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Review of VDOT's Traffic Analysis in the Draft Environmental Assessment for Proposed Route 29 Bypass

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Overview

The project that the Virginia Department of Transportation (VDOT) evaluates in the draft Environmental Assessment for the Route 29 Bypass (Draft EA) is a modified version of the Alternative 10 bypass alignment that VDOT selected as part of the preferred alternative in the Final Environmental Impact Statement (FEIS) it completed for this project in 1993. As stated on page 4 of the Draft EA, the purpose of the project remains the purpose set forth in the 1993 FEIS:

> The purpose of the Route 29 Corridor Study is to find a solution to existing and future 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. A secondary purpose of the study is to complete a gap in ongoing improvements to U.S. Route 29 through Central Virginia.

It has now been almost twenty years since the agencies completed the FEIS. The traffic study that VDOT and FHWA used to compare the transportation efficacy of different alternatives in the FEIS—and which they relied upon in selecting the Alternative 10 alignment over other alternatives—was completed in 1990, twenty-two years ago. To this day, that 1990 Traffic and Transportation Analysis technical memorandum is, to the best of my knowledge, the only traffic study that VDOT has ever completed for this project that provides a comparison of the proposed bypass to alternatives.

Traffic and development patterns along the Route 29 corridor have undergone drastic changes since 1990. As mentioned in the Draft EA, even in the nine years that have passed since the SEIS was completed, a substantial amount of additional development has been built or approved along the Route 29 corridor. Some of this development has been approved within the portion of the corridor that would be bypassed, but a great deal of it has been approved north of the proposed northern terminus of the bypass. The Southern Environmental Law Center has reviewed development approvals and related information on file with Albemarle County and has provided a conservative estimate that nearly 3,000 residential units and over 3.3 million square feet of non-residential development have been approved solely along the portion of Route 29 between the location of the proposed northern terminus of the bypass and Albemarle County's northern border just since the completion of the SEIS.

Beginning roughly a decade ago, the Charlottesville-Albemarle region began to formulate a transportation strategy that, instead of focusing on a bypass around Route 29, would improve Route 29 directly by combining selected improvements to Route 29 with improvements to the network of local parallel and connecting streets in the Route 29 corridor. This strategy can be seen taking shape in the recommendations contained in the two "29H250" studies that the Thomas Jefferson Planning District Commission ("TJPDC"), VDOT, the City of Charlottesville and Albemarle County prepared in 2003 and 2004. The strategy is fully embodied in the set of transportation improvements recommended in the US 29 North Corridor Transportation Study Final Report that the Charlottesville-Albemarle's Metropolitan Planning Organization's Policy Board unanimously endorsed in 2008 ("MPO Corridor Study").

In light of the vast increase in the amount of development built or approved along the Route 29 corridor, including the spread of large-scale development much farther to the north than twenty-two years ago, the 1990 traffic data and projections are now so outdated that any conclusions based on that data are irrelevant and must be reconsidered. To make reasonably informed judgments about the ability of this project to satisfy the described purpose, it is imperative that a new, reliable traffic analysis be completed, and that this new analysis take a fresh look at alternatives, particularly those that focus on improving Route 29 directly through a combination of grade-separated interchanges and other improvements to the existing highway, as well as extensions of the local parallel and connector roads located along Route 29.

Having carefully reviewed the Draft EA and the models used to compile the traffic data assessed in the Draft EA, I conclude that the traffic data are so seriously flawed that they cannot reasonably be relied upon for purposes of drawing conclusions about whether the proposed bypass would achieve the project purposes. Further, if one were to nonetheless attempt to draw conclusions from the flawed data, a reasonable analysis of that data shows that the proposed bypass, contrary to VDOT's assertions in the Draft EA, would <u>not</u> effectively solve congestion. Finally, modeling a scenario that simply adds a grade-separated interchange at the intersection of Hydraulic and Route 29 to the set of projects included in the so-called No-Build scenario convincingly demonstrates that an alternative that focuses on improving the existing Route 29 directly would more effectively reduce congestion along the corridor and achieve the project purposes than the proposed bypass.

I. The Version of the Regional Travel Demand Model that VDOT Used to Compile the Traffic Projections Analyzed in the Draft EA is Fatally Flawed.

A critical first step in providing a reliable traffic analysis of this project is to use a travel demand model that provides justifiable forecasts of traffic volumes and travel patterns for the Route 29 corridor. Unfortunately, the version of the regional travel demand model that VDOT's consultant used to prepare the traffic analysis for the Draft EA is defective. It significantly exaggerates estimates of traffic volumes that the bypass would divert from Route 29 and other roadways in the Route 29 corridor. The exaggerated estimates improperly distort the analysis and cannot reasonably be relied upon to assess the effectiveness of the proposed bypass in meeting the project purpose and need.

A. Flawed External Traffic Figures Significantly Exaggerate Growth in "Through" Traffic

As set forth in the August 16, 2012 Traffic and Transportation Technical Report (TTTR) prepared for the Draft EA, the traffic forecasts analyzed in the Draft EA are derived from the January 12, 2012 version of the Charlottesville-Albemarle Metropolitan Planning Organization's (MPO) regional travel demand model. On page 3, the TTTR makes clear that "[n]o adjustments were made by the study team to the MPO model prior to performing model runs to determine year 2040 forecasts." Thus, VDOT made no changes to the January 12, 2012 version of model it received from the MPO that it then used to generate the year 2040 traffic forecasts analyzed in the TTTR and the Draft EA.

