

## **Evaluating the Indirect Land Use and Environmental Effects of a Toll Discount Proposal**

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**ABSTRACT**

Physical improvements to a transportation network, or policy actions such as toll decrease, can have an impact on the environment by reducing the time and monetary costs of travel, which can work to enhance the attractiveness of surrounding land to developers, residents and businesses. A proposed toll discount on the Chesapeake Bay Bridge-Tunnel (CBBT) connecting the Hampton Roads metro area with the rural Eastern Shore of Virginia was analyzed for its potential to influence land use and impact the environment. The study illustrates how practitioners can couple well-established technical assessment methods in a variety of disciplines with public involvement and strategic planning to promote a comprehensive vision of the future for a rural area on the fringe of a growing metropolitan region. The study included an assessment of current conditions, assets, needs, goals and potential impacts in several key areas of interest to Eastern Shore residents: transportation, tourism, economic development, agriculture/aquaculture, natural resources, and quality-of-life/livable communities. The impact assessment examined the potential for effects attributable to toll reduction scenarios in each of these six topic areas. The assessment techniques included interviews, comparative case research, analysis of present and potential future regional development and commuting patterns through application of a gravity model, and extensive public involvement in the form of public meetings and topic workshops. As a complement to the impact assessment, the study team formulated strategies and actions to manage future growth and development that could be anticipated with or without a reduction in the toll.

Rural and suburban fringe communities throughout the United States have long looked to transportation enhancements as a method to promote economic development. But as the rising dialog over smart growth demonstrates, many of these communities are also concerned with managing growth and development, and minimizing impacts to the natural and human environment. In these communities, proposed transportation projects and policy decisions are receiving extra scrutiny for their long-term growth impacts. One example of a community seeking to balance the benefits and burdens of development through evaluation of a transportation policy change is the Eastern Shore of Virginia. This paper will describe how a proposed toll change on the Chesapeake Bay Bridge-Tunnel (CBBT) was analyzed for its potential to influence land use and impact the environment. The discussion will also illustrate how practitioners can couple technical assessment methods commonly used in a variety of disciplines with public involvement and strategic planning to promote a comprehensive vision of the future for a rural area on the fringe of a growing metropolitan region.

One of the largest facilities of its kind in the world, the CBBT links the Norfolk, Virginia Beach, Hampton Roads metropolitan region with the with the Eastern Shore on the southern tip of the Delmarva Peninsula. At the time of the study, toll charges for passenger cars were \$10 each way for autos on the 17-mile facility spanning the lower Chesapeake Bay. With toll revenues increasing yearly, the CBBT Commission considered reducing the toll for commuters traveling across the span.

Physical improvements to a transportation network, or policy actions such as toll change, can have an impact on the environment by reducing the time and monetary costs of travel, which can work to enhance the attractiveness of surrounding land to developers, residents and businesses. Development on vacant land, or conversion of the built environment to more intensive uses, is often a consequence of these transportation decisions, particularly where other factors favorable to development (e.g., land value, regulatory environment, expanding regional economy) are present. Growth in population and employment attributable to an improvement in accessibility is an indirect effect of the transportation decision that, in turn, produces its own effects on the environment.

Seeking more information on the potential connection between a toll change and land development pressures, the Accomack-Northampton Planning District Commission (A-NPDC) and the two counties comprising the Eastern Shore of Virginia commissioned a study to assess the land use, environmental, and socio-economic impacts of a commuter toll discount proposal. The Eastern Shore, one of the least-developed areas of Virginia, is rich in natural resources – the forest, marshland, and tidal water habitats are among the most important in the state. The regional economy is dependent in large measure upon these resources--there is a heavy reliance on farming, seafood harvesting and related industries, in addition to tourism. Many residents agree that growth in population and industry induced by a decrease in travel costs between the Shore and Hampton roads could improve the region's economic base, but could also degrade vital resources, place increased pressure on a sensitive aquifer, and alter the rural, coastal lifestyle.

## LITERATURE AND METHODS

A decrease in the cost of travel can be expected to have both short-term and long-term effects. In the short-term, the benefits of savings in travel costs can induce travelers to alter regular patterns of travel in favor of the lower cost route. In the long term, significant savings in travel cost can induce changes in the location decisions of businesses and households stimulating development in the vicinity of the route.

