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Review of Traffic Projections for Proposed Route 29 Bypass

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OVERVIEW

The Virginia Department of Transportation (VDOT) is proceeding with plans for construction of a 6.2-mile, four-lane bypass to the west of existing Route 29 in Albemarle County (the 29 bypass). In its Request for Proposals (RFP) for the project dated September 27, 2011, VDOT states that the "purpose of the project is to relieve congestion on existing Route 29 and to improve the movement of through traffic." (RFP, Part 2, p. 3 of 87). However, the proposed bypass will do little to meet these objectives. The most comprehensive forecasting of the proposed bypass done to date found that it would only divert a moderate amount of traffic from Route 29, because only about 10% of Route 29 traffic is "through" traffic, and that it would not prevent Route 29 from operating at a failing level-of-service "F" during peak periods.

Further, the proposed road would be even less effective today than the prior forecasting indicated. It would fail to "bypass" the intensive development, traffic growth, and proliferation of traffic signals that have occurred north of the proposed northern terminus of the bypass. There are currently 9 traffic lights on the 6-mile stretch of Route 29 in Albemarle County north of the proposed northern terminus. Further, since 2003, in Albemarle County alone, roughly 3,000 residential units and more than 3 million square feet of non-residential development have been approved along the Route 29 corridor north of where the proposed bypass would tie back into Route 29. As a result, the bypass will not be an effective solution to existing and future traffic congestion on Route 29.

The benefits of the bypass are further exaggerated by the fact that VDOT's recent estimate in the RFP of 32,300 vehicles per day on the proposed bypass by the year 2036 appears to be based on an assumed rate of future traffic growth that far exceeds actual growth rates along the 29 corridor over the past 20 years. Specifically, recent VDOT projections incorporate an assumed compound growth rate of 1.7%. In fact, the traffic data show that the actual compound growth rate on the most heavily traveled segment of the 29 corridor in the Charlottesville-Albemarle area was only 0.5% over the past 20 years. If this growth rate continues, the forecast of traffic volume for 2036 set forth in the RFP would not be reached until the year 2230.

VDOT has stated that new traffic projections for the bypass will be undertaken as part of the required reevaluation of the existing environmental studies. For such projections to be accurate, best practices would dictate that a new origin-destination study be done. In addition, it is critical that the travel demand model properly account for induced travel demand and increased development as a result of the bypass. Otherwise, the modeling results will further overstate the benefits of the bypass and fail to account for increased congestion that may occur further north along the 29 corridor as a result of the bypass itself.

The 29 bypass is an outdated and ineffective solution to congestion on Route 29, and it is critical that VDOT thoroughly evaluate the effectiveness of alternatives. In particular, VDOT should fully and objectively evaluate an alternative that includes the building of grade-separated intersections at the most congested intersections along Route 29 and improvements to the local road network.

I. The Proposed Bypass Would Not Be Effective

A. The Most Valid Analysis of the Bypass Found Little Benefit

The 2003 Supplemental Environmental Impact Statement (SEIS) (p. 1-12) on the proposed 29 bypass reiterated the project Purpose and Need from the original 1993 Final EIS (FEIS):

> The purpose of the Route 29 Corridor Study is to find a solution to existing and future traffic congestion on a three-mile section of U.S. Route 29 between U.S. Route 250 Bypass and the South Fork Rivanna River in the City of Charlottesville and Albemarle County north of Charlottesville. (FEIS, p. I-1).

The extent to which the proposed 29 bypass would be a "solution to existing and future traffic congestion" depends entirely on future traffic volumes both on existing Route 29 and on the bypass itself. Various traffic analyses have been offered over the years in an attempt to predict those volumes, and each of those analyses is flawed. However, the best attempt to date—the forecasting that was incorporated into the FEIS—clearly showed that the 29 bypass would not be an effective solution to congestion on Route 29.

The forecasting effort that was incorporated into the FEIS dates back to the period 1988-90 and is set forth in a 1990 report entitled *Traffic and Transportation Analysis: Technical Memorandum for Route 29 Corridor Study Environmental Impact Statement* [hereinafter, "*1990 TTA Report* "]. It included an extensive data collection component, including traffic count data and a major origin-destination study done in 1988. The 1988-90 forecasting also included a complete travel demand modeling component; the following excerpts from the *1990 TTA report* summarize the modeling work underlying the report:

> Traffic forecasts for the design year 2010 and an interim year 2000 were developed using a regional travel demand model. This model was especially designed and calibrated for the Charlottesville Area Transportation Study based on the household survey data collected by the consultant in 1987. (p. 16).
>
> The zone specific values of land use (employment by category and dwelling units by type) and socioeconomic variables (households, auto ownership, school enrollment, etc.), and transportation network information are basic inputs of the travel demand forecasting process. Future year external trips are estimated by factoring the External Survey information. The factoring process takes into account the demographic changes within the study area and the historical trend of traffic at each external station. (p. 17).
>
> The travel demand model system was validated to check its ability in replicating the existing travel pattern. At all selected locations (i.e., cutlines and screen lines) within the study area the difference between the observed and estimated traffic volumes fall within the acceptable level of 15 percent. Validation tests showed that the model performed extremely well in simulating travel patterns at the regional scale. (p. 17).