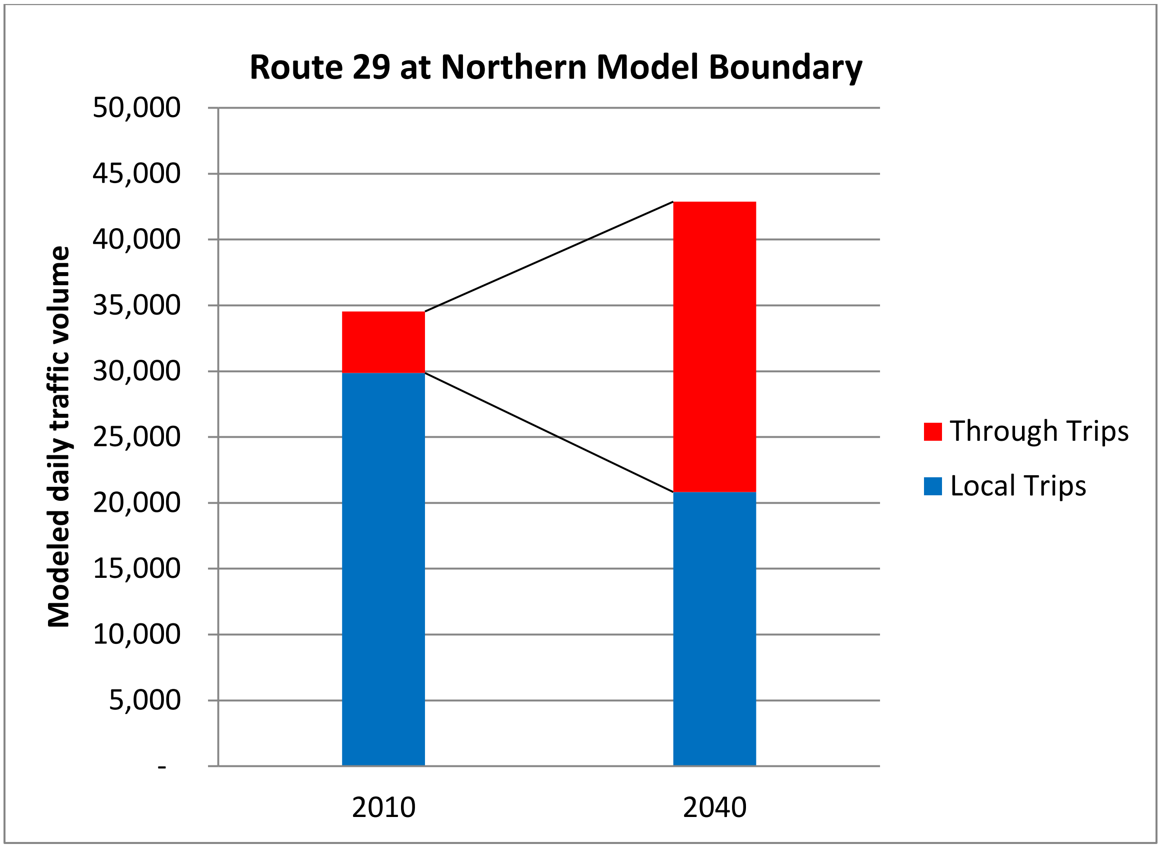
The MPO provided SELC with the January 12, 2012 version of its regional travel demand in mid-January. Knowing the model would be used to develop forecasts that would shape important decisions about transportation priorities in the Charlottesville region—not just on the proposed bypass, but all projects under consideration for inclusion in the MPO's Long Range Transportation Plan—SELC hired me to review the model and assess its validity.

Upon reviewing the model, I soon discovered that there was a significant problem with the way the model treats "external traffic," that is, traffic traveling into the geographic area covered by the MPO model ("MPO model area") from outside those boundaries.[1] A proper model should divide those external trips between destinations within the MPO model area and destinations outside the MPO study area. The MPO model, however, incorrectly treats <u>all</u> future growth in external traffic as "through" trips—meaning those external trips are all shown as traveling entirely through the MPO model area to destinations outside the model area's boundaries. By treating all growth in external traffic as through trips, the model produces a highly distorted growth rate for through trips. That excessive growth in through trips, in turn, results in a significant exaggeration of the volume of traffic the model projects on transportation facilities such as the proposed Route 29 bypass that are largely intended to attract through trips.

For instance, the model shows that, for the year 2010, 12% of external traffic is made up of through trips. But for the year 2040, the model projects that the percentage of through trips would jump to an unrealistic 46%. Focusing specifically on Route 29 at the northern boundary of the model area, the model shows a through trip share of 13.5% in 2010. Inexplicably, this share explodes to 51% in 2040.

[1] In contrast, "internal" traffic consists of trips entirely within the MPO study area.

As shown in the figure below, the model projects such tremendous growth in through trips between 2010 and 2040 on Route 29 at the northern boundary of the model area that, to make room for all the through trips, the model has to calculate that the number of non-through trips currently at that location will somehow decrease by roughly 10,000 trips per day over the next 30 years. This makes no sense.



Together with SELC attorneys, I raised this serious problem concerning the model during a conference call with MPO staff on January 18, 2012. MPO staff acknowledged the problem and said that they were working to fix it and would have a corrected version of the model ready as soon as possible.

Based on my recommendation, I understand SELC also brought this serious flaw to the attention of the MPO Policy Board—including the FHWA and VDOT members—at the Policy Board's January 25, 2012 meeting, informing them that the exaggerated through traffic figures would distort any analysis of the effect that projects such as the proposed bypass would have on the future transportation network. I understand that SELC urged VDOT and the MPO at that meeting to hold off on using the model for traffic forecasting purposes until the serious problem with the model could be corrected.

