

# **IS THE DESIGN AND CONSTRUCTION OF FOUR LANE HIGHWAYS STILL A VIABLE OPTION FOR AN URBANIZED AREA?**

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## **ABSTRACT**

Is the design and construction of four (4) lane highways still a viable option for those living in an urbanized environment; only for the State Departments of Transportation to return years later to construct additional lanes (e.g., the Baltimore-Washington Parkway) and create even more extensive commuter/travel delays? With vehicles only getting larger and with more and more families moving farther away from the Central Business District (CBD), it may be time to discontinue the design and construction of the four lane highway in lieu of the six/eight lane highway(s) as the standard. This paper does not see the continued use of four lane highways as a viable option for an urbanized environment and hypothesizes that state Departments of Transportation use the design and construction of six and eight lane highways as the recommended standard. Several case studies are presented from Maryland and Virginia in support of the hypothesis.

## **BACKGROUND**

With the number of vehicles per household increasing and with these vehicles only getting larger and with more and more families moving farther away from the Central Business District (CBD), it may be time to discontinue the design and construction of four lane highways in lieu of the six/eight lane highway(s) as the standard. It could be argued that the increased initial costs would only serve to cause the state and local governments to reject such projects early on without the necessary/proper review. But, the increased funds over the long-term would better serve the urbanized community. It is obvious that regardless of where we live or what we earn, we Americans place a high value on owning vehicles and in having at least two (2) in our garage. In a study of households with at least one (1) vehicle, households with three (3) or more cars are the single largest group among American car owners.

The United States is still very much in love with the automobile, with a national average of 2.28 vehicles per household (AutoSpies, 2008). It was determined that single- and two-vehicle households are almost neck and neck, at 34 percent and 31 percent, respectively.

However, households with three or more vehicles maintain the single largest category, at approximately 35 percent. The number of vehicles per household varies across states and regions, with Washington, DC, having the largest single-car ownership, at about 62.5 percent, and South Dakota the highest ownership of households with five or more vehicles at approximately 13 percent.

In addition, the most common pairing of vehicles in American households with two to four cars is a full-sized pickup truck and a standard, mid-size vehicle. Of households with two or more vehicles in which one is an SUV, almost 25 percent also own a pickup truck.

If you are wondering where the first author of this paper fits into all of this, here is the skinny. My household is composed of five vehicles; one luxury sedan, foreign; one Sports Utility Vehicle (SUV), foreign; one station wagon, foreign; one compact vehicle, foreign and one full size pickup truck (Super Crew Cab – i.e., 4 doors), domestic.

Why all of this techno-babble? Because as you can see the number of vehicles per household is steadily increasing and our affinity for vehicles and our low use of alternate transportation methods is contributing to a road network which is vastly out of date and well beyond its limits of capacity.

This paper will be limited to the Washington, DC Metropolitan area which includes the state of Maryland, the state of Virginia and the District of Columbia.

## **CONGESTION, WHAT IS IT AND WHY SHOULD WE CARE?**

The growth of urban traffic congestion is a problem of major proportions. To begin to quantify a roadway's degree of congestion, a qualitative measure describing traffic operational conditions and their perception by drivers is first needed. Such a measure is referred to as *level of service (LOS)* and is intended to capture factors such as speed and travel time, freedom to maneuver and safety. Current practice designates six (6) levels of service ranging from A to F, with level of service A representing the best operating conditions and level of service F the worst (Mannering, 1998).

LOS A – Drivers are virtually unaffected by the presence of other drivers in the roadway. The freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The level of comfort and convenience provided to drivers is excellent. You may have experienced this when traveling very early in the morning or very late at night.

LOS B – At this level, the presence of drivers in the roadway begins to be noticeable. The freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver.

LOS C – At this level, the freedom to maneuver is noticeably restricted. For example, lane changes now require careful attention on the part of all drivers. Disruptions, such as a vehicular accident or a vehicular disablement, can result in significant vehicular delays.

LOS D – At this level, the freedom to maneuver becomes more restricted and incidents can cause lengthy lines of traffic because the increasing traffic provides little space to absorb disruptions.

LOS E – At this level, even minor disruptions, such as vehicles entering from a ramp or changing lanes, can cause delays as other vehicles give way to allow such maneuvers. In general maneuverability is extremely limited.

LOS F – This level is the result of a complete breakdown in vehicular flow. See Figure 1, as this writer tries to provide a visual perspective of traffic at this level.

