INDUCED TRAFFIC DEMAND & US 50 HIGHWAY WIDENING

US 50 Eastbound, 2017 (WTOP news)

US 50 Eastbound, 1970 (Baltimore Sun)

Associated with the Chesapeake Bay Crossing Project

Prepared for:

Queen Anne's Conservation Association

Prepared by:

AKRF

7250 Parkway Drive, Suite 210

Hanover, MD 21076

March, 2022

Induced Traffic Demand and Highway 50 Widening Associated with the Chesapeake Bay Crossing Project

Prepared for:

Queen Anne's Conservation Association
P.O. Box 157
Centreville, MD 21617

Prepared By:

AKRF, Inc.
7250 Parkway Drive
Suite 210
Hanover, MD 21076

March, 2022

Executive Summary

The Queen Anne's Conservation Association ("QACA") has engaged AKRF, Inc. ("AKRF"), a regionally respected environmental planning and engineering services firm (whose nearest office is in Hanover, MD) to conduct an independent transportation study to assess the long-term adverse traffic effects that would be caused on highways many miles and towns away from the Chesapeake Bay Bridge, and the need for widening US 50 if an additional bridge span was built. Since the additional span would result in an increase from five lanes to eight lanes in the bridge vicinity (according to the Maryland Transportation Authority ("MDTA") Bay Crossing Study Draft Environmental Impact Statement, February 2021 ("DEIS")), this change would increase traffic on both sides of the bridge by attracting new travelers.

This effect called "induced traffic demand" is a well-documented concept and occurs because drivers change their habits to use the newly constructed lanes thereby absorbing the increase in traffic capacity within a relatively short period of time post-construction. However, induced traffic demand is often ignored because policymakers see highway and bridge widening projects as a win in the public eye. An article from *Governing* titled "Why the Concept of Induced Demand is a Hard Sell[1]" included a quote from induced demand researcher Amy E. Lee, of the University of California, Davis: "People think of traffic like a liquid and if you widen the pipe, it won't clog anymore. But there is not a static or set amount of fluid in this analogy. There could always be more liquid. Because we are talking about humans who are dynamic and responsive to things like a change in the perceived ease with which they can get places."

The widening of the Bay Bridge would temporarily relieve congestion on the bridge itself, but not on the highways leading to it unless they were also widened.The additional traffic attracted to the wider bridge would correspondingly require widening of large stretches of US 50 in the years following the bridge project to avoid new traffic bottlenecks. Unfortunately, the extent and repercussions of this "induced traffic demand" to roadways beyond the vicinity of the bridge were not considered in the DEIS.

The DEIS used the regional travel model to project traffic growth out to a 2040 horizon year for the purpose of analysis of the existing and proposed bridge traffic capacities. The DEIS discussed but did not analyze the induced growth on land development the new bridge span could have, nor did it analyze or discuss induced traffic growth. It states that for the preferred alternative of adding a span to the existing bridge (known as "Corridor 7") that "induced growth could still occur as a result of reduced traffic congestion in Corridor 7, which was considered *qualitatively* (emphasis added)." Furthermore, the DEIS only analyzed traffic on the bridge itself, stating in its Traffic Analysis Technical Report that it focused on "the existing Bay Bridge and its ability to accommodate current and future traffic demand," and "a new Bay crossing and the effect of that new crossing on traffic volumes at the existing Bay Bridge," but "not on the approach and departure roadways."

[1] https://www.governing.com/now/why-the-concept-of-induced-demand-is-a-hard-sell

It can therefore be surmised that the 2040 traffic projections used in the DEIS to analyze the traffic capacity improvements of the new span do not account for the impacts of additional traffic growth on connecting highways that the added bridge capacity would induce, nor does it analyze the resulting environmental effects. The transportation study presented in this report provides historic research on the effects of adding capacity to a bridge or highway segment, including how such projects have induced growth over and above the prevailing traffic growth preceding the widening project. It presents the results of an estimation tool for induced traffic growth, with specific metrics for all highways in Queen Anne's County and Anne Arundel County. This report estimates daily traffic growth would reach or exceed 30 percent within 3 to 5 years on US 50 in the vicinity of the bridge with the proposed additional span, as is summarized in the chapter titled "Induced Traffic Demand Historic Research and Effects."

This report also presents documentation on the nearly immediate return to congested conditions on the Chesapeake Bay Bridge a short time after the second span was constructed in 1973. Documentation is provided that only 5 years after that construction project, daily traffic rose by 37 percent, despite a portion of that period being subjected to gas rationing from an oil embargo.