Previous studies regarding the potential effects of a toll discount on the CBBT commissioned by the Virginia Department of Transportation (VDOT) (1) and the CBBT Commission (2) indicated that the short-term effects of a toll reduction on the CBBT would be limited. Estimates produced for the CBBT indicated that short-term induced demand related to a commuter toll discount amount to a one percent increase in traffic per year. This finding was based on limited evidence of latent demand illustrated by low levels of existing commuting activity between the Eastern Shore and Hampton Roads, survey results from non-commuters, and the recent failure of a lower cost transit alternative. Reviews of effects of toll removals on other crossings in the Hampton Roads also confirmed that commuting trips are relatively

inelastic to price changes and that commuters with higher incomes are less sensitive to changes in toll expenses.

Given these findings, it was anticipated that effects arising from a toll discount are likely to be limited to long-term induced development effects. A case study approach of toll changes on other bridge or tunnel crossings employed for the CBBT-commissioned study revealed no direct or predictable relationship between toll changes and land use effects in the areas surrounding crossings. This finding suggests that toll increases are similar to other changes in accessibility in that they constitute only one of many factors in the location decision-making process of households and businesses.(3)

In commissioning its study, the A-NPDC hoped to expand upon this previous work by combining more quantitative assessment methods with a public involvement program to perform a comprehensive indirect effects assessment.

Several recent National Cooperative Highway Research Program (NCHRP) Reports have summarized the literature and the state of the practice in the assessment of the indirect land use and environmental effects of transportation projects. NCHRP Report 423A (4) reviews the role of transportation in the location decisions of key actors in the marketplace--developers, households, and businesses-- and outlines the range of methods applicable to the assessment process. NCHRP Report 456 (5) provides a comprehensive review of the direct and indirect social and economic impacts and applicable measurement techniques including accessibility, community cohesion and economic development analysis. NCHRP Report 403 (6), recently updated as practitioner training handbook and published as NCHRP Report 466 (7), outlines eight steps for assessing indirect effects of transportation projects:

- Set the study area boundary
- Identify study area direction and goals
- Inventory notable features
- Identify impact causing activities
- Identify indirect effects for analysis
- Analyze indirect effects
- Evaluate analysis results
- Assess consequences and develop mitigation

The eight-step process was adapted for use in the CBBT study and several of the methods recommended for each step in the process were utilized. The study methodology and findings are described below.

## **SCOPING AND TOPIC REPORTS**

The scoping process was designed to identify trends, notable features, and potential impacts for further analysis. Several techniques were employed during this step.

To assist the study oversight committee and initiate the process of public involvement, a thirty-member committee comprised of a broad range of local experts, community group representatives, and other stakeholders was formed and met throughout the study process to assist in data collection and review of findings.

Valued social, economic, and natural resource features on the Shore that could be impacted by growth related to a toll reduction were identified through detailed reports on existing conditions and future plans compiled by the study team in six topic areas: economic development, tourism, agriculture, natural resources, transportation, and quality-of-life/livable communities. Preparation of the topic reports involved review of local plans, secondary data sets, and field interviews.

To involve the public in the identification of potential impacts, findings from the topic reports were presented and discussed at two public involvement workshops (one in each county). Attendees

divided into small groups corresponding to topic areas and formulated lists of valued features and potential impacts. These lists formed the basis of the impact assessment conducted later in the study.

### **TOLL REDUCTION SCENARIOS**

To provide the groundwork of assumptions necessary to complete the impact analysis, three toll discount scenarios were chosen.

1. *No-Action* – Conditions in the future without a discount or other change in the current toll structure were estimated. The No-Action Scenario served as a baseline to which the other scenarios were compared, allowing for the incremental change of the toll discount scenarios to be identified. Population and employment projections for the forecast year of 2025 were drawn from other studies undertaken for the planning district.
2. *Commuter Toll Discount* – Under this scenario, the one-way toll would be reduced from \$10.00 to \$7.00 for travelers completing a round-trip within a 24-hour period. This discount had been discussed at CBBT Commission meetings and provided a reasonable center point for the three-scenario evaluation.
3. *Maintenance Toll* – In recent years, a surplus in toll collections has allowed the CBBT to plan for early retirement of its bond obligations. This scenario assumes that debt service and other capital obligations have been retired by 2010 and that tolls would be reduced in that year to the equivalent of \$3 one-way (for Class 1 vehicles) to cover facility maintenance expenses.

