational success on the basis of measures of throughput, transit ridership, car pooling, energy consumption, and carbon monoxide concentrations. Unfortunately, the lessons learned from that experience have not been communicated effectively. Thus, it is important to examine the (similar) story of the Dulles Toll Road HOV debacle.

The Dulles Toll Road HOV experience resembles the Santa Monica experience

because of the intensity of the reaction of motorists, the high profile of the controversy, and the removal of a lane from general traffic use for HOV use when existing traffic volumes were in excess of the capacity of the remaining non-HOV lanes. However, it differs from the Santa Monica situation in some important respects and offers some new lessons to be learned for planning future HOV systems.

## Background on Dulles Corridor

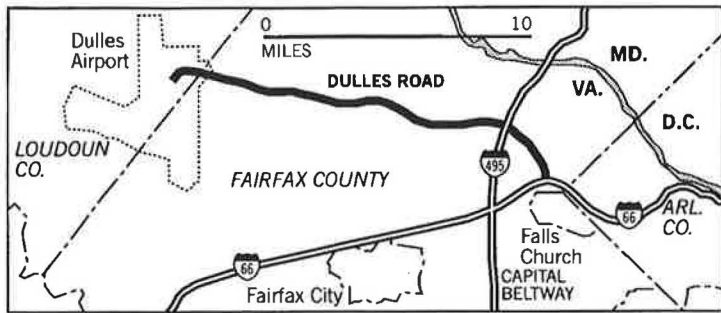
The Dulles Toll Road is an 18-mile-long radial highway in Fairfax County, Virginia, that runs parallel to the Dulles Airport Access Road from an outer suburban location (Route 28) near the Dulles Airport to another radial freeway (I-66) in the inner suburb of Arlington County, about 6 miles from downtown Washington, D.C. The toll road consists of the two outer roadways of a dual-dual highway. The two interior roadways comprise the access road, which provides service only to and from the airport. Ramps on the access

road are limited to on-ramps in the airport-bound direction and off-ramps in the other direction. The toll road provides local access and egress at most major cross routes for tolls that range from 25 to 85 cents, depending on the distance.

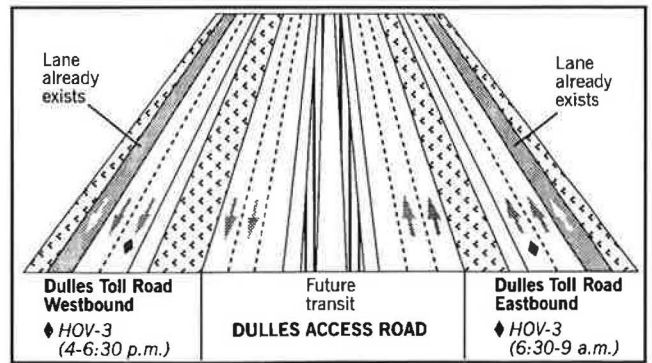
The access road was built at the same time as the airport in the early 1960s to provide high-speed access to the then-remote location about 30 miles from downtown Washington, D.C. To preserve free-flow service into the long-term future, the access road was designed to serve airport traffic only; however, space was reserved for future roadways that could provide local service.

About a decade ago, after substantial development had occurred and congestion on parallel routes had become a problem, the toll road was built in the Dulles corridor right-of-way as a four-lane facility. Rapid development continued throughout the rest of the 1980s, in part due to service improvements provided by the toll road, resulting in regularly occurring peak-period congestion by the end of the decade. To help alleviate this congestion, a

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SOURCES: American Automobile Association, Virginia Department of Transportation



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Figure 1 Dulles Toll Road and carpool lanes.

decision was made to widen the toll road to six lanes, and, as part of a planned areawide HOV grid network, to dedicate the two inner lanes to HOV during peak periods. At the time, this decision was widely supported by local officials and community organizations, who pressured Virginia officials to begin HOV operations when the new lanes were first opened to traffic.

However, the lessons from the Santa Monica diamond lane debacle had not been learned. The new toll road lanes were first opened to all traffic, then converted to HOV operations after commuters had enjoyed free-flow conditions for a few weeks. When the HOV operations began the day after Labor Day 1992—one of the heaviest traffic days of the year—the LOS went from A to F, and opposition to HOV went from being an occasional dissent to the dominant transportation issue in the region.