To illustrate how this growth would play out on adjoining highways following the implementation of the new bridge span proposed by MDTA, a highway widening scenario on US 50 between Queenstown and Easton is presented along with potential construction cost (dollars) and duration (years of construction) and additional land area required (in acreage). The estimates indicate that the Queenstown to Easton widening would cost approximately $407 million, take 4 years at best (but more likely 5 to 7 years), and require an additional 60 acres in land.

Additionally, other highway segments on the Eastern Shore and in Anne Arundel County likely to also require lane widening are identified. East of the bridge, these include US 50 from the bridge over Kent Island to US 301 in Queenstown, US 50 through Cambridge or around it via a new bypass, from MD 313 in Mardela Springs to the Salisbury Bypass, and continuing on the Salisbury Bypass. West of the bridge, the roads likely to require widening include US 50 from the bridge to MD 2/MD 450 in Winchester, and from Winchester on US 50 to Annapolis and on MD 2 to MD 10/MD 100 in Pasadena. These additional widenings would cost an estimated $950 million and take over 20 years if constructed in phases and require approximately 170 additional acres of land. While this report indicates that induced demand resulting from the increased traffic capacity of the MDTA-proposed bridge project will likely require the highway segments cited above to need widening, more detailed studies beyond those presented in this report would be needed before definitive statements regarding the exact locations and extent of highway widening projects can be made.

In total, this report estimates that over $1.35 billion in widening projects on nearly 70 miles of highway requiring approximately 230 acres of land and taking over 20 years of construction may be warranted by the additional span crossing the Chesapeake Bay. This could result in significant disruptions to municipalities along Route 50 and further impact land area due to increased development and additional suburban sprawl along the widened highway. It is recommended that MDTA, in cooperation with the Maryland Department of Transportation (MDOT, owner of US 50 leading to the Chesapeake

Bay Bridge) should study and disclose the environmental effects of the induced traffic demand and associated US 50 widening to accommodate the new traffic.

It should be noted that only some of the adverse traffic effects have been investigated in this report. In addition to the widening needs discussed in this study, there would be additional feeder routes to the main route of US 50 highway and intersections along it that may require additional widening for through or turning lanes, additional traffic control devices or upgrades to existing ones, and other traffic capacity-increasing measures and investments to address new bottlenecks. Additionally, there would be very large losses in acreages of private and public property, structures (e.g., commercial, houses of worship, and residential), and natural and historic resources (e.g., parks, wetlands, threatened and endangered species habitats, archaeological and architectural resources, etc.). The highway widening would spur development and could lead to additional suburban sprawl. The full costs and scope of these losses including the costs associated with responsible mitigation are not reflected in the construction cost estimates presented in this report and are likely significantly higher than just the road widening construction cost.

Table of Contents

Introduction

In response to the ongoing Chesapeake Bay Crossing Study being led by the Maryland Transportation Authority ("), AKRF, Inc. ("AKRF") was asked by the Queen Anne's Conservation Association ("QACA") to review the Study's Purpose and Need Assessment ("PNA"). AKRF reported its findings to QACA in a document dated December 15, 2020, which QACA formally submitted to MDTA on April 26, 2021 as an attachment to QACA's comments on the February 2021 Draft Tier 1 Environmental Impact Statement ("DEIS"). AKRF's research found that the traffic growth projected to the year 2040 in the PNA (and repeated in the DEIS) using the regional growth model was overestimated, considering the historic growth trends and existing traffic capacity of the bridge, which would limit that unchecked growth, thus calling into question the claimed need for additional bridge lanes. In addition, AKRF found that the PNA (and DEIS) had not adequately considered the effects on traffic and congestion of future economic downturns, the introduction of cashless tolling, or the post-COVID increase in telecommuting. Further, AKRF's review found that in reaching the conclusion that a new, larger bridge was necessary, MDTA had not assessed the beneficial effects on traffic and congestion of readily available operational improvements, such as improved dynamic lane management and congestion pricing of tolls. Subsequently, QACA asked AKRF to begin consideration of what will be some of the consequences if the capacity of the Bay crossing at its current location is substantially expanded even though it has not been demonstrated that expansion is necessary. Accordingly, in this study we consider whether, and at what cost, any of the existing roadways connecting with a new bridge will have to be widened to handle the added traffic that will result from increasing the capacity of the Bay crossing.