### **ESTIMATING THE POTENTIAL FOR INDUCED DEVELOPMENT**

Once scoping had been completed and toll scenarios identified, the next step was to estimate the potential for land development induced by a toll change. To estimate the number of households that may be attracted to the study area as tolls are decreased, the study team conducted a regional analysis of accessibility to employment, then employed a formulation of the simple gravity model to estimate the redistribution of regional growth on the basis of a change in travel costs. The evaluation involved equating the monetary cost of travel with travel times.

#### **Calculating the Time and Monetary Cost of Travel**

Because the only link between the Eastern Shore and Hampton Roads is a tolled facility, the measurement of accessibility in the region must take into account the time and monetary cost of travel. In gathering data for the quantitative analysis the study team assembled information on regional travel times and translated the toll charges under each of the three toll reduction scenarios to travel time equivalents in order to measure changes in accessibility. Data gathering included the following steps.

- Output from the Hampton Roads regional travel model for 2021 was obtained through the cooperation of the Hampton Roads Planning District Commission (HRPDC). Data supplied included travel times between each of the 1,052 Traffic Analysis Zones (TAZs) in the travel model region.
- The Eastern Shore was not part of the HRPDC regional travel demand model, so boundaries for nine TAZs covering the Eastern Shore and travel times between these TAZs and the modeled region were identified using information presented in other transportation studies for the Shore (see Figure 1 for a depiction of the Eastern Shore with zone and county boundaries).

The monetary cost of the CBBT tolls under each of the three toll scenarios considered in this study were translated into equivalent travel times by equating the value of commuter time to toll charges on the CBBT. Earlier studies conducted for the CBBT employed an estimate of the value of time for commuters of \$16.10 per hour per vehicle. This rate, recommended for use by the Virginia Highway and Transportation Research Council, reflects the value of commute time in current dollar terms and is comparable to the findings of other recent studies which value commuting time at 60 percent of the average wage rate, exclusive of benefits.<sup>(5)</sup> Table 1 shows approximate travel times from the Eastern Shore TAZs to the foot of the CBBT on the Virginia Beach side, along with the travel time equivalents of the one-way

toll charges in each of the toll reduction scenarios. The analysis demonstrated the substantial time equivalent of the toll and the significant differences between the scenarios: a time equivalent of 40 minutes under the No-Action Scenario; 26 minutes under the Commuter Toll Discount Scenario; and 11 minutes under the Maintenance Toll Scenario.

### **Accessibility Analysis**

A review of Census journey-to-work data for recent decades reveals long-standing commute patterns that limit most commute trips in the Hampton Roads region to under an hour. By this measure, most portions of the Eastern Shore are at the fringes of the Hampton Roads commuteshed, especially when the time-equivalent of the toll is taken into account. Census data indicates that only a small portion of the regional workforce have commute times of over an hour—in Hampton Roads and the Eastern Shore, three percent of workers have commutes in excess of one hour<sup>(8)</sup>. With employment in Virginia Beach expected to grow by 300,000 jobs through 2025<sup>(9)</sup>, the pool of new workers commuting from distances similar to those of the Eastern Shore could be as great as 9,000. While not all of these workers will be attracted to live on the Eastern Shore this indicates the magnitude of the potential for residential growth.

Figure 2 is a thematic map illustrating the number of jobs available within a 30-minute commute of each TAZ in the study region. The map reveals that the core of the Hampton Roads metro area, including Norfolk and portions of Virginia Beach, Chesapeake, and Newport News, is expected to be within a 30-minute commute of over 500,000 jobs in 2025. As the distance from the metropolitan core grows, the number of jobs available within the predominant commute times decreases. Most areas of the Eastern Shore are accessible to less than 10,000 jobs (on the Shore or in the Hampton Roads region) within a thirty-minute commute.

The analysis of travel time, cost, and employment location in the Hampton Roads and Eastern Shore regions revealed that a change in toll rates on the CBBT could have the effect of making the employment centers of the metro area more accessible to the Eastern Shore. This effect is limited in its magnitude and geographic extent. These limitations coupled with the relatively small pool of commuters willing to travel the distances typifying commutes from the Eastern Shore under every toll scenario suggest that induced development effects of a toll change are also likely to be limited.