Why should we care? Highway congestion conditions affect vehicle operating costs for fuel and oil consumption, tire wear and maintenance principally as a result of speed changes stopped delays. With fuel already rising and the price of tires increasing, these costs can add up very quickly and could be substantial. Also, as was stated previously, our vehicles are getting larger and larger which means larger tires and greater fuel consumption.



**Figure 1 – Level of Service F – Atlanta, Georgia**

**THE NUMBER OF VEHICLES IN ASHINGTON, DC METROPOLITAN AREA**

Just how many vehicles are we talking about? Let us use the data we discussed previously. It was stated that the average household owned 2.28 vehicles. Because no one can own 0.28 vehicles, we will use three (3) as the number of vehicles owned by the average household. Tables 1 through 3, provides the number of vehicles in households in the States of Maryland and Virginia and the District of Columbia.

A. Maryland

**Table 1 – The Number of Vehicles for the State of Maryland**

| Year              | 2010          | 2000      | 1990      | 1980      |
|-------------------|---------------|-----------|-----------|-----------|
| No. of Households | 2,194,400 (e) | 1,980,859 | 1,748,991 | 1,460,865 |
| No. of Vehicles   | 6,583,200 (e) | 5,942,577 | 5,246,973 | 4,382,595 |

B. Virginia

**Table 2 – The Number of Vehicles for the State of Virginia**

| Year              | 2010          | 2000      | 1990      | 1980      |
|-------------------|---------------|-----------|-----------|-----------|
| No. of Households | 1,936,303 (e) | 1,672,110 | 1,443,964 | 1,327,550 |
| No. of Vehicles   | 5,808,909 (e) | 5,016,330 | 4,331,892 | 3,982,650 |

C. The District of Columbia

**Table 3 – The Number of Vehicles for the District of Columbia**

| Year              | 2010        | 2000    | 1990    | 1980    |
|-------------------|-------------|---------|---------|---------|
| No. of Households | 201,943 (e) | 224,521 | 249,634 | 274,747 |
| No. of Vehicles   | 605,802 (e) | 673,563 | 748,902 | 824,241 |

To determine the number of vehicles for the Washington, DC Metropolitan Area, using the 2010 data, the formula is  $(0.5 \times \text{The number of Vehicles for MD}) + (\text{The number of Vehicles for DC}) + (0.33 \times \text{The number of vehicles for VA}) = 5,833,705$  vehicles. For 2010, roads in the Washington, DC Metropolitan Area can expect to carry approximately 5.8 million vehicles. Despite the regular use of mass transit in this area, Washington, DC is still ranked #1 (Forbes, 2009) when it comes to congestion.

**EXAMPLES OF AREA ROAD WIDENING PROJECTS**

A. The Baltimore-Washington (BW) Parkway

Opened in October of 1954, the BW Parkway is a 29-mile, four lane scenic highway that connects Baltimore, Maryland with the District of Columbia. At present, the National Park Service manages the 19-mile section from Maryland State Route 175 to the District of Columbia border. The remaining 10-mile section from MD SR 175 to the city of Baltimore is managed by the Maryland State Highway Administration (National Park Service, 2004).

In October 2008, work began to widen 1.5 miles of the parkway from I-695 (Baltimore Beltway) south to I-195 (BWI Airport). First announced by then-Governor Robert Ehrlich in 2004, the \$12.4 million project is scheduled for completion in late 2011 (see Figures 2 and 3 depicting the current process of this project).



**Figure 2 – Widening of the Baltimore-Washington Parkway (Looking Northbound)**



**Figure 3 – Widening of the Baltimore-Washington Parkway (Looking Northbound)**

The Maryland State Highway Administration is charged with overseeing the process of widening this portion of the parkway from four lanes to six lanes. The widening is making use of the existing median as the extra travel lanes will be added to the inside of each roadway.

Let us question what is taking place here. Why one additional lane? Why not two? Many will point to the current cost of construction. With 1.5 miles per roadway, that is 3 miles for the entire project at a cost of \$12.4 million or an eye-popping \$4.13 million per mile!! Two additional lanes per roadway or 6 miles would cost approximately \$25 million.

Let us play Devil’s advocate and estimate the cost of widening the BW parkway to four lanes in each direction, that is, we are proposing to add, to the situation above, another 3 miles. What is the cost?