This report presents results of an independent transportation study to assess some of the long-term adverse traffic effects that would be caused on highways many miles and towns away from the Chesapeake Bay Bridge if an additional bridge span was built. It should be noted that only some of the adverse traffic effects on these adjoining highways have been investigated in this report. There would be additional feeder routes to the main route of US 50 highway and intersections along it that may require additional widening for through or turning lanes, additional traffic control devices or upgrades to existing ones, and other traffic capacity-increasing measures and investments to address new bottlenecks. Additionally, there would be very large losses in acreages of private and public property, structures (e.g., commercial, houses of worship, and residential), and natural and historic resources (e.g., parks, wetlands, threatened and endangered species habitats, archaeological and architectural resources, etc.). The highway widening would spur development and could lead to additional suburban sprawl. The full costs and scope of these losses including the costs associated with responsible mitigation are not reflected in the construction cost estimates presented in this report and are likely significantly higher than just the road widening construction cost.

Since the additional span would result in an increase from five lanes to eight lanes in the bridge vicinity according to the DEIS, this change would increase traffic on both sides of the bridge, which was not considered in the DEIS. This effect called "induced traffic demand" is a well-documented repercussion of projects that have a goal of alleviating acute traffic congestion such as the periodic summer weekend traffic at the Bay Bridge and occurs because drivers change their habits to use the newly constructed lanes thereby absorbing the increase in traffic capacity within a relatively short period of time post-construction. However, this induced demand often results in the unintended consequence of attracting even more traffic than the current condition, with traffic congestion again ensuing quickly thereafter. The additional traffic attracted to the wider bridge would correspondingly require widening of large stretches of US 50 in the years following the bridge project to avoid new traffic bottlenecks. Unfortunately, the extent and repercussions of this “induced traffic demand” to roadways beyond the vicinity of the bridge were not considered in the DEIS.

The DEIS used the regional travel model to project traffic growth out to a 2040 horizon year for the purpose of analysis of the existing and proposed bridge traffic capacities. The DEIS discussed but did not analyze the induced growth on land development the new bridge span could have, nor did it analyze or discuss induced traffic growth. It states that for the preferred alternative of adding a span to the existing bridge (known as “Corridor 7”) that “induced growth could still occur as a result of reduced traffic congestion in Corridor 7, which was considered *qualitatively* (emphasis added).” Furthermore, the DEIS only analyzed traffic on the bridge itself, stating in its Traffic Analysis Technical Report that it focused on “the existing Bay Bridge and its ability to accommodate current and future traffic demand,” and “a new Bay crossing and the effect of that new crossing on traffic volumes at the existing Bay Bridge,” but “not on the approach and departure roadways.” It can therefore be surmised that the 2040 traffic projections used in the DEIS to analyze the traffic capacity improvements of the new span do not account for the additional traffic growth on highways leading to it that the added bridge capacity would induce, nor does it analyze the resulting environmental effects.

This report presents assumptions, research, and calculations conducted using available data. Due to limited available and projected data on hourly and seasonal traffic volumes along several of the highway segments, and the need for detailed traffic analysis and environmental feasibility studies to justify highway widening, assumptions were made using relevant literature research and professional judgment to characterize several highway segments that may require widening from a traffic demand standpoint during certain high-demand times of day or year due to the addition of a third span on the Chesapeake Bay Bridge. Although this report should not be viewed as advocating for widening these highways because the costs may far outweigh the benefits, the illustrative scenarios presented herein is intended to underscore to MDTA and decision-makers the scale of additional costs (in real construction dollars, time, and hidden environmental and land costs) that increasing traffic capacity on the bridge would trigger.

The report is organized as follows: First, research into regional and nationwide induced traffic demand effects on bridge and highway widening projects is presented and applied to the Chesapeake Bay Bridge and its vicinity. Historic news articles summarizing this induced traffic demand phenomenon associated with the last Chesapeake Bay Bridge expansion project from the 1970s are included.

Next, a detailed case study on a corridor—Queenstown to Easton—that will likely require widening after additional traffic is induced by a new bridge span, is exhibited. The case study presents order-of-magnitude construction costs (in dollars) and duration (in years) based on research into actual highway widening projects in Maryland and the region. The report also presents a calculation of additional land area required (in acreage), and identifies several additional hidden costs, infrastructure improvements, and studies that would be necessary that are not captured in the construction cost estimates since those items are currently unknown.