### **Gravity Model Application**

To develop an estimate of the magnitude of residential development that a toll discount on the CBBT could induce, a formulation of the traditional gravity model was employed. Gravity models are used often in transportation and travel modeling. They are based on the observation that the overall attractiveness of an area to potential residents is a function of the capacity of an area for development (vacant developable land in valued and affordable locations) and accessibility to employment and activity centers. The model produces quantified results that can serve as the basis for assessing land use change and impacts to valued social, economic, and natural resources in a community.

A literature review revealed that a modified version of the Hansen formulation of the gravity model<sup>(10)</sup> was most appropriate to the goals of this study and the level of data and resources available. The following were considerations in the choice of the modeling tool.

- The model redistributes regional household growth and produces a numerical estimate tied to a geographic area suitable for use in assessing environmental impacts
- The model used data that was readily available or easily constructed and could be developed and run within the time frame and budget constraints of the study
- The model addresses the key variable expected to change in the region under study: improvement in accessibility to employment centers through a reduction in the cost of travel

Because factors in addition to accessibility and vacant developable land have been found to influence the location of households, researchers have refined the basic formulation of the gravity model to incorporate consideration of factors such as net natural increase, anticipated economic growth, land use

controls, infrastructure, tax rates, and local public services. In a 1990 *Transportation Research Record* article, Hirschman and Henderson describe a method for incorporating these factors into the gravity model appropriate for an area that has been evaluated as part of a transportation demand modeling effort. These factors can be incorporated into the gravity model by substituting the product of these causal factors for the vacant land factor ( $V_j$ ) so that:

$$G_j = G_t \times V_j A_j / \sum V_i A_i$$

Where

$G_j$  = population growth increment allotted in subregion  $j$   
 $G_t$  = total population growth expected for the region as a whole  
 $V_j = (L_j \times V_a \times V_b \times V_c \times \dots)$  the product of vacant land and other factors of location suitability and attractiveness.  
 $A_j$  = accessibility index (composite weighted travel time to employment centers from subregion  $j$ ):  
 $A_j = \sum E_j / T_{ij}^a$

Where

$E_j$  = employment in each subregion  $j$   
 $T_{ij}$  = the travel time between subregion  $j$  and each other subregion  $i$   
 $a$  = exponential time-impedance parameter, found to equal 2.0 in most calibrated applications of the technique.

Hirschman and Henderson note that in regions covered by a travel demand model it is often not necessary to measure the individual elements that make up  $V_j$  explicitly for each subregion. Values for  $V_j$  can be derived implicitly once baseline  $A_j$  values have been calculated because values for total regional growth ( $G_t$ ) and growth in each zone ( $G_j$ ) are known in the baseline condition and reflect consideration of zone development attractiveness and potential. Once baseline  $V_j$  values have been derived it becomes possible to calculate growth in a zone by running the gravity model for each accessibility change scenario, varying the accessibility scores while holding all other factors constant. (11)

Application of the gravity model to the data gathered by the study team produced the anticipated finding—portions of the Eastern Shore in closest proximity to the CBBT (particularly the two southernmost TAZs in Northampton County) would experience higher rates of household growth under the toll reduction scenarios. Figure 3 illustrates the household growth projected under each scenario for Northampton and Accomack counties and shows that with a reduction in toll household growth impacts would occur exclusively in Northampton County and that growth there would outpace that of Accomack. The order of magnitude estimate of growth produced by the analysis indicated that under the No-Action Scenario, Northampton County would see an annualized growth rate of 0.7 percent through 2025. This rises to 1.5 to 2.3 percent under the Commuter Toll Scenario and 2.1 to 3.3 percent under the Maintenance Toll Scenario.

## **IDENTIFYING AREAS SUSCEPTIBLE TO LAND USE CHANGE**

In applying the gravity model, the study team produced an estimate of the magnitude of household growth associated with the toll reduction scenarios and an indication of where that growth was likely to occur within the TAZ geography. To translate this estimate into an evaluation of socio-economic and environmental effects, the study team needed to identify land use changes likely to be associated with growth in households and where, below the broad TAZ geography, that change would most likely occur. This evaluation involved review of development regulations and the characteristics of available land in the southern portion of Northampton County.

### **Build-Out/Holding-Capacity Analysis**

Estimates for population and household growth produced through the gravity model reveal the magnitude of residential development that could result from a toll change. To determine if the projected growth can

be accommodated in the areas where it is anticipated, an analysis of the holding capacity of the latest Northampton County Zoning Regulation was conducted.