With the cost of highway construction materials up 43 percent since 2003 (see Table 4) and the cost of labor & overhead up 27 percent (Buechner, 2007), the cost of three additional miles, with construction starting in 2011, would be approximately \$36 million ( $\$12.4 \text{ million} \times 1.86 \times 1.54 = \$35.5 \text{ million}$ )!! This represents approximately \$11 million beyond constructing the additional lanes today. How does the state of Maryland and the Maryland State Highway Administration justify that cost!?!??

**Table 4 – The Rising Cost of Highway Materials and Labor & Overhead**

| Year | Rise in the cost of Materials | Rise in the cost of Labor & Overhead |
|------|-------------------------------|--------------------------------------|
| 2004 | 10.75%                        | 6.75%                                |
| 2005 | 21.5%                         | 13.5%                                |
| 2006 | 32.25%                        | 20.25%                               |
| 2007 | 43%                           | 27%                                  |
| 2008 | 53.75%                        | 33.75%                               |
| 2009 | 64.5%                         | 40.5%                                |
| 2010 | 75.25%                        | 47.25%                               |
| 2011 | 86%                           | 54%                                  |

## **FUTURE WIDENING PROJECTS**

Plans are underway to widen the entire 326 miles of Interstate 81 in Virginia. The Virginia Department of Transportation (VDOT) expects to widen the highway to a minimum of six lanes, with about 75 miles of eight-lane widening in urban areas such as Roanoke, Harrisonburg, Staunton and Winchester, and its estimated to cost a total of \$3.3 billion for engineering, right-of-way and construction, to be completed in phases by 2020.

Other widening projects include; Route 1 widening to six lanes (Woodbridge, Virginia), \$20 million; Route 28 widening to six lanes (Manassas, Virginia), \$37 million; and the Prince William County (Virginia) Parkway widening to six lanes, \$20 million. For just

three projects in Prince William County, Virginia, a total of \$77 million is needed for construction.

## **THE CONSEQUENCES OF WIDENING AREA ROADWAYS**

Due to the many road widening projects in the area, roads are awash in backhoes and orange safety cones. Exit ramps are closed one day and relocated the next. The various state highway officials estimate that keeping area traffic moving during construction requires an additional \$34 million annually (Washington Post, December 10, 2009).

In addition, amid the heavy construction, motorists must remain extremely attentive to avoid accidents. With work zones across the region, drivers need to pay very close attention to the concrete barriers. An inattentive driver that strays into the shoulder runs the risk of straight into a concrete barrier. Shoulder accidents and work zone collisions are up 20 percent this year alone.

## **THE FLIP SIDE – WHY WIDER IS NOT BETTER**

In order to effectively deal with increasing congestion, we must have a comprehensive regional plan that accounts for development, growth, and changing commuting patterns.

Current regional plans, as well as the statewide transportation program anticipate billions of dollars in public spending for transportation projects in the coming years - including projects, such as rail to Tyson's, Dulles, and Centreville, that would address I-66 congestion.

### **A. Traffic congestion needs a regional, comprehensive solution - not a cosmetic "quick fix."**

Implementing independent proposals, outside of the regional planning process could undermine the success of the plan and divert scarce resources that are needed to effectively address the transportation needs of the region.

### **B. Those who have proposed widening have not yet fully studied the more sensible, cost-effective alternatives that could be implemented as part of a comprehensive plan to address congestion.**

Increase parking capacity at Metro lots, increase number of Metro trains and cars per train, publicize Metro Check and promote its use by employers in the targeted zones (Tyson's, Dulles, etc.) to increase Metro ridership.

Extend rail connections (Metro/light rail) to developed centers.

Implement Bus Rapid Transit (BRT) or priority/express bus service).

Enhance High Occupancy Vehicle (HOV) lanes through:

- Better enforcement of existing HOV restrictions.
- Reinstating HOV-3 on "traditional" commute (eastbound morning/westbound evening).
- Enacting HOV restrictions on "reverse" commute (westbound morning/eastbound evening).

Promote alternatives to single occupancy vehicle transportation:

- Provide more commuter parking lots (e.g. Quincy parking garage) to be used for car pooling, van pooling, or charter/express bus service.
- Better promote car pooling and ride sharing information (now available through commuter services) to educate commuters on their options.
- Explore options of highway pricing, especially high occupancy tolls (HOT) for single-occupancy vehicles using HOV capacity.
- Provide tax incentives for employers and employees to promote alternatives to single occupancy vehicle transportation.