Finally, the report uses the case study results to show the effects on several other highway corridors that will potentially need to be widened to offset the induced traffic demand resulting from the new span at the Chesapeake Bay Bridge, again presenting construction costs and durations, and additional land area required. Finally, this report concludes that significant highway widening will likely be necessary on both sides of the bridge due to the induced traffic growth from the proposed third span, and that this effect should be considered in the environmental documentation of the MDTA Bay Crossing Study. Hidden costs are also presented since, beyond construction dollars, there are impacts to people, businesses and the environment when a highway is widened. While this report indicates that induced demand resulting from the increased traffic capacity of the MDTA-proposed bridge project will require certain highway segments to likely need widening, more detailed studies beyond those presented in this report would be necessary before definitive statements regarding the exact locations and extent of highway widening projects can be made.

Induced Traffic Demand Historic Research and Effects

The proposed span is being considered to reduce current traffic congestion over the bridge. However, widening a highway or bridge to increase traffic capacity and reduce congestion often results in the unforeseen consequence known as induced traffic demand. This is a phenomenon where new trip making is attracted to the same facility since motorists are led to believe that the construction project has reduced or eliminated traffic congestion. More and more motorists will continue to travel the facility at the time it is most convenient to them until traffic capacity is reached, and delays begin to accumulate as they did before the widening project. This process of induced traffic demand causing a return to congested traffic conditions following a widening project can take as little as 3 to 5 years, as demonstrated below. It is a fairly predictable culmination that has played out many times throughout the US and locally in the DC-Baltimore Metro area, even at the Chesapeake Bay Bridge in the 1970s. AKRF conducted a literature review of highway and bridge capacity increase projects where induced traffic demand resulted. Effects on the two counties adjoining the bridge using an induced traffic estimation tool are presented, followed by a discussion of effects on US 50 itself, a history of effects following the 1973 addition of a second span, and additional news and research articles on the subject of induced traffic demand.

AKRF estimates that the addition of the third span will result in an increase of 30 percent or higher in daily traffic within 3 to 5 years. The value of approximately 30 percent or higher increases in daily traffic on US 50 has been arrived at in three different ways in this report to demonstrate the concept of induced traffic demand for the Bay Bridge widening project:

1. Adding the regional traffic model growth used by MDTA for the Bay Crossing Study DEIS[2] (23 percent on weekdays) to the induced growth tool predicted for all of Queen Anne's County's highways (6 percent) equals 29 percent growth in daily traffic for all county highways, and would be even likely higher on US 50.

2. In the 1970s, just 5 years after the second span was completed, daily traffic grew 37 percent entering the bridge toll plaza.

3. Professional reports show that for every 1 percent increase in traffic capacity, there is a 1 percent increase in daily traffic. Applied to the 33 to 37 percent increase in peak directional traffic capacity of a third span, there would be a 33 to 37 percent increase in daily traffic in the peak direction.

[2] Adding traffic capacity to the bridge would allow the predicted regional traffic growth to continue unchecked and also fuel induced demand. The traffic growth rate predicted by the regional traffic model used by MDTA for the Bay Crossing Study DEIS ranged from 14 percent on summer weekends to 23 percent on typical weekdays through 2040 and does not assume any of the traffic capacity constraints of the existing bridge. For reference, AKRF predicted a lower growth rate based on historic traffic growth at the bridge and considering its traffic capacity constraints, which would limit growth (4 percent on summer weekends to 8 percent on typical weekdays, per the December 2021 QACA Chesapeake Bay Bridge Crossing Transportation Study).

Highways in Queen Anne's County, Maryland

Using an estimation tool developed by the National Resources Defense Council, National Center for Sustainable Transportation, and others, the induced growth traffic effects of adding a third bridge span can be modeled. The "SHIFT" tool[3] shows the estimated increase in county-wide vehicle miles traveled 5-10 years after capacity expansions of large roadways based on existing lane mileage and historic studies of vehicle miles traveled data from the Federal Highway Administration (FHWA). It cannot model the increase in vehicle miles traveled on a specific highway, such as US 50, within a county. The addition of 13 lane miles (3 lanes over 4.3 miles) representing Bay Crossing Study Corridor 7, Queen Anne's County's highways and freeways (called class 2 facilities) and other principal arterials (called class 3 facilities) would experience between 3.7 and 5.6 percent more vehicle miles traveled each year, within 5 to 10 years after the bridge project is constructed. Per the tool's output, "Queen Anne's County, Maryland currently has 212 lane miles of class 2 and 3 facilities on which ~627 million vehicle miles are travelled per year. A project adding 13 lane miles would induce an additional 23 to 35 million vehicle miles travelled per year." Anne Arundel County, which has significantly higher volumes of traffic and highway mileage, would experience between 1.3 and 2 percent more traffic (see **Table 1**).