> Land use and socioeconomic data for the years 2000 and 2010 were provided by the planning offices of the City of Charlottesville and Albemarle County. A post processing procedure was later applied by the consultant to develop additional inputs (e.g., households by auto ownership and size) from the data provided by the local planning offices. (p. 17).
>
> Traffic forecasts for the Base Case and eight Build Alternatives were developed for the design year (2010) and the interim year 2000. (p. 20).[1]

These data collection and modeling steps in combination represent a systematic approach to forecasting and analyzing future traffic volumes with and without the bypass, the extent of which has not been repeated since the 1988-90 effort. As a result, the conclusions reached in the *1990 TTA Report* and set forth in the 1993 FEIS regarding the potential diversion of traffic onto the proposed 29 bypass, and how that diversion would impact the level-of-service of Route 29, are more reliable than the conclusions reached in subsequent reports and analyses, as will be explained in later sections of this report.

The results of the data collection underlying the *1990 TTA Report* indicate that most traffic on the relevant section of Route 29 is local: "Within the most critical segment of Route 29 north (i.e., between Rio Road and Hydraulic Road), thru traffic to total traffic is observed to be 10 percent." (*1990 TTA Report,* p. 3). The data also indicated that "[t]he current (1987) average daily traffic (ADT) on this facility varies from 25,800 vehicles per day (vpd) south of Airport Road to 50,700 vpd between Rio Road and Hydraulic Road." (p.3). Therefore, the number of daily through traffic vehicles in 1987 on Route 29 between Rio and Hydraulic Roads was about 5,000 (10% of 50,700).

Of the various alternatives that were modeled in the *1990 TTA Report,* the route labeled "Alternative 10" is most like the current proposed 29 bypass. The current proposal shares the same general alignment as Alternative 10, but its northern terminus has been extended, and it does not include interchanges on the proposed bypass at Barracks Road and Hydraulic Road that were originally included as part of Alternative 10.

The *1990 TTA Report* estimated that Alternative 10 would carry 17,400-17,900 vehicles per day in 2010. (p. 32). However, the estimated traffic reduction on Route 29 was substantially less: 10,900 vehicles per day. These 10,900 vehicles represent the 5,000 through vehicles observed in 1988 plus some assumed growth in the number of through vehicles, as well as other vehicles using the proposed bypass for local trips. The additional 6,500-7,000 vehicles on the 29 bypass above and beyond the reduction of traffic on Route 29 necessarily represent "induced traffic." Induced traffic is new traffic that is encouraged by the construction of the new

[1] In addition to the excerpts included above, much of the *1990 TTA Report* is devoted to describing the extensive transportation modeling process that was undertaken, including: Chapter 5, Traffic Prediction; Appendix B of Charlottesville/Albemarle County Transportation Planning Model – Model Calibration and Application Results; and Appendix C: Year 2010 Travel Demand Forecasting and Evaluation of Future Alternatives.

roadway.[2] Modeling induced traffic is a critical part of any analysis of the impacts of a new high-speed roadway. This is discussed in more detail in a later section of this report.

Significantly, the reduction in forecast traffic on Route 29 modeled for 2010 (10,900 vehicles per day) as a result of the 29 bypass was not great enough to prevent Route 29 from operating at a failing level-of-service in the analysis. Table IV-3 of the FEIS includes the modeling results projecting that Route 29 would have an arterial level-of-service "F" in the year 2010 regardless of which bypass alternative were built, unless grade-separated intersections were built at key intersections along Route 29. Similarly, the *1990 TTA Report* found that under the proposed Alternative 10 bypass, "the critical intersections [along existing Route 29] continue to operate at unacceptable levels of service." (p. 31). The failing intersections included Airport Road, Rio Road, Woodbrook Drive, and Greenbrier Drive in the morning peak hour, and Airport Road, Rio Road, Greenbrier Drive, and Hydraulic Road in the afternoon peak hour. (Tables 5 and 7, pp. 26 and 29).