### Actions Leading to HOV Lane Opening

Northern Virginia has had two major HOV facilities in successful operation for some time and has recently planned an ambitious “grid” of interconnecting HOV routes.

During the mid-1960s, then Federal Highway Administrator Lowell Bridwell took the initiative to have a busway operate during reconstruction of the Shirley Highway, the northern part of I-95 in Virginia approaching Washington, D.C. On completion, the reversible center two lanes

became the nation’s first major barrier-separated HOV facility. Today, after several extensions, the two I-95 HOV lanes serve more people than any other HOV facility in the country and serve more people during peak periods than the six non-HOV lanes. The lanes were originally operated under a four-occupant HOV (HOV-4) restriction, with high LOS, but as a result of a congressional mandate, they are now operated as HOV-3, with reduced LOS.

In the early 1970s, then Secretary of Transportation William Coleman resolved a long-standing controversy over plans for construction of another radial freeway, I-66, inside the Washington Beltway (I-495) through Arlington County by requiring that the highway be limited to four lanes and that it be operated as an HOV facility in the peak direction. I-66 now carries more people during the peak period, peak direction than could be carried if the lanes were open to all traffic, and it carries them at a good LOS, whereas major backups would undoubtedly occur if the HOV-3 lanes were open to all traffic.

HOV lanes were recently opened on I-66 for several miles outside the Beltway. Subsequently, as a result of experience in the Dulles corridor and further study of the issue, the Virginia Commonwealth Transportation Board (CTB) decided to change the designation of these lanes from HOV-3 to HOV-2 on a temporary basis until the level of HOV traffic approaches capacity.

Meanwhile, the outer lanes of the Dulles highway were constructed as a toll road and opened in 1984 to general traffic

from near the Beltway to near Dulles Airport. At that time no commitment had been made to serve HOV traffic for the main part of the toll road; however, for a several mile section between I-66 and an interchange near the Beltway, the Dulles highway serves only HOV traffic and airport-bound traffic. Also, when the Federal Aviation Administration granted the easement to the state for the toll road in 1983, it specified that the Virginia Department of Transportation (VDOT) should “expedite the flow of high occupancy vehicles during the peak hours in the peak direction” if traffic congestion on the toll road impeded the flow of HOVs.

Traffic growth was so great on the Dulles Toll Road that planning for a widening project was initiated in 1985. Projected traffic on the original four lanes for the design period had been 47,000 vehicles per day, but by the time widening was completed in 1992, traffic had grown to 76,000 in the peak-volume section. By 1990, when daily traffic had reached 73,000 in the peak section, LOS F was occurring in the peak period over about half the length of the toll road.

Meanwhile, because of the success of the HOV system in Northern Virginia and because of overwhelming support from local governments, citizen groups, and others at the design hearing in 1988, both houses of the state legislature unanimously passed a bill in 1989 requiring that the new lanes of the Dulles Toll Road be reserved for HOVs during the peak period, peak direction. According to one of the authors of the legislation, the legislative intent was that the new lanes be

## THE HOV EXPERIENCE

opened for HOV use from the beginning. However, the language of the bill was not entirely clear on this point, and a period of debate about safety, HOV volumes, and other issues followed for the next 1.5 years without a firm decision on the HOV lanes, while construction proceeded.

After considerable pressure from local governments, citizen groups, and legislators, and after extended negotiations with the airports authority over design details, CTB resolved in December 1990 to have the new lanes opened as diamond lanes. As a result of the negotiations with the airports authority, CTB committed several million dollars to the construction of a fly-over ramp to serve traffic from the airport to Tysons Corner, Virginia (a major employment center about 15 miles from the airport), so that this traffic would not have to weave across the diamond lane and the other two toll road lanes.

Also during the late 1980s, then Governor Gerald Baliles undertook a major effort to develop a new transportation plan for Northern Virginia. After an intensive effort, with in-depth involvement from a large citizens' committee, local elected officials, and local agency staffs, a plan was developed and adopted in concept by most local governments and regional bod-

ies. One of the key features of the plan was an "HOV grid," with several interconnecting radial and circumferential routes, served by a new network of express buses operating between all major suburban centers with timed-transfer connections at transit centers and rail stations. The network included a Dulles corridor HOV facility connecting with other new HOV routes on the Beltway, and eventually, the Fairfax County Parkway (an outer circumferential route).