The holding capacity of Northampton County was based on the most recent revision of the zoning density regulations and zoning map for the county. The calculation involved considering density regulations in a variety of zoning districts. Because overlay zoning districts can be applied in many locations altering the underlying density regulations, holding capacity was calculated for a base zoning scenario and a scenario where up to 50 percent of the land area of each zoning district would be incorporated into a Planned Rural Village Overlay (PRVO) zone that permits higher densities. These scenarios represent the potential upper and lower bounds for buildout in Northampton County. Interviews with county officials indicated that historically very few proposed PRVO zones are ultimately adopted and it is anticipated that this trend will hold for the future.

Taking into account available subdivided lots and the range of potential density regulations the analysis revealed an incremental increase of 1,600 to 12,000 acres over the base scenario. The environmental effect of this magnitude of land consumption is unclear until the location is pinpointed at a finer level of detail than the TAZ structured used in the gravity model. To accomplish this step a qualitative assessment of development potential was conducted.

### **Development Potential Analysis**

To determine which areas in the southern portion of Northampton County have the highest potential for development, a qualitative matrix was created to rank (with a high, medium and low ranking scheme) those factors that would be considered favorable to development in areas closest to the CBBT. Based on discussions with local planners, the following factors likely to contribute to household location decisions were ranked for each tax/zoning map index area to determine those areas with the highest development potential:

- Quantity of existing vacant subdivided lots
- Quantity of other developable land in residential or agricultural zoning districts
- Zoning density
- Property values
- Road access
- Waterfront access
- Distance to CBBT
- Access to shopping facilities and services

Another factor that commonly influences household location and development decisions—the presence of water/sewer infrastructure—was not included in the evaluation on the recommendation of local planning officials. Interviews with officials indicated that the limited coverage of current water/sewer service areas in Northampton County was unlikely to be extended and that future development would likely be serviced with individual or collective well and septic systems.

After ranking these factors, the scores were averaged out for each map index area to derive a final ranking score in order to determine the level of development potential based on these factors. Those areas with a “high” average ranking were chosen for further analysis for specific resource impacts.

### **SOCIAL, ECONOMIC AND ENVIRONMENTAL RESOURCE IMPACT ASSESSMENT**

Once estimates of the magnitude and location of land use change were produced, impacts to environmental resources in each of the six major topic areas of the study were evaluated with particular emphasis placed on locations where notable features or community goals may conflict with projected land use changes. A variety of qualitative and quantitative analysis methods, suitable to each topic area, were employed. Brief descriptions of these methods and findings are outlined below.

### **Transportation**

Future transportation needs, traffic congestion, and safety were identified during scoping as key concerns for community members. To assess the impacts of increased land development activity on the number of trips for the forecast year, the relationship between average daily traffic estimates for TAZs and the number of households forecast in each TAZ was established through a review of a U.S. 13 corridor study recently completed for the A-NPDC. Corridor study traffic estimates were then inflated proportionate to the household projections for each toll scenario to estimate new levels of traffic corresponding to the changes in household location decisions attributable to the toll discount.

The analysis revealed that traffic levels under the toll discount scenarios would be 10 percent to 30 percent higher than the No Action baseline in the southernmost portions of Northampton County suggesting the need for further examination of transportation needs in that portion of the U.S. 13 corridor.

### **Economic Development**

Promotion of economic development opportunities is an important goal on the Eastern Shore. The potential for the toll reduction proposal to affect local economic development was estimated through the use of quantitative and qualitative techniques. The potential for increased employment in the retail, service, and construction industries were estimated through a review of historic relationships between employment in these sectors and regional growth in households and new unit construction. An input-output economic impact model was employed to estimate the multiplier effects of increased activity in these selected industries on the rest of the regional economy. The analysis revealed that 400 to 600 additional full and part-time jobs would be created to serve the household growth under the toll reduction scenarios. Effects to existing businesses or the attraction of new businesses was found to be minimal based on the frequency of business travel on the CBBT and the price elasticity of demand for that segment estimated in a CBBT commissioned survey.(2)

### **Tourism**

Results of the CBBT survey were also used to estimate the impact to tourist travel. Day and overnight visitors were found to be uninfluenced by the price of crossing or unaffected by the terms of the discount.