MPO staff corrected the problem by early February and shared the corrected version of the model with SELC and me on February 7, 2012. MPO staff informed SELC that they also provided VDOT with the corrected version of the model at that time.

Using the corrected version of the model that the MPO provided to us on February 7, the amount of traffic it projects would use the proposed 29 bypass in the year 2040 dropped 14%, from 27,798 vehicles per day to 23,918 vehicles per day. This is a significant decrease for purposes of evaluating the effectiveness of the proposed bypass in addressing traffic congestion. In addition, the corrected February model projects significantly fewer vehicles for various segments of Route 29 in the No-Build scenario. For example, for the segment of Route 29 between Polo Grounds Road and Hilton Heights Road, the February model projects 6,000 fewer vehicles per day in 2040 than the January model, a reduction of 8%. Thus, the flawed January model makes the future baseline (or "no-build") conditions look worse, and the bypass much more effective, than the corrected model indicates they will be.

The projections generated by the corrected February model result in a substantially different picture of the effectiveness of the bypass in addressing traffic congestion on Route 29 and achieving the project purposes. The significant difference between the projections generated by the flawed January model and the corrected February model demonstrates clearly that the defective data generated by the January model—the data that form the basis of the traffic analysis in the Draft EA—are invalid and cannot be relied upon to make a reasonable assessment of whether the proposed bypass would even meet the project purposes.

B. The Outdated Origin-Destination Data Further Undermine Through Traffic Estimates.

Another significant problem with the version of the MPO regional travel demand model used by VDOT in preparing the Draft EA is the unacceptably outdated "origin-destination data" that it incorporates. Origin-destination data—real-world survey information gathered on drivers' starting points and destinations—are particularly important for traffic studies of bypass facilities because they help provide a reasonable estimate of the overall volume of through traffic using a particular corridor. These data then help ground truth the model's future projections of through traffic volume.

The last origin-destination study for the relevant portion of the Route 29 corridor is now over twenty years old, and the significant development that has occurred since then has certainly altered transportation patterns along the corridor such that the prior origin-destination data is obsolete. I originally discussed this concern in my October 26, 2011 report titled "Review of Traffic Projections for Proposed Route 29 Bypass." SELC provided that report to FHWA and VDOT on that same day, and SELC raised this concern again in a May 31, 2012 letter to FHWA and VDOT after becoming concerned that not even modest efforts to assemble updated origin-destination data were being undertaken.

The obsolete origin-destination data incorporated into the traffic model VDOT used for the Draft EA further undermine the validity of the traffic projections that are used to draw conclusions about the project's effectiveness in the Draft EA.

II. <u>Even Using the Flawed Data, a More Complete Traffic Analysis Shows the Bypass Would Not Effectively Satisfy the Project Purpose and Need.</u>

Even if the significant flaws with the model were ignored and the flawed traffic forecasts it generates were used, it is apparent that the bypass is an outdated and ineffective solution to the congestion on Route 29.

A. VDOT's Capacity Analysis Overlooks Important Traffic Impacts Farther North on Route 29.

On page 13, the Draft EA states that "[t]he proposed project would relieve congestion on the three-mile section of U.S. Route 29 between U.S. Route 250 Bypass and the South Fork Rivanna River by providing additional north-south highway capacity and diverting traffic from the existing road to the new parallel road."

Providing additional capacity does not necessarily translate to relieving congestion. Unless the volume of traffic exceeds capacity in the area in which the new capacity will be added, the additional capacity will often not have a demonstrable effect in improving levels-of-service, the metric used to measure congestion. Also, if adding the new capacity along one portion of a corridor generates additional traffic in an adjacent portion that already has insufficient capacity, the effects of exacerbating congestion on the portion that already exceeds capacity can spill over into the portion in which the additional capacity was added, in turn undermining the benefit of adding capacity there.

In Table 3 on page 6 of the Draft EA, VDOT compares projected No-Build and Build traffic volumes on various segments of Route 29 and other roads. However, the Route 29 segments it includes are almost exclusively located south of the northern terminus of the proposed bypass. The table only includes one short segment north of the proposed northern terminus. (This one segment is labeled "North of Rt 29 Bypass Interchange" in Table 3 and extends from approximately where Ashwood Boulevard is located north to Hollymead Drive.) There are no data presented on the impact the bypass would have on traffic volumes any farther to the north of the proposed northern terminus than Hollymead Drive. Yet such information is essential to determine the effect the bypass would have on congestion on Route 29, both within the portion that would be bypassed, as well as farther north.

To make this assessment, I used the same January 12, 2012 version of the MPO model that VDOT used to generate the data comparing 2040 No-Build and Build volumes along various segments of Route 29, but I extended my analysis farther to the north than VDOT. I also included a comparison of the 2040 volumes to 2040 capacity, since volumes alone, without information on capacity, indicate little about congestion. The results are presented in the table below.

