Appendix A – Analysis Methodology

The Coalition for Smarter Growth (CSG) analyzed the Northern Virginia Transportation Authority's (NVTA) last adopted TransAction long-range plan (2017), 106 projects funded to date,[1] and proposed list of projects to be funded in the next six-year program for fiscal years 2022-2027.

TransAction Project Review and Induced Demand Analysis

TransAction Project Classification

CSG reviewed the 484 projects and classified them into three general categories:

- Highway or Roadway Expansion Projects – new roads, projects adding new travel lanes, and new interchanges or vehicle capacity expansions of existing interchanges or intersections;[2]
- Roadway Traffic Operations Projects – projects that improve vehicular traffic flow and/or increase speeds without expanding lane or intersection capacity; and
- Transit, Pedestrian, Bicycle, and Complete Streets Near Transit (includes new local street grid connections within one mile of Metrorail and VRE stations).[3] Regional travel demand management strategies (#340) and the Long Bridge expansion project (#297) were also grouped in this category.

For Road Expansion Projects:

- CSG classified highway and roadway expansion projects with new lanes as: Interstate highways (FHWA class 1), Principal Arterial highways (FHWA classes 2 and 3), and Other Major Roads (includes minor arterials and collectors; FHWA classes 4 and above) based on local jurisdiction transportation plans or VDOT data for roads not indicated in local plans.
- NVTA project descriptions (TransAction plan Appendix G) and Google Maps were used to estimate new lane miles for proposed new travel lanes. Proposed dedicated bus-only lanes were excluded.
- Classification of TransAction projects was based on their project definitions in the 2017 plan. Since adoption of the 2017 TransAction plan, some project sponsor agencies (local jurisdictions, VDOT, transit agencies) have made changes to proposed project elements.[4]

Geographic classification of projects:

- Interstate highway projects and proposed new lane miles were grouped at the regional level, as the SHIFT calculator estimates induced demand for the metropolitan statistical area. For Figure 6, Northern Virginia Vehicle Miles, Climate Targets, and TransAction Induced Driving, only the new lane miles in Northern Virginia and their induced demand were included.
- New principal arterial projects were grouped and analyzed at the jurisdiction level. Two of these projects involve new highways and bridges across the Potomac River and extending into Maryland. Where lane miles and induced driving is broken down by jurisdiction, the new lane miles extending across portions of rural Maryland according to TransAction project descriptions are grouped under Maryland.

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[1] Excludes locally directed allocations of NVTA 30% funds.
[2] While many of these projects contain other multimodal improvements like sidewalks or shared use trails, their primary focus - and the vast bulk of their project costs - go to adding more lanes for general vehicle traffic. Also note that while NVTA classifies projects by transportation mode, its "Roadway" projects include some that primarily serve other modes (e.g., Crystal City transitway) or that improve traffic flow without expanding lane capacity; these projects were not included in the highway/road expansion projects.
[3] A few new road projects near transit hubs but with over-designed roadway widths and excessive numbers of lanes for general vehicle traffic in their conceptual designs were classified as road expansion projects. These included #17 Reston Town Center Parkway new four-lane divided roadway, #18 Seven Corners Ring Road, #167 Innovation Avenue widening to six lanes, and #218 Route 123 widening and interchange with local street extensions.
[4] For example, Loudoun County is now proposing to widen U.S. Highway 15 north of Leesburg to Points of Rocks Bridge, while the project in the 2017 TransAction plan consisted of operational improvements like roundabouts and restrictions on turning movements north of Montressor Road. Likewise, Fairfax County plans for BRT along Route 7 and in Tysons Corner now plan for some new lanes to be bus-only, while TransAction projects planned new general purpose traffic lanes for some of those segments.

Note that some recent major Northern Virginia projects are not included in the 2017 TransAction 2040 plan and are left out of this analysis. These include the I-95/395 and I-66 express lanes projects which have added and are continuing to add significant numbers of new lane miles to the highway network, and also the Silver Line Phase II extension in and Fairfax and Loudoun counties.

The list of NVTA-funded projects in NovaGateway was reviewed to see if portions of TransAction road projects had been completed prior to 2019. Only one project was found, Route 28 Hot Spot Improvements, which included a 1.1 mile new lane segment, and this lane mileage was excluded from the Loudoun County total used in the analysis.