Table 1
Estimated Range of Induced Traffic Rates on All Highways County-wide from Bay Crossing Study Corridor 7, per SHIFT Tool

	Current Traffic	Induced Traffic (Low Range)		Induced Traffic (High Range)	
	Travel per Year (Vehicle Miles)	Travel per Year (Vehicle Miles)	Percent Growth	Travel per Year (Vehicle Miles)	Percent Growth
Queen Anne's County	627,000,000	23,000,000	3.7%	35,000,000	5.6%
Anne Arundel County	2,800,000,000	36,000,000	1.3%	55,000,000	2.0%

It should be noted that this is the induced growth of daily traffic throughout Queen Anne's or Anne Arundel Counties, and is in addition to the continued background traffic growth predicted by the regional traffic model growth used by MDTA for the Bay Crossing Study DEIS (23 percent on weekdays), which would all now be accommodated with the proposed third bridge span for a short time, until congestion returns. Therefore, on all Queen Anne's County highways, there could be a 29 percent

[3] https://shift.rmi.org/

increase in daily traffic, or even higher on US 50 since it is the main route to the Bay Bridge, as is discussed in the following section.

Effects of Induced Traffic Demand on US 50

Although data from available traffic studies on highways leading to the Chesapeake Bay Bridge is limited, it can be assured an additional bridge span will induce traffic growth on US 50 on both sides of the bridge in addition to accommodating forecasted background traffic growth, and that will necessitate traffic capacity improvement projects such as highway widening. The induced traffic demand will be higher on US 50 in both counties, since the traffic capacity increase effects on the bridge will be most intense along the corridors leading to it.

Clearly, further studies will be needed to determine the specific areas and magnitude of widening and other improvements. But there are already existing summer traffic congestion issues, documented by news articles. Last July, local residents said “Thursday is the new Friday” since working from home and telecommuting provides more flexibility for vacationers to expand their weekend trips beyond the traditional Friday-to-Sunday, and a Kent Island resident said westbound traffic is using “every back road” to reach the bridge.[4] A 13-mile backup was seen on westbound US 50 leading to the bridge on Labor Day in 2021 as motorists left the beach following the holiday weekend.[5] When induced traffic growth is added to these conditions along with projected background growth, the questions of widening will not be “if and how,” but “where and when,” as was the case following the completion of the second span of the Chesapeake Bay Bridge in 1973.

Addition of Second Bridge Span in 1973 and “Reach the Beach” Projects

After the second bridge span was added in 1973, induced traffic demand quickly highlighted the need for highway widening on both sides. A 1981 Final Environmental Impact Statement (FEIS) by FHWA and MDOT analyzed the need for widening US 50/301 to 6 lanes from Annapolis to the Chesapeake Bay Bridge. The average daily traffic entering the Bay Bridge Toll Plaza presented in that FEIS shows that in just 5 years after the second span was completed, traffic grew 37 percent (see **Table 2**).

[4] https://www.wbaltv.com/article/ocean-city-beach-bound-traffic-getting-worse-chesapeake-bay-bridge/37048299

[5] https://www.nbcwashington.com/news/local/drivers-advised-to-wait-as-traffic-backs-up-bay-bridge-for-13-miles/2793746/

Table 2
Annual Traffic Growth at Chesapeake Bay Bridge following Second Span Completion in 1973

Year	Bay Bridge Toll Plaza Average Daily Traffic (vehicles per day)	Percent Growth (cumulative)
1973	19,655	N/A
1974	19,927	1.4%
1975	21,958	12%
1976	24,199	23%
1977	25,800	31%
1978	26,940	37%

The result of 37 percent daily traffic growth is considered extremely large given the oil embargo during a portion of this period, which led to gasoline rationing and no growth in national vehicle miles traveled between 1974 and 1975.[6]

A Baltimore Sun article from 2019[7] reported on the history of traffic congestion following the addition of a second span, "two years after a second, 3-lane span was added in 1973, a 12-mile backup was reported on a mid-Saturday afternoon." In that article, an MDOT spokesperson was quoted in August 1975 saying, "there is no way to get X amount of cars into X amount of lanes with a slowdown or backup," meaning that the congestion-eliminating project completed two years before had already induced enough traffic demand to reach its new capacity.