Comparison of 2040 No-Build and Build Volumes and Capacities on Existing Route 29

Segment	2040 Daily Traffic Volume		2040 Capacity	2040 Volume-to-Capacity Ratio	
	No-Build	Build		No-Build	Build
(North of proposed bypass)					
North of Frays Mills Rd	42,981	42,981	45,600	94%	94%
Frays Mill Rd to Dickerson Rd	49,836	50,244	45,600	109%	110%
Dickerson Rd to Lewis and Clark Dr	50,965	51,476	45,600	112%	113%
Lewis and Clark Dr to Airport Rd	61,559	61,723	68,400	90%	90%
Airport Rd to Timberwood Blvd	60,677	62,811	68,400	89%	92%
Timberwood Blvd to Town Center Dr	70,486	72,665	68,400	103%	106%
Town Center Dr to Hollymead Dr	71,314	72,463	68,400	104%	106%
Hollymead Dr to Rt 29 Bypass	66,542	74,859	68,400	89%	109%
(South of proposed bypass)					
Rt 29 Bypass to Polo Grounds Rd	73,078	65,410	68,400	107%	96%
Polo Grounds Rd to Hilton Heights Rd	75,664	63,510	91,200	83%	70%
Carrsbrook Dr to Woodbrook Dr	76,678	64,434	91,200	84%	71%
Woodbrook Dr to Rio Rd	81,058	68,593	91,200	89%	75%
Rio Rd to Berkmar Dr	65,945	51,167	91,200	72%	56%
Berkmar Dr to Dominion Dr	80,317	58,462	91,200	88%	64%
Dominion Dr to Greenbrier Dr	84,360	62,926	91,200	93%	69%
Greenbrier Dr to Hydraulic Rd	83,284	67,704	91,200	91%	74%
Hydraulic Rd to Angus Rd	83,292	63,087	91,200	91%	69%
Angus Rd to Route 250 Bypass	86,878	65,566	91,200	95%	72%

Key: 2040 daily traffic volume exceeds 2040 daily capacity

Notes:

1) The table includes the Route 29 segments included in Table 3 in the Draft EA, as well as additional segments of Route 29 continuing north to Frays Mills Road.
2) Daily roadway capacity for each segment is determined from the MPO model using the projected number of lanes, which varies from four lanes, to six lanes, to eight lanes from north to south in the segments included.
3) Volume-to-capacity ratios are calculated from the 2040 daily volume and the 2040 daily capacity.

The data indicate that 2040 traffic volumes along the stretch of Route 29 above the northern terminus of the proposed bypass generally will exceed capacity, whether or not the bypass is built. Conversely, the data show that there will be sufficient capacity within all but a short stretch of the 4.2-mile portion of Route 29 that the proposed bypass would circumvent. In other words, the bypass would remove vehicles from the portion of the Route 29 corridor that generally will have sufficient capacity to handle 2040 traffic volumes *without the bypass*; at the same time, the bypass would generate additional traffic volume in the area north of the proposed northern terminus that would have *inadequate* capacity in 2040.

More specifically, under the scenario in which the bypass is not built (the so-called No-Build scenario), only one of the ten segments of Route 29 located south of the proposed northern terminus of the bypass, a segment measuring about 0.8 mile, will be above capacity in 2040. Meanwhile, four of the eight segments of Route 29 located *north* of the proposed northern terminus of the bypass—totaling over 3 miles in length—will be over capacity in 2040 in the No-Build scenario.

Further, in the Build scenario, the additional traffic volume that would result from building the bypass would exacerbate the capacity deficiencies in the four segments north of the proposed northern terminus mentioned above, while also pushing a fifth segment beyond capacity, for a total of 3.37 miles of Route 29 that would exceed capacity north of the proposed bypass. And although the bypass would reduce traffic volumes along the single segment of Route 29 south of the northern terminus that is projected to be above capacity in 2040, this segment would still be at 96% capacity.

The traffic bottlenecks resulting from the capacity deficiencies that the bypass would exacerbate north of the proposed bypass could also spill over onto the bypassed portion of Route 29 and even undermine the relatively small benefit that the additional capacity would provide along that portion. Moreover, the additional congestion the bypass would generate north of its northern terminus would undercut what little effectiveness it might offer in facilitating intrastate and interstate trips passing through central Virginia because the most severe bottleneck would become even more congested.

By ignoring future traffic conditions and capacities on Route 29 farther north of the proposed bypass, and by ignoring the effects of the bypass on those conditions, the Draft EA provides an incomplete and misleading analysis of the project's effectiveness in reducing congestion on Route 29 and facilitating the movement of through traffic. When the impact of the bypass on the segments of Route 29 located north of the proposed bypass are taken into account, it appears that the bypass would not noticeably improve travel conditions for through traffic; nor would it effectively address congestion on Route 29, even within the three-mile segment located between the 250 Bypass and the South Fork Rivanna River.[2]

B. VDOT's Intersections Analysis Indicates that the Bypass Would Do Little to Solve Congestion on Route 29.

The Draft EA also attempts to demonstrate the project's ability to achieve the project purpose by evaluating the effect that diverting traffic from Route 29 onto the proposed bypass would have on levels-of-service[3] and average delay times[4] at four major intersections along the portion of Route 29 that would be bypassed: Greenbrier/29; Hydraulic/29; Rio/29; and Hilton Heights/29.

On page 6, the TTTR explains that the study team used the traffic analysis software "Synchro" to conduct an analysis of traffic operations at these four intersections. However, as will be discussed in more detail below, the Synchro modeling failed to account for the significant coordination between traffic signals that has already been completed along this portion of the Route 29 corridor. It is critical that a reasonable level of traffic signal coordination be accounted for in intersection operations analyses such as the one VDOT undertook for the Draft EA in order to produce defensible results. I have rerun the Synchro analysis using the same projected volumes that VDOT used, but I incorporated signal coordination into my model runs in order to generate a more reliable intersections analysis. I will discuss those results in the next section.

First, however, even setting aside the failure to include appropriate signal coordination, VDOT's Synchro output—included on page 14 of the Draft EA, as well as pages 11-12 of the TTTR—indicates that the bypass would offer minimal value in solving traffic congestion on Route 29 compared to the set of projects included in the No-Build scenario. It would not effectively address the major sources of congestion at Hydraulic and Rio Roads along Route 29, and the slight, isolated improvements it might offer at some of the less congested intersections would not effectively address overall congestion on this portion of the Route 29 corridor.