Other ways to address congestion long term:

- Telecommuting.
- Better land use planning in the entire region (linking increased density with transit development) and other anti-sprawl initiatives.

**C. Regional experience and recent research demonstrate that adding capacity to existing roads fails to resolve long-term traffic congestion.**

Increasing highway capacity typically has only a temporary and limited impact on congestion as demonstrated by recent experience and research. Maryland's I-270 offers a classic example of a road widening project that provided only short-term relief (five years). Traffic on some segments of the highway already exceed levels not projected to be reached until 2010. Interstate 270 is not an isolated case.

**D. Where will the additional volume of vehicle traffic go?**

Additional road capacity that simply moves bottlenecks a few miles down the road is not a solution - short-term or long-term.

**E. Construction will increase the amount of time spent in traffic with little ultimate payoff.**

The typical project to improve traffic flow removes only seconds or, at best, minutes from a daily commuting trip. A recently released study indicates that completed improvements to the Springfield I-395/I-95/I-495 interchange ("mixing bowl") only saved 30 seconds per commute. Drivers will spend more time in construction delays associated with the project that they will likely never make up from the increased road capacity.

**F. Widening roadways will negatively affect the environment and the community's quality of life.**

Regional air quality will suffer, since more traffic equals more air pollution. [Note: the region is already in violation of federal EPA air quality standards.] Increased runoff from additional paved surfaces will eventually end up in the local streams and then the Bay - as well as in Bluemont Beaver Pond. Additional traffic will increase noise pollution in the area. Bike trail and community parks and recreation areas may be adversely affected.

**G. Widening creates a safety hazard.**

Many regional road capacity expansion efforts have included conversion of shoulders/breakdown lanes into traffic lanes. This conversion of a breakdown lane into a traffic-bearing lane has killed drivers forced to stop their vehicles in an active traffic lane. Further, emergency response by police and fire vehicles would be hampered if there were no shoulder for their use.

**H. The high cost of widening roadways is a waste of scarce taxpayer dollars that would be better spent on a comprehensive regional response, as described previously.**

According to the Maryland Department of Transportation (MDOT) Capital Beltway Studies, one light rail line (e.g., trolley) can move the equivalent of eight freeway lanes of traffic. One heavy rail line (e.g., Metro) can move the equivalent of 17 freeway lanes.

**I. More mass transit - the expansion of which would be an effective alternative to the widening of roadways - is better for the region's economy.**

Widening is likely to reduce ridership for mass transit and would thereby require increased local government subsidies to offset the drop in fare revenue.

**WHAT HAPPENS WHEN REALITY MEETS FINANCIAL CONSTRAINTS?**

On Tuesday, October 27, 2009, Prince William County, Virginia, officials announced plans to stop the widening of U.S. 1 to a six-lane highway between Neabsco Mills Road and Featherstone Road as the county wrestles with record budget shortfalls.

Budget shortfalls/constraints may doom several widening projects which were designed and implemented to reduce congestion. Not proceeding will only increase congestion and constructing at a later date will only see increased costs. It is the simple adage of "Pay me now or pay me later" and we all know what happens when you pay later? You always pay too much!!

## **SUMMARY**

With the number of vehicles per household increasing and with these vehicles only getting larger and with more and more families moving farther away from the Central Business District (CBD), it is time to discontinue the design and construction of four lane highways in lieu of the six/eight lane highway as the standard.

Although, it could be argued that the increased initial costs would only serve to cause the state and local governments to reject such projects early on without the necessary/proper review. But, the increased funds over the long-term would better serve the urbanized community.

## **CONCLUSIONS**

It is obvious that regardless of where we live or what we earn, we Americans place a high value on owning vehicles and in having at least two (2) in our garage.

Americans will always love their vehicles just as much as they love life and like in life we want to enjoy those vehicles. That is, we want to get the maximum out our cars because these vehicles were not made to sit in traffic and not moving at the recommended/posted speeds.

We say take into consideration the tremendous amount of vehicles in the area today and design and construct a highway to better accommodate those vehicles. These vehicles are not going away and are getting larger as more and more Americans purchase more of them. Owning a vehicle is second only to owning a home. Owning a car/truck/SUV is a part of the American dream. Let us embrace that fact not destroy. Build better/wider roads to accommodate and build these roads now!!

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