SHIFT Calculator

CSG estimated induced travel for interstate and principal arterial highway lane expansion projects in the TransAction plan using the State Highway Induced Frequency of Travel (SHIFT) calculator developed by Rocky Mountain Institute (RMI) in partnership with other organizations. The SHIFT calculator is based on the Induced Travel Calculator developed by the National Center for Sustainable Transportation based at the University of California at Davis. The calculator estimates induced vehicle miles traveled (VMT) anticipated within five to ten years of project construction based on existing 2019 lane miles and VMT on the metropolitan-level interstate network or jurisdiction-level principal arterial network. The calculator applies different demand elasticities for interstate and principal arterial highways based on the academic research literature. Estimates of induced VMT from the calculator are intended to be order-of-magnitude estimates and not substitutes for detailed project-level analysis. The calculator produces low- and high-end estimates for future additional VMT resulting from expanding the highway network to reflect the range of induced demand elasticity in the research literature and project-by-project variability. RMI provides FAQs and more detailed methodology on the SHIFT website.

Proposed TransAction projects span the plan's timeframe of 2018 to 2040, so the use of the SHIFT calculator by this analysis is intended to provide an order-of-magnitude illustration of their cumulative impact, not a precise point-in-time estimate. Note that while the SHIFT calculator bases its induced demand estimates on 2019 VMT and highway network lane miles data for the geographic area, the SHIFT calculations use the *proportion* of VMT to highway network lane miles. Thus, future year applications of the SHIFT calculator for a given addition of new lane miles would yield similar estimates of induced VMT if baseline VMT and highway network miles grow proportionately.

Proposed new high-occupancy vehicle (HOV) or new express toll lanes that increase the total lanes on a highway were included in the SHIFT analysis. The SHIFT calculator methodology and initial research indicate that additional overall numbers of lanes on highways with HOV or express toll lanes are likely to contribute to induced demand, though noting that the magnitude and type of impacts depend on the specific project features.

Regional VMT Growth, Induced Demand, Climate Targets

Figure 6, "Northern Virginia Vehicle Miles, Climate Targets, and TransAction Induced Driving", is intended to show the general order-of-magnitude increase in total VMT that the induced demand from TransAction's interstate and principal arterial highway expansion projects would cause if built out. The induced VMT is provided in the context of TPB's recent Climate Change Mitigation Study, which shows that the region must limit future VMT growth below baseline forecast levels, even with rapid electric vehicle (EV) adoption, to achieve its greenhouse gas emissions reduction goals. CSG estimated total VMT impacts and approximate future forecast levels based on the following sources and assumptions:

- **Pre-Pandemic VMT** - 2019 VMT for NVTA jurisdictions is from 2019 Virginia Department of Transportation (VDOT) VMT daily data for all road classes (interstates, principal arterials, and other roads) by jurisdiction. VMT counts were multiplied by 365 to create an annual total. Totals of NVTA jurisdictions, 2019 daily VMT on all roads and vehicle types, was 53.65 million, which is 19.58 billion annual VMT. These annual totals from VDOT data are consistent with (although not the same source as) the FHWA data used as the 2019 network VMT in the SHIFT calculator for interstate highways and principal arterials.