### **Agriculture**

With over 400 farms on the Eastern Shore and sales of over \$100 million annually, the Eastern Shore's agricultural sector contributes to its economic base and provides the inputs needed for food processing at major local manufacturing operations. The potential for impacts exists because some of the most productive soils are also the most suitable for septic systems for residential development. To assist in the determination of impacts, soil conditions and prime farmland were included in the study's GIS mapping. The land consumption analysis (see Buildout/Holding Capacity analysis above) provided an estimate of farmland that could come under development pressure under each toll reduction and overlay zoning scenario producing a range in farmland impacts from 4,000 acres to 26,000 acres for the Shore as a whole. The potential for additional impacts were noted including conflicts between farm operators and homeowners, especially over issues such as odors, noise, dust, chemical usage and hours of operation; and fragmentation of farmland affects its productivity and viability leaving tracts of land too small or segmented to be efficient.

### **Natural Resources**

The Eastern Shore supports a diversity of habitats and species and is characterized by its unspoiled, fragile ecological resources. The undeveloped land of the Eastern Shore also provides a significant economic resource to the area, offering opportunities for tourism, fishing and forestry, and agriculture and aquaculture. The Southern Tip of the Delmarva Peninsula, in particular, is regarded as a vital resource for its abundance of woodland (it has been designated as part of the International Biosphere Preserve) and its

key role in the flow of migratory birds on the Eastern Seaboard. Although the precise location and form of future development could not be determined, adverse impacts on woodlands and habitat related to development were described and likely impact areas (see Development Potential Analysis above) were mapped for each toll reduction scenario.

Surface and groundwater are also vulnerable to development impacts. As part of the impact assessment, sensitive water resources and groundwater recharge zones susceptible to septic failure were mapped in the study GIS and potential impacts noted. Suggested topics for further action and study in preventing surface water contamination, aquifer depletion, and recharge impacts were recommended. An evaluation estimating the likely level of water consumption attributable to new housing found that while localized impacts were possible if development was not carefully regulated, the supply of the sole source aquifer was not likely to be threatened with the levels of development estimated under any of the forecast scenarios.

### **Quality of Life/Livable Communities**

A qualitative review of citizen concerns and potential impacts revealed that the toll discount scenarios were estimated to have both positive and negative effects on local quality-of-life. Less expensive access to the amenities and services of the metro area and the prospect of greater retail services and employment on the Eastern Shore are viewed positively by some Eastern Shore residents. The loss of rural lifestyle in areas that would experience the highest growth, increase in the cost of living, the potential for residential displacement, and strain on community facilities were cited by others at the public hearings as significant adverse impacts at the levels described in the impact assessment.

Fiscal impacts were also noted as a concern. Interviews with local officials suggested that growth in households on the Eastern Shore is expected to add to county and town tax bases but will also cause an increase in the demand for services. A review of recent experience elsewhere in the Hampton Roads metro area and an analysis of the Northampton County fiscal position based on county data and a recent local study by the American Farmland Trust, was conducted and suggested that the residential and commercial growth coupled with consumption of open and agricultural land anticipated under the action scenarios will result in budget shortfalls of approximately 25 percent annually by 2025, also indicating the potential for upward pressure on tax rates.

### **PUBLIC INVOLVEMENT**

The progress of CBBT study was followed with interest by many residents on the Eastern Shore and the public involvement workshops events were well attended. Four workshop events were held during the study. In the events, presentations of trend and resource information or impact assessment findings were followed by breakout sessions on each of the six topics areas explored in the study. Residents separated into moderated topic sessions according to their interests. At the final set of events a written survey instrument was distributed to solicit comments on impacts and strategy recommendations. The following major themes emerged during the workshop events.

- Many residents expressed concern over the negative impacts of growth to the environment and quality of life, particularly on the southern tip of Northampton County where environmental resources and the rural lifestyle would be most threatened. Residents also expressed the need for moderate levels economic development and job growth.
- Participants in the workshops suggested that a commuter toll may not be the most important toll discount for residents of the Shore—discounts for travel for medical and educational purposes may be of greater benefit to current residents.
- Workshop participants had questions and concerns over the process of decision-making at the CBBT Commission and how residents of the Eastern Shore could be heard and represented.
- Preventing travel delays and safety problems on the CBBT and other portions of U.S. 13 were also a top priority. The issue of the need for a second set of tunnels is one example that was voiced.