[2] Of the relevant segments of Route 29 that the Draft EA's traffic analysis ignores, all of the ones I included in my analysis are located in northern Albemarle County. However, the Draft EA also fails to include any analysis of how the bypass would impact traffic and land development patterns in southern Greene County, two issues that are pertinent to the effectiveness and the impacts of the proposed bypass and which should therefore be included a proper assessment of the project.

[3] As discussed in footnote 4 of the Draft EA, level of service (LOS) is a grading system used to characterize the operating conditions on roadway facilities. In general, it equates to the level of congestion.

[4] Average delay is calculated as a weighted average of the delay for all movements through an intersection, so that higher-volume movements are weighted more heavily than the lower-volume movements.

Table 4. 2040 No-Build and Build Intersection Delay and LOS

Intersection	2040 No-Build				2040 Build			
	AM		PM		AM		PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Route 29 at Hydraulic Road	219	F	312	F	126	F	202	F
Route 29 at Greenbrier Drive	44	D	129	F	47	D	126	F
Route 29 at Rio Road	35*	D*	40*	D*	36*	D*	38*	D*
Route 29 at Hilton Heights Road	31	C	70	E	24	C	44	D

* The construction of a grade-separate interchange at Route 29 and Rio Road is programmed in *UnJAM2035*, the region's current financially constrained long range transportation plan. The delay and level of service shown here are based on analysis of this location as a single-point urban interchange where the through traffic on Route 29 passes underneath and would not need to stop at a signal.

a. Intersection of Greenbrier Drive and Route 29

As the Draft EA shows in Table 4, copied above, building the bypass would offer no improvement at the intersection of Greenbrier Drive and Route 29 beyond that already provided by the set of projects included in the No-Build scenario. The difference between the delay in the No-Build and Build scenarios at the Greenbrier/29 intersection is insignificant. While the bypass decreases delay by a trivial amount (3 seconds) in the PM peak, building the bypass actually *increases* delay at the intersection by the same amount in the AM peak hour. Significantly, the level of service at the intersection is also the same between the No-Build and Build scenarios. The bypass clearly would not improve traffic conditions at this intersection.

b. Intersection of Rio Road and Route 29

Similar to the Greenbrier/29 intersection, the bypass would have no impact on traffic conditions at the Rio/29 intersection. The difference between the delay in the No-Build and Build scenarios at this intersection is minimal, and again, building the bypass does not improve the level of service. As with the Greenbrier/29 intersection, the bypass is no more effective than the No-Build scenario at the Rio/29 intersection.

Further, Table 4 in the Draft EA does not include the Synchro output data that were included in the TTTR showing that the planned grade-separated interchange is the reason the busy Rio/29 intersection is projected to operate at an acceptable condition in 2040. More specifically, the data in Table 6 in the TTTR demonstrate that simply building a grade-separated interchange—without building the bypass—would reduce average delay from 86 seconds to 35 seconds in the AM peak hour (improving the level of service from "F" to "D"), and from 242 seconds to 40 seconds in the PM peak hour (also improving the level of service from "F" to "D"). Notably, adding the bypass would only provide an additional 2 seconds of time savings in the PM peak hour, and it would actually *increase* delay at that intersection by a half-second in the AM peak hour.

Therefore, using VDOT's own Synchro output, it is clear that building the bypass offers no discernible benefit beyond the No-Build scenario at the Rio/29 intersection, and that the planned grade-separated interchange is essential to solving this major source of congestion.[5]

c. Intersection of Hydraulic Road and Route 29

Table 4 in the Draft EA shows a noticeable reduction in delay between the 2040 No-Build and the 2040 Build scenarios for the intersection of Hydraulic/29. Significantly however, the intersection would still function at a failing "F" level of service even if the bypass were built. This means that congestion at that intersection and in the vicinity would not be solved by the bypass. Rather, the intersection would remain a major, unresolved chokepoint and a primary source of congestion along that part of the Route 29 corridor.

Further, VDOT's Synchro modeling did not assume a grade-separated interchange would be constructed at the Hydraulic/29 intersection. As with the Rio/29 intersection, a grade-separated interchange at Hydraulic/29 intersection would be a far more effective solution than the bypass, as I will further discuss below (in section III).

d. Intersection of Hilton Heights Road and Route 29

Table 4 in the Draft EA also shows a reduction in delay—although fairly slight—between the 2040 No-Build and the 2040 Build scenarios for the intersection of Hilton Heights/29. Here, the 7-second reduction in delay during the AM peak hour does not improve the level of service from the No-Build scenario. In the PM peak hour, the Build scenario shows a 26-second reduction in delay and an improvement in the level of service from "E" to "D." However, this improvement would occur at an intersection at which congestion is projected to be much less severe than at other intersections that will have a far greater effect on overall congestion along Albemarle County's portion of Route 29. This slight level of improvement certainly does not demonstrate that the bypass will effectively address congestion overall on the corridor other than offering minimal, isolated improvements. Moreover, as will be discussed below, once the Synchro modeling is corrected to account for the lack of traffic signal coordination, the 26-second improvement the bypass would provide at Hilton Heights/29 in the PM peak hour is reduced to only 16 seconds.