There is even evidence of disruption to downtowns and the use of eminent domain to widen US 50 to reach the beach following the construction of the first span of the Chesapeake Bay Bridge in 1952. A Delmarva Now article from 2017[8] describes the widenings in Salisbury "cut a swath between downtown and a neighborhood of Victorian-era homes known as Newtown." And although US 50 was originally built in Cambridge and Easton to bypass the old downtowns, the highway has induced commercial land development growth in those cities and slowed traffic considerably more than the pace intended.

---

[6] https://afdc.energy.gov/data/10315

[7] https://www.baltimoresun.com/opinion/editorial/bs-ed-1009-bay-bridge-traffic-20191008-6r2f7y33lfaitgia3worufoiza-story.html

[8] https://www.delmarvanow.com/story/news/local/maryland/2017/07/28/maryland-chesapeake-bay-bridge/517541001/

According to a documentary from 2011[9] titled "Chesapeake Bay Bridge: Spanning the Bay," a landowner whose farm was subject to eminent domain from the US 50 widening stated, "everybody knew that there were plans for the bridge, but no one knew exactly what were the plans for the road."

Increases in highway capacity have also historically led to increases in development along US 50. "Because Eastern Shore transportation is so heavily dominated by one highway and its bridges, the correlation between highway construction and sprawl is even more evident in this region," states the research paper[10] titled "Paving the Way: How Highway Construction Has Contributed to Sprawl in Maryland." It describes that growth in land development on the Eastern Shore has outpaced state population growth, and provides data showing that "the greatest disparity between the rate of Eastern Shore property development and statewide population growth occurred during construction of the second span of the Bay Bridge and in the first two years it put into service."

Since it is a given that history will repeat itself if a third bridge span is built to relieve traffic congestion at the Chesapeake Bay Bridge, only to shift congestion to the highways leading to it, a representative widening project is presented as a likely scenario in the section below titled US 50 Widening from Queenstown to Easton.

Professional Reports and News Articles

The documentation of induced growth and a speedy return to congested traffic conditions following the construction of the second span of the Chesapeake Bay Bridge is not a unique occurrence. National news articles and professional papers were researched for evidence as to whether adding highway capacity does or does not relieve traffic congestion after an initial period of relief. Per a Bloomberg article,[11] a highway widening project in Houston on the Katy Freeway that took 3 years and cost $2.8 billion with a goal to alleviate severe highway congestion experienced increases in travel times of 30 to 50 percent in the 3 years following project completion. A Streetsblog article[12] presented a highway widening project in Los Angeles on the Sepulveda Pass of I-405 that took 5 years and cost $1.6 billion with a goal to alleviate highway congestion, but experienced increases in travel times of 50 percent, just 4 years following completion. According to a research paper originally published in the Institute of Transportation Engineers (ITE) Journal in 2001 and made available by the Victoria Transport Policy Institute,[13] over the long term (three years or more), induced traffic fills all or nearly all of the new capacity. The author of the article modeled how both traffic growth and travel time increases are

---

[9] https://vimeo.com/220302397

[10] https://frontiergroup.org/sites/default/files/reports/MD-Paving-the-Way-text--cover.pdf

[11] https://www.bloomberg.com/news/articles/2018-09-06/traffic-jam-blame-induced-demand

[12] https://usa.streetsblog.org/2019/05/08/l-a-really-is-a-great-big-freeway-thanks-to-induced-demand/

[13] https://www.vtpi.org/gentraf.pdf

underestimated when ignoring induced demand, specifically stating, “travel time savings end after about 10 years, when traffic volumes per lane return to pre-project levels, resulting in no congestion reduction benefits after that time.” A Curbed article[14] describes “adding 1 percent more road capacity produces the exact same increase in the amount of vehicle miles traveled.” A research paper evaluating induced traffic demand in a number of California metropolitan areas [15] stated that within 4 years after completion of projects adding an average of 10 percent traffic capacity, a 9 percent increase in traffic was measured.

According to the DEIS, the existing bridge traffic capacity per direction is reached at approximately 3,800 to 3,900 vehicles per hour using the contraflow lane. The proposed Corridor 7 would increase capacity to approximately 5,200 vehicles per hour per direction using four lanes,[16] about 33 to 37 percent more capacity than the existing condition. According to the above research, this would translate into a corresponding 33 to 37 percent increase in daily traffic in the peak direction of the bridge.