Although strong support for HOV existed among elected officials, local and regional agencies, and community organizations, this support was largely based on an understanding of the cost-effectiveness of HOV systems, not on broad popular enthusiasm. A newspaper report during this period showed that a small majority responding to a survey supported the provision of additional HOV lanes in the communities served by the major HOV routes, but that a small majority county-wide did not support such facilities. This suggests that HOV systems must be managed and marketed well to gain sufficient support for an ambitious HOV development program.

Conditions in the corridor were almost ideal for success of an HOV facility.

Employment is highly concentrated in the regional core and at Tysons Corner (the inner end of the Dulles Toll Road)—the nation's largest suburban center or "edge city." Employment in the corridor is highly concentrated in office space, which is most conducive to ridesharing. The average trip length in the corridor is quite long. Congestion levels are high along all parallel radial routes, and it is the most rapidly growing corridor in the Washington, D.C., metropolitan area.

Unfortunately, lengthy construction delays occurred on the Dulles Toll Road widening project, and traffic congestion continued to worsen. In mid-1991, CTB decided to open sections of the widened toll road to all traffic. Eventually, the entire length of the new lanes was opened to all traffic before VDOT was prepared to initiate HOV operations. Traffic conditions went from LOS F for a substantial portion of the morning peak over a several mile stretch to free-flow conditions. During the summer of 1992, before HOV restrictions were imposed on the new lanes, traffic was undoubtedly diverted from parallel routes, so that volumes grew to well over the capacity of the original two lanes in each direction. This intensified the level of congestion that occurred when the HOV restrictions were imposed.

Other unfortunate conditions have become clear in retrospect. HOV restrictions were first imposed on the Tuesday after Labor Day, traditionally one of the worst traffic days of the year because it marks the end of vacations, the beginning of school, and the beginning of a new session of Congress. Travel time that day, at its worst, was 45 minutes—an average of 18 mph for the 14-mile stretch. Congressional campaigns were hitting full stride, and one candidate sent an anti-HOV mailing to all registered voters in the district. On more than one occasion, candidates stirred up anti-HOV protests.

The only major park-and-ride lot in the corridor was filled to capacity early each morning before the new HOV lanes were put in operation. No new bus service was added, and little was done to make new parking spaces available. Prominent signs were installed announcing the coming of HOV restrictions, but there were no spe-



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Number of drivers using car pools on Dulles Toll Road grew rapidly during opening weeks of HOV lane operation, but lane use appeared low.



HOV users were offered their own lane through the toll plaza.

cial marketing efforts for transit and ridesharing in the corridor.

During the first 8 days of HOV operation, VDOT made several speed runs during the peak periods. The average time loss for single-occupant vehicles (SOVs) using the conventional lanes was 4:29 during the morning peak and 2:40 during the afternoon peak, compared with the average travel time of about 14 minutes over the 14 miles of the HOV lanes. However, the variation in travel times was significant. On 5 of 39 morning speed runs, SOVs took more than 10 minutes longer than HOVs, with the worst cases requiring approximately 30 minutes extra travel time. The evening conditions were less severe; only 2 of 44 speed runs had more than 10 minutes extra travel time, with the worst case being about 17 minutes extra.

After HOV operations ceased, conditions returned to relatively freer flow, with LOS C or better during most of the peak period. However, projections are for congestion to continually worsen, with LOS E expected in 1994 and LOS F in 1996 in the peak travel sections. Surveys show that

7 percent of the peak-period toll-road users were ridesharing before HOV—about 300 carpools during the peak period. This grew rapidly to about 600 by the second week of operation, compared with 360 carpools at the beginning of HOV operation on the Shirley Highway—the most successful HOV facility in the country in terms of persons served. By the end of the month of operation, despite widely publicized efforts to stop HOV operations, the average number of people legally using the HOV lanes was approaching that of each of the other two lanes. VDOT expected that within 3 months the HOV lanes would be carrying more people than each of the other two lanes in the peak direction. Based on the experience of the first month, this was a conservative projection.

Like the Santa Monica experience, the short-lived Dulles Toll Road HOV experience showed strong evidence of proving to be a substantial success based on technical criteria, but it was a complete failure from the political and transportation management perspectives.