Thus, even without correcting the problem with VDOT's Synchro analysis mentioned above, the data demonstrate that the proposed bypass does very little to improve traffic operations on Route 29. It would not effectively solve the major sources

[5] It is worth pointing out that when VDOT calculated the average delay for the scenario in which the Rio/29 intersection is replaced by a grade-separated interchange, it failed to average in the "through" traffic movements on Route 29. Because of the very nature of a grade-separated interchange, these through movements would not experience any delay; they would be free-flowing through the interchange. Thus, the average delay figure VDOT provides for the Rio/29 intersection is overstated. If the lack of delay for the through traffic movements were factored into the average, the average delay would be closer to 15 seconds.

of congestion along Route 29 in northern Albemarle County, and the slight, isolated improvements it might offer at less congested intersections would not effectively address overall congestion on the Route 29 corridor in this area. In short, the data indicate that the bypass would not achieve the project purpose and need.

III. Alternatives that Focus on Direct Improvements to Route 29 Would be More Effective than the Bypass.

As discussed in a document that VDOT provided to a member of the Albemarle County Board of Supervisors in July 2012, VDOT has recently reduced delay on Route 29 in northern Albemarle County by roughly five minutes simply by coordinating the traffic signals along that stretch.

First, in 2007, VDOT re-timed the 12 traffic signals on Route 29 from Hydraulic Road to Polo Grounds Road and installed more sophisticated traffic signal controllers. Travel times along this stretch were reduced from 8-9 minutes to 6-7 minutes during most peak periods as a result.

Then, in September 2008, VDOT installed a coordinated signal system along Route 29 from Polo Grounds Road to Airport Road/Proffit Road. Travel times were reduced along this stretch from 6-7 minutes to 3-4 minutes. Moreover, the VDOT document also states that, in 2014, VDOT will reevaluate the Route 29 corridor for additional signal coordination in the form of Adaptive Traffic Signal Control technology. Thus, there is already a high level of coordination of traffic signals on Route 29 that has improved traffic flow significantly, and additional coordination improvements will be considered in the near future.

However, as I mention above, VDOT's Synchro modeling in the TTTR and Draft EA did not account for even the existing level of signal coordination. Although the Synchro software has a signal coordination component, VDOT did not use this component and instead modeled the intersections as if they were isolated intersections at which vehicles will arrive randomly. As a result, VDOT's Synchro modeling essentially adds back in the five minutes of delay in the corridor that the recent signal coordination eliminated, exaggerating delay times.

I corrected the lack of coordination to provide a more reliable traffic operations analysis of the intersections evaluated in the Draft EA.[6] As mentioned above, I also

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[6] Synchro calculates signalized intersection delay and level of service by following a set of mathematical procedures prescribed in the Highway Capacity Manual published by the Transportation Research Board. These procedures include a data input for information about the arrivals of vehicles during the green phases of signals. VDOT did not provide these inputs in its Synchro analyses, so that their Synchro modeling defaulted to "random arrivals," the setting that represents no coordination. Based on the VDOT document describing the agency's recent successful signal coordination along this portion of Route 29, as well as my own observations of peak hour traffic in this corridor, I input the value for "highly favorable progression" for the mainline northbound and southbound movements on Route 29. For the northbound and southbound right-turn and left-turn movements, I input the value for "favorable progression." For the eastbound and westbound movements, I assumed "uncoordinated signals or random arrivals."

replaced the at-grade intersection at Hydraulic/29 with a grade-separated interchange in the model so that I could directly model the bypass in comparison to an alternative that simply adds a grade-separated interchange at Hydraulic/29 to the set of projects assumed in the so-called No-Build scenario. Finally, I used the most recent version of the Synchro software (Synchro 8) for my analysis because it implements the latest and most sophisticated version of the Highway Capacity Manual (2010) in calculating intersection delay. The results are presented in the table below.

2040 No-Build and Build Intersection Delay and LOS (incorporating signal coordination)

Intersection	2040 No-Build				2040 No-Build with Hydraulic Grade-Separated Interchange				2040 Build			
	AM		PM		AM		PM		AM		PM	
	Delay (sec/ veh)	LOS	Delay (sec/ veh)	LOS	Delay (sec/ veh)	LOS	Delay (sec/ veh)	LOS	Delay (sec/ veh)	LOS	Delay (sec/ veh)	LOS
Hydraulic	245	F	333	F	38*	D*	62*	E*	147	F	219	F
Greenbrier	19	B	107	F	19	B	107	F	27	C	115	F
Rio Road	35*	D*	40*	D*	35*	D*	40*	D*	36*	D*	38*	D*
Hilton Heights	9	A	51	D	9	A	51	D	7	A	35	C

* with grade separation

These results show that building a grade-separated interchange at Hydraulic/29 without a bypass would reduce average delay by 207 seconds (3 minutes, 27 seconds) in the AM peak hour, and by 271 seconds (4 minutes, 31 seconds) in the PM peak hour.[7] In contrast, building the bypass without a grade-separated interchange would reduce average delay only by 98 seconds in the AM peak hour and by 114 seconds (1 minute, 54 seconds) in the PM Peak Hour. In other words, building a grade-separated interchange at this intersection would provide 109 seconds (1 minute, 39 seconds) of savings in the AM peak hour and 157 seconds (2 minutes, 37 seconds) of savings in the PM peak hour over the bypass. In addition, the interchange would improve the intersection level of service to "D" and "E" in the AM and PM peak hours, respectively. In contrast, even if the

[7] Because VDOT did not factor the through lanes on Route 29 into its average delay calculations for the Rio/29 grade-separated interchange, I likewise did not incorporate those in my average delay calculations for the Hydraulic/29 grade-separated interchange. As discussed in footnote 5 with respect to the Rio/29 interchange, if the through lanes were included in the calculation, the average delay at the Hydraulic/29 intersection would be only about half of the average delays reported above.

bypass were built, both would remain at a failing "F" level of service in the AM and PM peak hours in the absence of the interchange.[8]

Thus, even using daily vehicle trip volumes generated by the flawed regional travel demand model, a Synchro analysis that properly incorporates traffic signal coordination shows that simply adding a grade-separated interchange at Hydraulic/29 to the set of projects assumed in the No-Build would more effectively reduce congestion on Route 29 than the bypass.