Further, it is important to note that these traffic forecasts assumed the construction of two intermediate interchanges on the 29 bypass: one at Barracks Road and one at Hydraulic Road. A portion of the forecasted bypass traffic thus consisted of vehicles accessing the 29 bypass at those intermediate interchanges. If these interchanges were not included in the modeling, the forecasted traffic volume for the bypass, and the diversion of traffic from Route 29 onto the bypass, would have been considerably lower. Hence, the diversion shown in the *1990 TTA Report* represents an upper bound on what the true amount of diversion of traffic onto the 29 bypass from Route 29 would be.[3]

To summarize, the only complete forecasting for the bypass, which was done in 1988-90 and which formed the basis for the traffic analysis in the FEIS, showed:

1) The bypass would divert only a moderate amount of traffic from Route 29 because the great majority (90%) of Route 29 traffic is local traffic.
2) The diverted traffic would not be great enough to prevent Route 29 from operating at a failed level-of-service "F" during peak periods.

These conclusions indicate that the proposed bypass would not solve the purpose and need of the project identified in the FEIS and SEIS or effectively reduce congestion on Route 29.

[2] Components of the induced traffic modeled in 1990 likely included:

- Route changes (e.g., travelers at the north end of Route 29 going north to the bypass to head south due to travel time savings); and
- Destination changes (e.g., travelers being more likely to travel between Charlottesville and destinations north of the bypass due to the travel time savings).

[3] A later bypass study by a VDOT consultant states: "If both the Barracks Road Interchange and Hydraulic Road Interchange were constructed, an increase of between 7,000 and 12,000 additional vehicles per day would use the Bypass." (Parsons Brinckerhoff Quade & Douglas, Inc., *Route 29 Bypass Interchange Feasibility Study*, p. 7, 1996). This study significantly overestimated bypass traffic as discussed later in this report. However, this excerpt shows that the presence or absence of intermediate interchanges would have a large impact on the projected traffic volume for the bypass.

B. The Proposed 29 Bypass Would Not "Bypass" the High Growth Area Along Route 29

The proposed 29 bypass would be even less effective today than the limited value demonstrated by the 1988-90 forecasting because of intensive development, large traffic volumes, and the increase in the number of traffic signals north of the proposed northern terminus of the project.

1. Proliferation of Traffic Signals North of the Proposed Bypass on Route 29

There are currently 9 traffic lights on the 6-mile stretch of Route 29 in Albemarle County north of the proposed northern terminus of the bypass. In addition, at least 3 additional traffic lights have been proposed in this stretch but not yet installed. As summarized by John J. "Butch" Davies, III, the former representative of the Culpeper District on the Commonwealth Transportation Board, in a November 20, 2008 memo to local government officials:

> Development in the corridor over the past decade has dramatically altered the character of the corridor. The initial focus on traffic lights was the basis of the original Charlottesville Bypass. What has happened is that the Charlottesville Bypass now has minimal impact due to the accelerating of traffic signals north of the proposed terminus of the bypass.

2. Significant Development North of the Proposed Bypass on Route 29

Since the SEIS was approved in May 2003, in Albemarle County alone, roughly 3,000 residential units and more than 3 million square feet of non-residential development have been approved along the Route 29 corridor north of where the proposed bypass would tie back into Route 29.[4] This development includes the Hollymead Town Center, the North Pointe community, and expanded capacity at the National Ground Intelligence Center and at the University of Virginia Research Park.

Notably, much of this approved development has yet to be built. Even so, VDOT's published traffic counts show that traffic in this section of Route 29 north of the proposed bypass has already grown significantly over the past 10 years. In particular, 2010 traffic counts on Route 29 at the Albemarle-Greene County line, Camelot Drive, and Hollymead Drive have all increased from counts taken in 2000. As a result of the huge amount of development that has been approved but not yet built beyond the proposed bypass, it is virtually a certainty that there will be continued traffic growth to the north of the bypass. As a result, the proposed road is not really a bypass: it would tie back into Route 29 south of where significant traffic growth is occurring and will continue to occur.

In addition, building the bypass may accelerate new development and traffic growth north of the proposed northern terminus, further reducing the limited benefit the project offers. As will be discussed later in this report, induced travel is a critical element that should be explored in updated traffic modeling and forecasting for the proposed bypass.

[4] These figures were compiled from various Albemarle County documents pertaining to development approvals since 2003, including approved zoning map amendments and related planning staff reports.

Thus, the most extensive traffic forecasting performed to date for the proposed bypass shows that it would not be effective in reducing congestion on Route 29, and even that forecasting effort overstated the amount of traffic that the bypass would divert from Route 29. Further, due to patterns of development along the Route 29 corridor north of the proposed bypass, the roadway would be even less effective today at avoiding congestion along the corridor than when the project was originally conceived.