## Decision to Stop HOV Operations

The decision was made to suspend HOV operations by CTB, following Governor Douglas Wilder's decision that the state would take this action on its own instead of being forced to do so by the federal government. Congress had just passed an appropriations bill that was about to be signed by the President that included a provision preventing HOV restrictions until July 1, 1993, on any toll road on federal land (i.e., the Dulles Toll Road). The provision was inserted as part of the U.S. House of Representatives Appropriations Committee action in drafting the bill by Congressman Frank Wolf, who represented most of the affected commuters, and it passed without debate or challenge by Virginia officials.

After the 1992 election and 3 months into the 9-month "cooling off period" required by the appropriations bill, CTB extended the ban on HOV on the Dulles Toll Road until April 1, 1994, to provide more time for (a) citizen involvement, (b) full consideration of several HOV and related alternatives being analyzed by VDOT and a special advisory task force, and (c) opportunity for the state legislature to review the results of the task force effort and any subsequent decisions made by CTB and to consider possible legislative action in the 1994 session.

## Alternatives for Possible Future HOV Systems

Several alternatives to reimposing three-occupant HOV (HOV-3) restrictions on a diamond lane of the toll road were analyzed by the HOV advisory task force, including the following:

- Two-occupant HOV (HOV-2) restrictions;
- Construction of a temporary reversible HOV lane in the median for use until a rail transit system is built;
- Addition of a shoulder lane (a fourth lane in each direction) on the toll road, and

the designation of one lane as HOV (presumably the original HOV lane—the left lane);

- Construction of a fourth lane in each direction (the shoulder would be retained), achievable within the available right-of-way by narrowing all lanes from 12 to 11 feet.

- Opening of Dulles Airport Access Road lanes to HOV traffic (the inner lanes, which currently serve only airport traffic and commuter bus operations) (an alternative that is opposed by the airports authority); and

- Contraflow HOV lanes with movable barriers.

Reimposing HOV restrictions, even HOV-2, on the existing toll road would be extremely difficult, given the intensity of the controversy and the continued growth in traffic, which nearly reaches capacity on the three lanes during the morning peak at a critical merge point where the heaviest entrance-ramp volume occurs.

Despite the debacle, support for some form of HOV incentives exists among local officials and community organizations. The most popular alternative is opening of the airport access road to HOV. However, opposition of the airports authority to this has remained adamant. The task force has instead recommended construction of a

fourth lane in each direction, but urges that the access road lanes be used as an interim HOV facility until construction of the new lanes is completed. The task force also recommends implementation of a comprehensive program involving improvements in transit service, park-and-ride facilities, and interchanges, together with a marketing program.

### Lessons Learned

Unfortunately, the Santa Monica lesson had to be relearned in the Dulles corridor: do not take space away from general traffic for diamond lanes in the peak period unless capacity remains available for general traffic. This lesson should not have to be relearned in other future HOV corridors. In addition to this one major lesson, however, the Dulles HOV experience offers several other lessons:

- Do not open HOV facilities during election campaigns unless there is firm support from elected officials. To do so is to invite candidates to campaign against HOV, invite violations, and almost guarantee failure.

- Do not open HOV facilities when traffic conditions are expected to be at

their worst. Open them when traffic conditions are moderate, well before worst-case conditions are expected.

- Do not open portions of completed facilities to all traffic before HOV operation starts, and certainly do not open the entire new facility to all traffic.

- Document the reasons for HOV failures elsewhere and make this information available to all elected officials and other responsible leaders in metropolitan areas where HOV improvements are planned.

- Educate the public about HOV systems, which have much higher capacity, almost always serve more people, and do more to alleviate congestion than building additional conventional lanes.

- Make all elected and other responsible officials aware that HOV facilities cannot easily be put in place in the future when congestion occurs and space for widening is not available.

- Make all elected officials and other responsible officials aware that HOV use usually starts at a modest level but builds up to a level at which HOV lanes carry more people than general traffic lanes.

- Develop an areawide strategy for HOV system development, including timing of new facilities and all services. Build consensus around the strategy, adopt it, and regularly update it.

- Develop a comprehensive HOV implementation program for each corridor, including a major marketing effort, improved transit services, park-and-ride spaces, consensus building among all leaders in the corridor, and careful control over timing of each element of implementation.



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Frequent signing on Dulles Toll Road provided information on HOV lane eligibility and hours of operation. Buffer area helped promote safe separation of traffic operation.