It is clearly essential that VDOT thoroughly evaluate new alternatives as part of the ongoing NEPA process.

IV. Conclusion

I have reviewed the Draft EA and the transportation models, analyses, and data used to document the transportation impacts of the proposed Route 29 bypass in the Draft EA.

Based on my review, I conclude:

1) The version of the regional transportation model VDOT used to generate future traffic forecasts is so seriously flawed in its treatment of external traffic that it cannot reasonably be relied upon for proper traffic forecasts for the proposed bypass or Route 29; nor can it reasonably be relied upon for purposes of drawing conclusions about whether the proposed bypass would achieve the project purposes.

2) If one were to nonetheless attempt to draw conclusions from the flawed data, a reasonable analysis of that data shows that the proposed bypass, contrary to VDOT's assertions in the Draft EA, would not effectively reduce congestion or satisfy the project purposes. It ignores the larger regional context that has transformed transportation planning efforts along this portion of the corridor to focus on direct improvements to Route 29 that simultaneously benefit local trips as well as trips passing through Charlottesville and Albemarle.

[8] Moreover, even these results downplay the positive effects that Berkmar Drive Extended, a key local parallel road project included in the No-Build scenario, would have on the Route 29 corridor. The flawed regional travel demand model that VDOT used shows Berkmar Drive Extended with a volume-to-capacity ratio of only 39 percent in 2040, even though it would run directly parallel to several segments of Route 29 projected to be over capacity. The travel demand model fails to distribute a realistic amount of traffic to Berkmar Drive Extended because it does not correctly calculate travel speeds on Route 29. For instance, despite showing several segments of Route 29 as over capacity in 2040, the model incorrectly calculates that drivers will be able to travel at an average speed of 43 mph along this portion of the highway. As a result, the model sees no reason to shift vehicles from Route 29 to Berkmar Drive Extended, resulting in an unrealistically low volume of traffic on that road. If the model properly calculated the average speed on Route 29, Berkmar Drive Extended would divert a much higher number of trips from the congested segments of Route 29 that it parallels, resulting in an even higher level of effectiveness for alternatives that add different combinations of recommendations from the MPO Corridor Study to the so-called No-Build alternative.

3) Simply augmenting the No-Build alternative with a grade-separated interchange at the intersection of Route 29 and Hydraulic would make the No-Build alternative outperform the proposed bypass. This is clear when the intersection level-of-service analyses properly include the effects of signal coordination (which was not done in the EA analyses).

4) A traffic analysis of the bypass needs to be redone that uses the corrected version of the MPO's regional travel demand model. The intersection analysis in the traffic study should properly include signal coordination. Most important, the bypass should be directly compared to a set of improvements to the corresponding section of Route 29 drawn from the MPO's US 29 North Corridor Transportation Study Final Report.

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EDUCATION:

Master of Science in Engineering Sciences, Dartmouth College, Hanover, NH, 1982
Bachelor of Science in Mathematics, Worcester Polytechnic Institute, Worcester, MA, 1977

PROFESSIONAL EXPERIENCE:

Norm Marshall helped found Smart Mobility, Inc. in 2001. Prior to this, he was at Resource Systems Group, Inc. for 14 years where he developed a national practice in travel demand modeling. He specializes in analyzing the relationships between the built environment and travel behavior, and doing planning that coordinates multi-modal transportation with land use and community needs.

Regional Land Use/Transportation Scenario Planning

California Air Resources Board – Leading team including the University of California that is reviewing the ability of the new generation of regional activity-based models and land use models to accurately account for greenhouse gas emissions from alternative scenarios including more compact walkable land use and roadway pricing.

Climate Plan (California statewide) – Assisted large coalition of groups in reviewing and participating in the target setting process required by Senate Bill 375 and administered by the California Air Resources Board to reduce future greenhouse gas emissions through land use measures and other regional initiatives.

Chicago Metropolis Plan and Chicago Metropolis Freight Plan (6-county region)— developed alternative transportation scenarios, made enhancements in the regional travel demand model, and used the enhanced model to evaluate alternative scenarios including development of alternative regional transit concepts. Developed multi-class assignment model and used it to analyze freight alternatives including congestion pricing and other peak shifting strategies. Chicago Metropolis 2020 was awarded the Daniel Burnham Award for regional planning in 2004 by the American Planning Association, based in part on this work.

Envision Central Texas Vision (5-countyregion)—implemented many enhancements in regional model including multiple time periods, feedback from congestion to trip distribution and mode choice, new life style trip production rates, auto availability model sensitive to urban design variables, non-motorized trip model sensitive to urban design variables, and mode choice model sensitive to urban design variables and with higher values of time (more accurate for "choice" riders). Analyzed set land use/transportation scenarios including developing transit concepts to match the different land use scenarios.

Mid-Ohio Regional Planning Commission Regional Growth Strategy (7-county Columbus region)—developed alternative future land use scenarios and calculated performance measures for use in a large public regional visioning project.

Baltimore Vision 2030—working with the Baltimore Metropolitan Council and the Baltimore Regional Partnership, increased regional travel demand model's sensitivity to land use and transportation infrastructure. Enhanced model was used to test alternative land use and transportation scenarios including different levels of public transit.