II. VDOT'S Current 29 Bypass Traffic Forecast of 32,300 is Greatly Exaggerated

In the 21 years since the FEIS modeling and analyses were completed, a series of errors were introduced into subsequent forecasts, completely undermining the results of those forecasts. These compounded errors have culminated in VDOT's most recent estimate for future bypass traffic—an astounding 32,300 vehicles per day in the year 2036—that was published in the September 27, 2011 Request for Proposals to design and build the project. As will be discussed below, this number is far in excess of what can be reasonably estimated based on actual traffic data.

The beginning of the current flawed forecasts dates back to the reevaluation of the 1988-90 traffic forecasts that VDOT consultant Parsons Brinckerhoff Quade & Douglas, Inc. (PBQD) undertook during 1996-97. The 1996-97 PBQD analyses are important because they were relied upon for the future traffic forecasts used in the 2003 SEIS, which in turn appear to have formed the basis for the most recent forecasts. However, significant errors were incorporated into those analyses, including:

- improper model adjustments;
- inflation of future traffic forecasts; and
- overestimation of traffic diversion.

These errors completely undermine the results of the 1996-97 PBQD analyses, the abbreviated traffic analysis in the SEIS that was based on those analyses, and the forecast recently set forth in the RFP.

<u>Improper model adjustments</u>

The 1996-97 modeling began with the official regional travel demand model for the 1995 Charlottesville Area Transportation Study (CATS) to determine the average daily traffic projections. (PBQD, *Route US 29 Bypass Final Design Traffic Capacity Analysis*, p. 7, 1997) [hereinafter, "*1997 PBQD Study*"]. However, "refinements" were then introduced that completely changed the model behavior. In particular:

> Turn movement penalties were added to account for future signal delays on the existing US Route 29 at intersections with Hydraulic Road, Greenbrier Drive, and Rio Road. (*1997 PBQD Study*, p. 11).

The assignment of turn movement penalties introduced significant bias into the modeling process because the regional travel demand model is already designed to approximate intersection delays without the need to add intersection-specific turn penalties. In other words, it is calibrated to represent congested travel flows at all other intersections in the region without such penalties. Under the regional travel demand model, travel speeds are estimated using a "volume-delay function." The higher the modeled traffic volume is, the higher the modeled delay is, and the lower the speed is. These volume-delay functions are based on research and also validated with local traffic data. In the 1996-97 analyses, however, the consultants arbitrarily increased the delay on Route 29 beyond what the validated model already does. By doing so, the consultants forced the model to shift more traffic from Route 29 to the 29 bypass than would have been the case with the unaltered regional model. By overriding the regional model, the resulting analysis is invalid and unreliable.[5]

In addition, the numbers in the *1997 PBQD Study* literally "don't add up." Figure 6 on page 9 shows 2022 average daily traffic volumes at the northern terminus without the Meadow Creek Parkway. The daily traffic volume is higher to the north of the terminus (68,400) than it is on: (a) the 29 bypass and (b) Route 29 combined (24,400 + 36,100 = 60,500). Under this scenario, 7,900 vehicles, or 12% of the traffic north of the 29 bypass is not found on either of the roadways to the south. Such a scenario is impossible and would not have occurred without an alteration of the model output because the model quite rightly requires that cars show up on both sides of an intersection. Given the large size of this error, it appears that the adjustments made to the model were quite significant.

<u>Inflating traffic forecasts</u>

The *1997 PBQD Study* states that modeling was done for 2015 but that the numbers were then extrapolated to 2022:

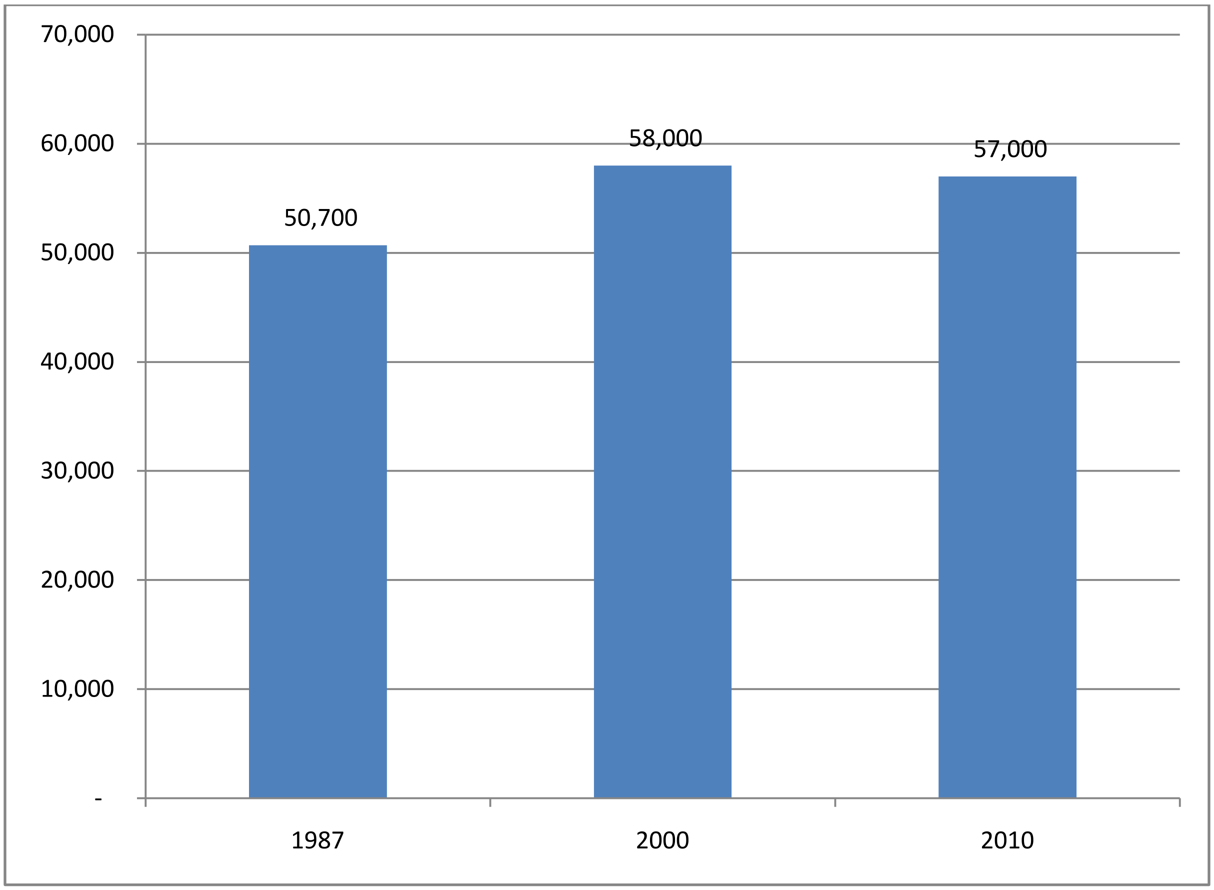
> An annual growth rate of 1.7 percent (compounded annually) was calculated based upon existing traffic counts and the model's projected 2015 volumes on US Route 29. This growth rate was then applied to 2015 model projections to reach 2022 design year volumes. (pp. 7 and 11).

This extrapolation to 2022 is very poor practice. Simply extrapolating traffic volumes beyond the travel demand model's horizon year is arbitrary and invalid. Appropriate travel demand modeling takes a systematic look at future land use and the effects of modeled travel time on travel patterns. This process begins with forecasts of future housing and jobs for small area Transportation Analysis Zones (TAZs). The housing and jobs are then converted to trips and the trips are assigned to the roadway network. This travel demand modeling process is much more accurate than simple trend extrapolation.

[5] This does not appear to be the only step in the process in which undocumented judgment and/or bias modified the modeling results. For example, the 1997 report also describes how "results were then adjusted to account for differences in flow patterns which could be reasonably assumed to occur and those indicated by the model." (p. 12). These changes were not documented so it is impossible to assess their importance.

Further, the 1.7% assumed growth rate has proven to be far higher than the actual rate of traffic growth over the past two decades on Route 29 between Rio and Hydraulic Roads, the most heavily traveled segment of the corridor. The graph below summarizes *actual* 1987, 2000, and 2010 traffic counts on this segment of Route 29.

Traffic Counts on Route 29 between Hydraulic Road and Rio Road



As the graph shows, actual traffic growth on this segment of Route 29 between 1987 and 2010 was relatively small, and traffic volume actually decreased between 2000 and 2010. The actual compound growth rate since 1987 on this stretch has been only 0.5%. Yet, as discussed above, the projections of traffic growth used in the PBQD analysis and relied upon in the SEIS were based on a 1.7% compounded growth rate between 2015 and 2022.

Thus the PBQD report's forecasts, which were incorporated into the SEIS, are not reliable.