[14] https://archive.curbed.com/2020/3/6/21166655/highway-traffic-congestion-induced-demand

[15] http://ansoncfit.com/wp-content/uploads/urban-economics-final-paper-anson-stewart.pdf, statistic based on 18 years of data from 14 California metropolitan areas by Robert Cervero, “Induced Demand: An Urban and Metropolitan Perspective.” Prepared for U.S. Environmental Protection Agency, March 2001.

[16] https://mdta.maryland.gov/sites/default/files/Files/Bay_Bridge_LCCA_Report_12-2015.pdf, according to the 2015 Life Cycle Cost Analysis Report, in Table 3.7, the per-lane capacity would be 1,300 vehicles per hour. Multiplied by 4 lanes, this would be 5,200 vehicles per hour. Even more directional capacity could be achieved using contraflow operation to provide 5 lanes in one direction and 3 in the other.

US 50 Widening from Queenstown to Easton

This segment has been selected as a case study since it is already a high traffic volume segment near the bridge that reportedly experiences traffic backups in some places on summer weekends, and therefore likely exceeds its traffic capacity during some portions of the time under current conditions. It runs along a 4-lane highway that will experience induced traffic demand if the proposed new bridge span is added to the Chesapeake Bay Bridge.

Construction Costs and Duration

The limits of the case study are from the US 301 interchange to the Easton Parkway (MD 322), and the road is assumed widened from 4 to 6 lanes for a length of 21 miles. The approximate project cost for widening was estimated using similar projects, as reported by MDOT.[17] A rough construction cost estimate is that the US 50 widening from Queenstown to Easton would cost over $407 million. This is the construction and design cost for widening on terra firma (see next section for potential additional items omitted from the basic construction costs). Widening the roadway to pave 24 additional feet of width for 21 miles would disturb a large land area. The additional area that would be needed for the widening—not all of which may be within the existing public highway right-of-way—would be approximately 60 acres. The duration of construction would be heavily dependent on funding and being able to complete the project in one phase. The best case, based on recent widening projects in the region[18] is 4 years. A more likely scenario would take 5 to 7 years.

Other Potential Widening Segments and Conclusion

According to a preliminary analysis by AKRF,[19] additional segments that will likely require widening, subject to detailed studies and analysis by the jurisdictional agencies owning and maintaining those roadways include:

[17] https://www.roads.maryland.gov/mdotsha/pages/Index.aspx?PageId=667 Maryland Department of Transportation State Highway Administration Projects and Studies, average per lane-mile cost of $9.7 million per 12-foot lane developed by AKRF from completed projects. For comparison, the $5.4 billion Bay Crossing Study Corridor 7 project would be an equivalent of $419 million per lane-mile, adding three lanes along the 4.3-mile length of the bridge.

[18] VDOT's Transforming I-66 project in northern Virginia was initiated in the summer of 2018 with an expected completion date of August 2021. The project is still ongoing with a revised completion date of December 2022. Additionally, widening projects presented above in Los Angeles and Houston took 3 to 5 years to complete.

[19] Based on an assessment of available existing traffic volumes and potential traffic growth due to background and induced effects, also taking into consideration existing highway cross sections in comparison to the eight-lane cross section of the Chesapeake Bay Bridge that would be provided by the proposed third span.

Anne Arundel County

- US 50, west of Chesapeake Bay Bridge (Skidmore) to MD 2/MD 450 (Winchester) would be widened from 6 to 8 lanes for a length of 5 miles. A rough construction cost estimate is $97,000,000 with a duration of approximately 4 years, and it would require an additional 15 acres.

- US 50, west of MD 2/MD 450 (Winchester) to MD 70 (Annapolis) including Severn River Bridge would be widened from 7 to 8 lanes for a length of 2 miles. A rough construction cost estimate is $19,000,000 (excludes bridge widening) with a duration of 2 to 3 years, and it would require an additional 3 acres (includes bridge segment).

- MD 2, north of MD 2/MD 450 (Winchester) to MD 10/MD 100 (Pasadena) would be widened from 4 to 6 lanes for a length of 15 miles. A rough construction cost estimate is $291,000,000 with a duration of 5 to 6 years, and it would require an additional 44 acres.