- **2040 baseline VMT** – The 2040 estimate is based on the National Capital Region Transportation Planning Board, 2018 Visualize 2045 constrained long-range plan (CLRP) forecast of percent growth in regional VMT (includes DC and suburban Maryland as well as Northern Virginia), as the 2017 TransAction plan does not report VMT. The 2018 Visualize 2045 plan forecasts that VMT will increase 20% by the year 2045 compared with forecast population growth of 23% during this time.[5] Given that the NVTA member jurisdictions are forecast to experience a 23% increase in population from 2019 through 2040, this approximate 20% increase in VMT at the regional level was applied to the 2019 NVTA jurisdiction VMT to create an approximate future 2040 baseline VMT estimate.
- **Effect of major new transit investments absent transit-oriented land use planning** – Estimated reduction in future baseline VMT growth from additional major new transit investments not included in Visualize 2045 is a rough order-of-magnitude estimate based on the 2017 TPB Long Range Plan Task Force study transit scenarios. That study modeled several major transit investment scenarios in isolation (BRT and transitways, commuter rail, Metrorail core capacity, and transit rail extensions), with each reducing regional VMT approximately 1% or less from the future baseline forecast assuming the CLRP. The four transit scenarios contain the general types of major transit investments that the unconstrained TransAction 2040 plan includes. Absent additional land use changes or changes in proposed highway projects, the order-of-magnitude decrease in regional VMT would be a few percentage points. CSG analysis assumed 3%, based on adding up the decreases in regional VMT from each of the four transit strategy scenarios in TPB's Long Range Plan Task Force scenario analysis. Future baseline VMT with TransAction is reduced by 3% in the chart as an illustrative potential impact of the transit projects.
- **Induced VMT** – Induced driving VMT is the mid-range SHIFT calculator estimate (average of the low- and high-end induced demand estimates) for new lane miles within Virginia jurisdictions on interstate and principal arterial highways. New lane miles in portions of proposed TransAction projects in Maryland and their share of the induced demand VMT are excluded from this total. Induced VMT in this analysis does not include estimates of potential induced demand VMT from TransAction's proposed 398 new lane miles on other major roads (minor arterials, collectors).
- **Limit of VMT growth to meet climate targets** – The VMT growth limit to meet climate forecasts is based on the TPB Climate Change Mitigation Study of 2021 (CCMS) final report, scenario analysis. Looking at the scenarios with feasible assumptions that reduced on-road transportation emissions sufficiently to meet the reductions in the MWCOG 2030 Climate and Energy Action Plan, only combination scenarios that included mode shift and travel behavior adequately reduced emissions.[6] The average reduction in future 2040 passenger car VMT below baseline forecasts needed in these combination scenarios would be 17%; as a percentage of total VMT (excluding medium and heavy-duty trucks), that percentage reduction is 14.3%.[7] If total NVTA jurisdiction annual VMT in 2040 under baseline forecasts is in the range of 23.5 billion, then to meet our needed greenhouse gas reductions, even with rapid adoption of electric vehicles, Northern Virginia must limit annual VMT to approximately 20.1 billion (14.3% less). TPB's CCMS showed a mix of mode shift and travel behavior strategies that can achieve this goal and which would also improve job access, reduce travel times and give residents travel and housing options.

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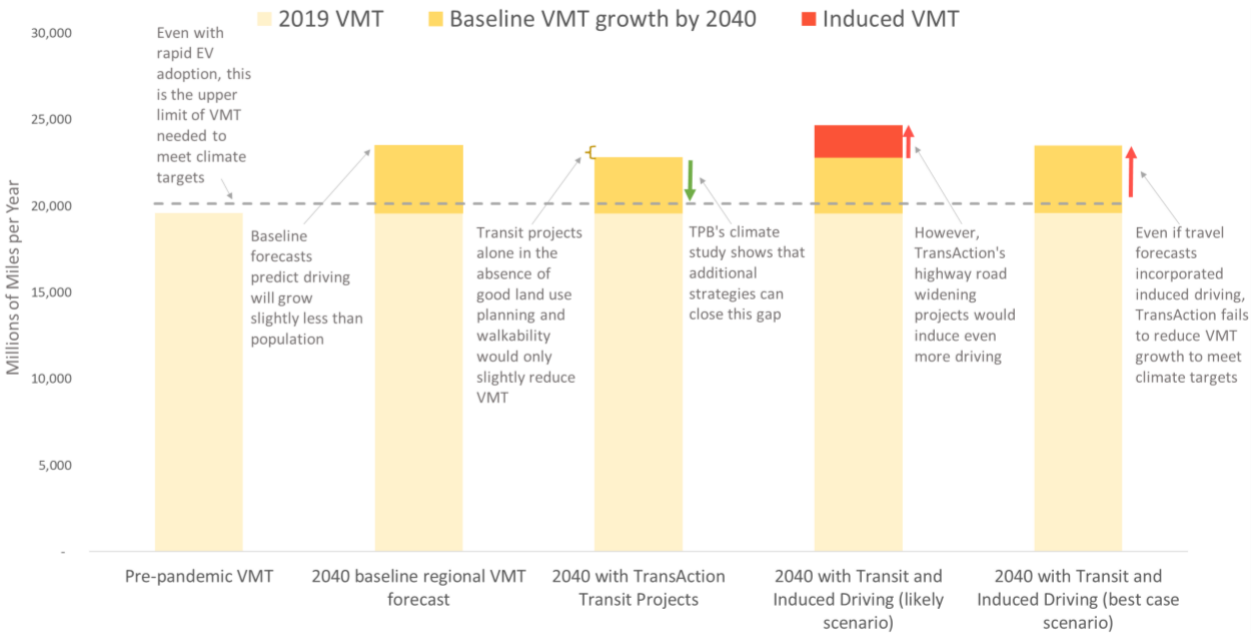
[5] 2019 population estimates from US Census: https://www.census.gov/data/datasets/time-series/demo/popest/2010s-counties-total.html; 2040 population forecasts from MWCOG Draft Round 9.2 Cooperative Forecasts: https://www.mwcog.org/documents/2021/12/02/cooperative-forecasts-employment-population-and-household-forecasts-by-transportation-analysis-zone-cooperative-forecast-demographics-housing-population/