Chittenden County (2060 Land use and Transportation Vision Burlington Vermont region) – leading extensive public visioning project as part of MPO's long-range transportation plan update.

Municipal Planning

City of Grand Rapids – Michigan Street Corridor – developed peak period subarea model including non-motorized trips based on urban form. Model is being used to develop traffic volumes for several alternatives that are being additional analyzed using the City's Synchro model

City of Omaha - Modified regional travel demand model to properly account for non-motorized trips, transit trips and shorter auto trips that would result from more compact mixed-use development. Scenarios with different roadway, transit, and land use alternatives were modeled.

City of Dublin (Columbus region) – Modified regional travel demand model to properly account for non-motorized trips and shorter auto trips that would result from more compact mixed-use development. The model was applied in analyses for a new downtown to be constructed in the Bridge Street corridor on both sides of an historic village center.

City of Burlington (Vermont) Transportation Plan – Led team that developing Transportation Plan focused on supporting increased population and employment without increases in traffic by focusing investments and policies on transit, walking, biking and Transportation Demand Management.

Transit Planning

Regional Transportation Authority (Chicago) and Chicago Metropolis 2020 – evaluating alternative 2020 and 2030 system-wide transit scenarios including deterioration and enhance/expand under alternative land use and energy pricing assumptions in support of initiatives for increased public funding.

Capital Metropolitan Transportation Authority (Austin, TX) Transit Vision – analyzed the regional effects of implementing the transit vision in concert with an aggressive transit-oriented development plan developed by Calthorpe Associates. Transit vision includes commuter rail and BRT.

Bus Rapid Transit for Northern Virginia HOT Lanes (Breakthrough Technologies, Inc and Environmental Defense.) – analyzed alternative Bus Rapid Transit (BRT) strategies for proposed privately-developing High Occupancy Toll lanes on I-95 and I-495 (Capital Beltway) including different service alternatives (point-to-point services, trunk lines intersecting connecting routes at in-line stations, and hybrid).

Central Ohio Transportation Authority (Columbus) – analyzed the regional effects of implementing a rail vision plan on transit-oriented development potential and possible regional benefits that would result.

Essex (VT) Commuter Rail Environmental Assessment (Vermont Agency of Transportation and Chittenden County Metropolitan Planning Organization)—estimated transit ridership for commuter rail and enhanced bus scenarios, as well as traffic volumes.

Roadway Corridor Planning

Managed Toll Lanes in the Chicago region (Reason Foundation) – Developed advanced model of the Chicago area that calculates variable tolls by link for seven weekday time periods. The model was used to analyze a comprehensive set of new toll roads and managed toll lanes added to existing freeways.

Hudson River Crossing Study (Capital District Transportation Committee and NYSDOT) – Analyzing long term capacity needs for Hudson River bridges which a special focus on the I-90 Patroon Island Bridge where a microsimulation VISSIM model was developed and applied.

State Routes 5 & 92 Scoping Phase (NYSDOT) —evaluated TSM, TDM, transit and highway widening alternatives for the New York State Department of Transportation using local and national data, and a linkage between a regional network model and a detailed subarea CORSIM model.

Research

Obesity and the Built Environment (National Institutes of Health and Robert Wood Johnston Foundation) – Working with the Dartmouth Medical School to study the influence of local land use on middle school students in Vermont and New Hampshire, with a focus on physical activity and obesity.

The Future of Transportation Modeling (New Jersey DOT)—Member of Advisory Board on project for State of New Jersey researching trends and directions and making recommendations for future practice.

PUBLICATIONS AND PRESENTATIONS (partial list)

Understanding the Transportation Models and Asking the Right Questions. Lead presenter on national Webinar put on by the Surface Policy Planning Partnership (STTP) and the Center for Neighborhood Technologies (CNT) with partial funding by the Federal Transit Administration, 2007.

Sketch Transit Modeling Based on 2000 Census Data with Brian Grady. Presented at the Annual Meeting of the Transportation Research Board, Washington DC, January 2006, and *Transportation Research Record*, No. 1986, "Transit Management, Maintenance, Technology and Planning", p. 182-189, 2006.

Travel Demand Modeling for Regional Visioning and Scenario Analysis with Brian Grady. Presented at the Annual Meeting of the Transportation Research Board, Washington DC, January 2005, and *Transportation Research Record*, No. 1921, "Travel Demand 2005", p. 55-63, 2006.

Chicago Metropolis 2020: the Business Community Develops an Integrated Land Use/Transportation Plan with Brian Grady, Frank Beal and John Fregonese, presented at the Transportation Research Board's Conference on Planning Applications, Baton Rouge LA, April 2003.

Chicago Metropolis 2020: the Business Community Develops an Integrated Land Use/Transportation Plan with Lucinda Gibson, P.E., Frank Beal and John Fregonese, presented at the Institute of Transportation Engineers Technical Conference on Transportation's Role in Successful Communities, Fort Lauderdale FL, March 2003.

Evidence of Induced Travel with Bill Cowart, presented in association with the Ninth Session of the Commission on Sustainable Development, United Nations, New York City, April 2001.

Induced Demand at the Metropolitan Level – Regulatory Disputes in Conformity Determinations and Environmental Impact Statement Approvals, Transportation Research Forum, Annapolis MD, November 2000.

Evidence of Induced Demand in the Texas Transportation Institute's Urban Roadway Congestion Study Data Set, Transportation Research Board Annual Meeting, Washington DC: January 2000.

MEMBERSHIPS/AFFILIATIONS

Member, Institute of Transportation Engineers
Member, American Planning Association
Member, Congress for the New Urbanism