Overestimating traffic diversion

As discussed in Part I above, the *1990 TTA Report* estimated total traffic volume for 2010 on Route 29 between Rio Road and Hydraulic Road to be 60,900 vehicles per day (vpd) without the 29 bypass, and 50,000 vpd with the 29 bypass, for an estimated diversion of 10,900 vpd from Route 29 to the bypass. (Table 6, p. 28). The *1990 TTA Report* further estimated total traffic on the 29 bypass (17,400-17,900 vpd) to be larger than the amount of diverted traffic (10,900 vpd) as a result of induced traffic.[6]

In sharp contrast, the *1997 PBQD Study* estimated significantly more traffic on the 29 bypass for year 2022 (24,400 vpd), than the 17,400-17,900 vpd projected in the *1990 TTA Report* for year 2010, while at the same time claiming that Route 29 future traffic volumes will be lower on Route 29 than estimated in the *1990 TTA Report*. The *1997 PBQD Study* estimates that 2022 traffic on Route 29 would be only 43,000 vpd at the southern end (Figure 5, p. 8) and 36,100 vpd at the northern end (Figure 6, p. 9), versus 50,000 vpd projected in the *1990 TTA Report* for Route 29 in 2010.

This shift in the estimated percentage of traffic using the 29 bypass is a direct result of the improper adjustments made in the model discussed above. These adjustments arbitrarily moved traffic that would use Route 29 onto the bypass, which would have excess capacity. These invalid numbers are not only at the core of the SEIS but also appear to be the foundation of the most recent VDOT estimates of future use of the 29 bypass.

In the Request for Proposals VDOT issued on September 27, 2011, VDOT estimated 32,300 vehicles per day on the 29 bypass in the year 2036. This estimate is somewhat less than VDOT's projection three weeks earlier of 35,000 vpd on the bypass in 2036 as set forth in a September 7, 2011 PowerPoint presentation to the Albemarle County Board of Supervisors. No new modeling has been done. In the September 7 presentation, VDOT project manager Harold Jones indicated that the estimate was based on a "1.7% annual rate of growth."[7] This growth rate is the same rate that the 1997 PBQD report assumed, as discussed above, and is even more unfounded today than it was in 1997, given the more than 20 years of actual traffic data showing much lower rates of traffic growth. The actual compound growth rate on Route 29 between Hydraulic and Rio Roads since 1987 is only 0.5%. At this rate, the projected 32,300 vpd would not be reached until sometime around the year 2230.[8]

For all the reasons set forth above, the forecasts and traffic analysis included in the SEIS are unreliable, and there is no justifiable basis for the forecasted volume of 32,300 vehicle trips per day included in the RFP.

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[6] As noted above, without the two interchanges on the bypass that the model assumed at Hydraulic and Barracks Roads, much less traffic would have been shown to use the bypass.

[7] Both of these VDOT numbers are mathematically incorrect, even assuming a 1.7% annual rate of growth. Taking the 1997 PBQD forecast of bypass traffic of 24,400 in 2022, compound growth of 1.7% between 2022 and 2036 would result in a traffic volume for 2036 of 30,900, not the 35,000 or 32,300 vpd that VDOT estimates.

[8] This compound growth works just like bank interest. The VDOT horizon year of 2036 is 25 years from now. With 1.7% compound interest a bank deposit would growth by 52% over 25 years. At 0.5% interest, it would grow by only 13%—one quarter as much.

III. New Data Collection and Traffic Modeling is Needed to Develop Valid Travel Forecasts

VDOT's RFP for the 29 bypass indicates that "[t]raffic projections will be refined by the design-build team through data collection and analysis of the current long range transportation plan." (RFP, Part 2, p. 34 of 87). Due to both the age and the various errors included in the prior traffic analyses of the 29 bypass, extensive new data collection and traffic modeling is needed in order to develop reliable traffic projections.

The Charlottesville-Albemarle Metropolitan Planning Organization (MPO) is finalizing a new travel demand model with a 2010 base year and a 2040 horizon year. This model should be used in forecasting traffic for the 29 bypass scenarios (including a no-build scenario). The travel forecasts should be done with the same model parameters and socio-economic inputs as used in the MPO's long-range planning, but should be sure also to test the effects of the bypass on future land use (as discussed below).

A. Properly Estimating Through Traffic Is Essential

Examining through traffic is an important component of any valid modeling of the proposed 29 bypass since it is a primary justification for the proposal. Origin-destination studies are one of the best tools for determining volumes of through traffic along a corridor. Because the last origin-destination study for this stretch of the Route 29 corridor is now over 20 years old, it would be extremely useful, and consistent with best practice, to do a new origin-destination study to determine how much through traffic is using the corridor today. It is also critical that the assumptions in the updated travel demand model about future growth in through traffic be accurate. As with assumptions about overall traffic growth, if assumptions about through traffic growth are unrealistic, all modeling outputs will be biased. The future growth rate in through traffic can be estimated by comparing the projected growth rates with actual growth rates over time. In updating the traffic modeling and forecasting, VDOT should compare through traffic volumes using a new origin-destination study with the through traffic volumes from the prior origin-destination study, and then calculate the annual rate of growth over that period of time.