Eastern Shore

- US 50, east of Chesapeake Bay Bridge (Kent Island) to US 301 (Queenstown) including Kent Narrows Bridge would be widened from 6 to 8 lanes for a length of 9 miles. A rough construction cost estimate is $175,000,000 (excludes bridge widening) with a duration of 4 to 5 years, and it would require an additional 26 acres (includes bridge segment).

- US 50 in Cambridge – Choptank River Bridge to Bucktown Road. This 2-mile downtown segment is currently 6 lanes with traffic signals, and already experiences traffic congestion during summer weekends. Given the dense commercial development, current traffic performance of the 6 lanes, and frequent access points and intersections along it, widening to 8 lanes would not add a commensurate amount of traffic capacity. It will either need urban traffic flow interventions such as adaptive traffic control (a connected, coordinated, computerized system constantly adjusting traffic signal timing and phasing based on traffic demand from a comprehensive system of sensors), access management (closing or consolidating excessive commercial access points to reduce the number of conflicts with through-traffic), and additional widening at key intersections to add turning lanes, or, alternatively, construction of a bypass, as was built for Salisbury. A rough construction cost for a 4-lane bypass (excluding right-of-way acquisition or any changes to the Choptank River Bridge, and using the same per-mile widening costs as above) is $78,000,000 with a duration of 2 to 3 years, and the right-of-way to build a new, divided 4-lane highway would require an additional 39 acres assuming a cleared width similar to the Salisbury Bypass of 160 feet.

- US 50, from MD 313 (Mardela Springs) to Business US 50 (western terminus of Salisbury Bypass) – would be widened from 4 to 6 lanes for a length of 8 miles. Rough construction cost estimate is $155,000,000 with a duration of 4 to 5 years, and it would require an additional 23 acres.

- US 50, Salisbury Bypass – Business US 50 to US 13 (Salisbury Bypass) would be widened from 4 to 6 lanes for a length of 7 miles. Rough construction cost estimate is $136,000,000 with a duration of 4 to 5 years, and it would require an additional 20 acres.

Cumulative Construction Costs and Duration Conclusion

Widening the above segments would total at least $950 million in construction costs, require approximately 170 acres of additional land area, have adverse effects on people, property, structures, and the environment, and would likely need to be constructed in separate phases due to construction costs and disruption to travelers, taking over 20 years[20] to complete. When considering these estimates along with the $407 million estimated widening from Queenstown to Easton and the $5.4 billion (low range estimate) cost of a new bridge span, it is recommended that the induced traffic and environmental effects be considered in any future planning and environmental documentation for the MDTA Bay Crossing Study.

Hidden Costs to Residents, Businesses, and the Environment

It should be noted that the construction costs for this case study do not consider the following social/environmental issues, studies, cost of mitigation for environmental impacts, and additional construction infrastructure:

- *Bridges and retaining wall structures*. Only widening costs on terra firma have been presented, but additional costs will be necessary to widen US 50's bridges and cut/fill where widening occurs on slopes, potentially requiring soil retaining walls.
- *Additional stormwater retention and drainage area.* Only the widths of the added lanes have been presented as part of the total acreage in the case study, whereas additional acreage would be necessary for storage and treatment of the increased water runoff from added lanes.
- *Condemnation/Eminent Domain.* Court proceedings and assessment of fair market value will be needed so the State can acquire land and structures needed to make way for the highway widening where private land acquisition is needed.
- *Environmental Justice/Title VI.* All persons regardless of race, color, or national origin are entitled to a safe and healthful environment, which must be evaluated for widening projects.
- *Natural and historic resources.* A study of encroachment, partial, or total loss of public parks, wetlands, threatened and endangered species habitats, archaeological and architectural resources, etc., due to highway widening, will be needed.
- *Noise effects and attenuation.* Increased lanes of traffic and vehicle speeds will increase noise, necessitating environmental studies, particularly in environmental justice areas, and possible attenuation such as noise barrier walls.
- *Environmental Impact Statement.* Many of the above areas will need to be analyzed for environmental effects, and a formal Environmental Impact Statement or Environmental Assessment

[20] Assumes each phase is constructed non-concurrently. A faster total construction duration could result based on available funding and coordinated phasing of projects.

will be required to scope and study other potential effects such as air quality, traffic/transportation, etc.

- *Resiliency measures.* Roadway elevation increases or floodwalls/levees may be necessary to protect against climate change events such as increased catastrophic flooding in urban areas, storm surges from more intense tropical storms, and sea level rise.