[6] While the most aggressive vehicle technology scenario (VT.2, which is part of COMBO scenarios 2 and 3), involving very ambitious electric vehicle sales goals, could in theory provide sufficient reductions on its own, this would depend on the Washington region surpassing California, the nation's clear leader in electric vehicle adoption. It also would only happen under an accelerated "Clean Grid" scenario that speeds up the region's transition to 100% carbon-free electricity by 2035, 10 years sooner than current policies. See the full analysis of the TPB CCMS scenarios in this Greater Greater Washington article by CSG senior policy fellow Bill Pugh, "Here's what it will take for Greater Washington to cut climate pollution from cars and trucks fast enough."

[7] Scenarios COMBO.2 and COMBO.3 had reductions in future baseline passenger vehicle VMT of 10 and 20% respectively by 2030 and 20% and 25% respectively by 2050. The average of these, interpolating for the year 2040, would be 17%. Based on a share of regional VMT from passenger vehicles of 84% (TPB 2012 data), the percentage decrease in all VMT would be 14.3%.

- **Incorporation of Induced Demand VMT from Highway Expansion in Travel Forecasts** – Travel forecast models typically do not account for the entire magnitude of induced demand that has been observed, in particular the long-term land use feedback.[8] While travel models and their future land use assumptions vary widely, for purposes of illustration, the Figure 6 bar chart assumes that the induced demand of the TransAction highway expansion is not included in the future baseline regional TPB forecast VMT growth. Even if the baseline regional travel forecasts of agencies like the TPB and NVTA accounted for all of the induced demand effects of their highway expansion projects, this forecast increase in VMT would still far surpass the limited growth in VMT that the region can afford in order to meet greenhouse gas reduction targets, even with a transition to electric vehicles. As shown in the illustrative chart below (which expands on Figure 6), the increase in VMT from massive highway expansion and induced driving makes it that much harder for Northern Virginia to meet its climate commitments.

Figure A-1: Northern Virginia VMT, TransAction Transit Projects and Induced Driving



Note: Forecast baseline vehicle miles traveled (VMT) are approximate and adapted from TPB regional studies.
Sources: 2019 VMT from VDOT; 2040 baseline VMT forecast from TPB, 2018 Visualize 2045 long-range plan; reduction in future forecast baseline VMT from transit based on the TPB 2017 Long Range Plan Task Force study; induced demand VMT growth from RMI SHIFT calculator based on CSG analysis of NVTA 2017 Transaction 2040 projects. See above section of this appendix for more information on sources and methodology.

[8] See page 11, "Modeling Generated Traffic" in Generated Traffic: Implications for Transport Planning, by Todd Litman, Victoria Transport Policy Institute (2022). Other examples are provided by the National Center for Sustainable Transportation in its policy brief Environmental Reviews Fail to Accurately Analyze Induced Vehicle Travel from Highway Expansion Projects (2021).