B. Induced Travel Is a Critical Component that Should be Modeled

It is critical that the travel demand model properly account for induced traffic. DeCorla-Souza (of the Federal Highway Administration) and Cohen define "induced demand" as an "increase in daily vehicle miles of travel (VMT), with reference to a specific geographic context, resulting from expansion of highway capacity."[9] This definition includes both short- and long-term effects. The short-term effects include more and longer trips, shifts from other travel modes to vehicle trips, and vehicle trips with lower occupancies. The long-term effects result from land development brought on by increased roadway capacity.

Induced demand effects are well known, and there is a large and growing research literature quantifying the effects of induced demand. This research was kicked off in the United

[9] DeCorla-Souza, P. and H. Cohen. *Accounting for Induced Travel in Evaluation of Metropolitan Highway Expansion*. TRB 77th Annual Meeting Preprint CD-ROM, TRB, National Research Council, Washington D.C., January 1998.

States with a 1997 study by Hansen and Huang that demonstrated large growth in VMT in California that resulted from increased freeway capacity.[10] Since then, many other studies have confirmed the existence and the importance of induced travel. These studies have become increasingly sophisticated in their use of statistical techniques. Robert Cevero of the University of California, Berkeley, revisited the California freeway case in a major study. He writes:

> The longer-run relationship appears fairly strong – every 10% increase in travel speeds is associated with a 6.4% increase in VMT.[11]

Most regional transportation modeling does an incomplete job of accounting for induced travel. Cevero further explains:

> In many parts of the United States, travel-forecasting models used by planning agencies are not up to the task of adequately accounting for induced travel and induced growth (Transportation Research Board, 1995). Long-range forecasting models are needed that are robust and sophisticated enough to capture both short-run behavioral shifts and long-run land use shifts triggered by road improvements. (p. 160).

Complete modeling requires accounting for each of the separate components of induced demand including:

- shifts to longer routes;
- changes in destinations causing longer trips;
- changes in travel mode to vehicle trips; and
- changes in home or work locations resulting in longer trips.

Too often a single vehicle trip table is applied to all alternatives. This accounts for only the first element: shifts to longer trips. Accounting for the second and third elements requires model "feedback," i.e., feeding back the results of the model's traffic assignments into the steps where travelers choose destinations and travel mode. For example, if the 29 bypass were to make trips from north of the northern terminus faster to areas in central and southern Albemarle County, trip lengths on average would increase and traffic volumes would be higher on Route 29 to the north of the bypass. Increased congestion there could offset any traffic benefits in the section of Route 29 that is bypassed. Model feedback is needed to assess these indirect traffic impacts and thus to accurately assess the impact of the proposed 29 bypass.

Accounting for the fourth element of induced travel (change in home or work locations resulting in longer trips) requires estimating changes in future land use that will result from a roadway project. For example, if the 29 bypass makes travel to and from areas in Albemarle and Greene Counties in the greater Route 29 corridor more accessible, it will encourage both residential and commercial development in those areas. This increased development will cause increased traffic volumes, again partially offsetting any benefit of the project. The best way to account for these impacts is to use a linked land use model. The National Cooperative Highway

[10] Hansen, M. and Y. Huang. *Road Supply in California*. Transportation Research A, Vol. 31, No. 3, pp. 205-218, 1997.
[11] Cevero, Robert. *Road Expansion Urban Growth, and Induced Travel: A Path Analysis*. Journal of the American Planning Association 69(2), p. 157, 2003. *See* pp. 145-163.

Research Program (NCHRP) has published a Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects (Special Report 466, 2002).

Carolyn Rodier of the Mineta Institute and the University of California has researched how well land use models and transportation models with feedback account for induced travel. She concludes:

> The body of literature on the ability of existing travel and land use models to represent induced travel indicates that when travel times are fed back to a land use model and/or the trip distribution step, then (1) models can represent induced travel within the range documented in the empirical literature and (2) the effect of new highway capacity on land use and trip distribution significantly contributes to the models' representation of induced travel. If induced travel is not represented in travel and land use models, then the need for, and the benefit of, the project will be overstated (e.g., 16% to 236% of VHT [vehicle hours of travel]), and negative environmental effects will be understated (e.g., 72% to 192% of NOx emissions).[12]

To avoid further exaggerating the benefit of the proposed 29 bypass, it is critical that VDOT properly account for all components of induced travel.

C. The Model Should Consider How Other "Bottlenecks" in the 29 Corridor Will Affect Traffic

Traffic is part of an overall system. Adding an additional traffic lane at an uncongested location will not reduce delay if the delay stems from a "bottleneck" in a different part of the corridor. Standard travel demand modeling and level-of-service analyses, however, treat each roadway segment as independent, which can give misleading and even incorrect results. A complete and accurate analysis of the 29 bypass must consider how other bottlenecks in the corridor (both north and south) will affect traffic operations, both on the bypass and on Route 29. Otherwise, the value of the 29 bypass in reducing delay will be significantly overestimated.

IV. Effective Alternatives to the Proposed 29 Bypass Exist and Should be Objectively and Fully Considered

As discussed above, the proposed 29 bypass is an outdated and ineffective solution to congestion on the Route 29 corridor, necessitating a fresh and objective look at alternatives. The modeling that was done in connection with the *1990 TTA Report* and the FEIS showed that grade-separated intersections at key congested intersections on Route 29 would reduce delay on

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[12] Rodier, Carolyn J. *A Review of the Representation of Induced Highway Travel in Current Travel and Land Use Models*, p. 8, 2004. Rodier also reports on the share of induced travel caused by each of the four components of induced travel identified above. Changes in destination produced the largest share of the total induced travel. In a Sacramento region case study with an integrated land use allocation model (MEPLAN), the land use component produced the second highest amount of induced travel. Changes in routing were the third highest factor. The relative proportions of the components varied depending on the study. However, Rodier's research results suggest that routing changes alone probably represent only about 1/5 to 1/3 of total induced travel, especially in cases where a project is in a bottleneck area with few parallel routes.

Route 29 more effectively than the 29 bypass. Further, a study recently prepared for the Thomas Jefferson Planning District Commission determined that a transportation strategy that combines grade-separated intersections with enhancements to the local road network would effectively serve projected traffic volumes along the entire portion of the corridor in Albemarle County between the City of Charlottesville and Greene County. As a result, VDOT should fully and objectively evaluate an alternative to the 29 bypass that focuses on building grade-separated intersections and expanding the local road network along Route 29.

The modeling results presented in Table IV-3 of the FEIS projected that Route 29 would have a future arterial level-of-service "B" if grade-separated intersections were built where Route 29 intersects with Rio Road, Hydraulic Road, and Greenbrier Drive, even if the 29 bypass were not built. On the other hand, the same modeling results indicated that Route 29 would have a future arterial level-of-service of "F" if no grade-separated intersections were built—*even if the 29 bypass were built*.[13] (FEIS, Table IV-3). As a result, an alternative that focuses on building grade-separated intersections at key intersections continues to offer great promise in addressing deficiencies for both local and through traffic in a way that the proposed 29 bypass does not.[14]

Grade-separated intersections were also recommended in the 2008 US 29 North Corridor Transportation Study, which thoroughly evaluated the entire 10.75-mile stretch of Route 29 between the Route 250 Bypass and the northern border of Albemarle County. The study was prepared for the Thomas Jefferson Planning District Commission, in conjunction with VDOT, as part of the development of the Places29 master plan for Albemarle County. The Metropolitan Planning Organization's Policy Board unanimously endorsed the transportation study in 2008.

In addition to the grade-separated intersections, the US 29 North Corridor Transportation Study's preferred roadway network included improvements to create a more complete street network to support access between existing and new development in the corridor. The Study determined that this roadway network would adequately serve projected traffic volumes in the future. (p. 28).

The preferred alternative in the US 29 North Corridor Transportation Study also incorporated other elements that are intended to help move cars while meeting other important community goals such as emphasizing mixed-use development that reduces vehicle trips by facilitating multi-modal transportation options. An additional advantage of the comprehensive set of improvements over a bypass is that the set of improvements can be built incrementally over time. The amount of money that would be necessary to build the proposed bypass could be spent much more effectively on targeted improvements along the Route 29 corridor.

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[13] Notably, in its comments on the 1990 Draft Environmental Impact Statement, the Environmental Protection Agency stated that the proposed bypass alternatives "will not relieve the traffic congestion problem without the construction of grade separated interchanges at Rio, Hydraulic, and Greenbriar Roads. Since the proposed build alternatives would not improve the Level of Service of Route 29, we question the need for a highway on a new alignment." U.S. EPA, Comment letter to FHWA Division Administrator, July 17, 1990.

[14] The SEIS attempts to discount the benefits of the grade-separated intersections alternative, claiming that the bypass would be more effective at reducing delay on Route29. However, that conclusion is undermined by the significant errors in the traffic forecasting and analyses underlying the SEIS that are documented in Part II of this report.