## STRATEGIC PLANNING

Once the potential for impacts was identified and analyzed, a second phase of the study was conducted to present strategies that would work to avoid or minimize the adverse impacts of a toll change. Three general methods were employed to identify workable strategies:

- Comments from the public involvement sessions;
- Case studies of comparable communities; and
- Recommendations developed by members of the citizen advisory and study oversight committees.

A review of the literature on growth management and economic development strategies suggested that there is no one combination of techniques used in practice around the nation. Strategies and techniques are assembled for each particular situation based on the goals, resources, growth pressures, and legal and regulatory constraints of the community. To illustrate the manner in which strategies have been matched to particular situations in locations around the nation, the study team identified a group of ten communities for further case study research. This research revealed several techniques for managing and directing growth related to residential development, tourist activity, and economic development in rural and environmentally sensitive areas. Many of the strategies were directly applicable to the Eastern Shore, others were found to be inappropriate or could not be implemented under the current land use planning enabling statutes for the Commonwealth of Virginia.

The strategies recommended in the report fall into two general categories: actions and policy positions to be taken by the county boards of supervisors, and local growth management initiatives. The potential actions are summarized below.

### County Policy Positions

The counties would ask the CBBT Commission to postpone any decision on toll discounts until further study on the need for future capital improvements is undertaken, allowing for full assessment of future toll revenue needs, stability of toll rates over time, and minimization of the adverse effects of a toll reduction identified in the study.

In response to the concerns of residents voiced in the public comment process, the counties were also advised to recommend further study by the CBBT Commission and the General Assembly on the level of Eastern Shore representation on the Commission, the Commission's policies on public comment for major policy decisions, the potential for the use of surplus toll revenue to fund off-site improvements, and the feasibility of discounts specific to medical and educational needs of Eastern Shore residents.

### Growth Management Strategies

- *Southern Tip Greenline/Resource Protection Overlay* – The study found that development and vital resources will come into greatest conflict in southern Northampton County. A greenline involves implementation of a resource protection district by the county in those vital areas to protect habitat, and agricultural resources. The overlay district would involve a combination of land use regulation techniques including changes in density and use regulations, lot sizes, and performance standards in key areas. Explicit limits on the expansion of sewer and water infrastructure and the purchase of easements would also be effective components of a greenline.
- *Land Use Taxation for Northampton County* – The Commonwealth provides standards for the enactment of agricultural and forestal districts as well as methods to adjust real property tax assessments to reflect the value of agricultural and forestland as used. This voluntary program is in practice in Accomack County and other jurisdictions in Virginia and can be an effective method to relieve financial pressures and the incentive to subdivide working farms and open space.
- *Other Strategies* – In addition to specific strategies for Northampton County, there are several regulatory strategies that would help to channel growth and mitigate its effects that would be applicable throughout the Shore. These include: revision of performance standards for vegetation

protection and site planning to minimize the impacts of development activity; and the establishment of detailed proffer guidelines to facilitate discussions between county officials and developers on exactions. These steps could also be augmented by planning studies for capital improvements, open space and recreation, economic development, and tourism, to identify future needs and community goals that would help shape future regulatory changes. Other strategies specific to the needs of the Eastern Shore (e.g., construction job training, affordable housing, transit alternatives, and access management initiatives) were also found to be appropriate.

## CONCLUSION

The CBBT Commuter Toll Impact Study concluded that a toll discount would improve the accessibility of the Eastern Shore by reducing the cost of travel to the Hampton Roads employment market, attracting some of the residential growth anticipated in the metro area over the next twenty years. Because of its proximity to the CBBT, the southern tip of the peninsula was found to be the most attractive to residential development. The analysis conducted by the study team indicated that even moderate levels of residential growth in that area may conflict with the sensitive woodland and coastal habitat, agricultural land, open space, and rural quality of life that local residents value. This knowledge helped the citizen advisory and study oversight committees formulate recommendations for policy positions and growth management strategies that were later adopted and approved for further study in Northampton County.

The study demonstrates the utility of employing a variety of well-established qualitative and quantitative tools, following the steps of recent NCHRP guidance, to inventory notable features, estimate changes in regional development patterns and localized land use, and identify resource impacts. The approach included combining a formulation of the gravity model, a staple of transportation analysis, with buildout analysis, and a qualitative rating scheme to estimate growth and development, while using GIS mapping, comparative case analysis, expert interviews, and fiscal, economic, environmental indicator to estimate related resource impacts. While each of the tools for forecasts and impact estimation are limited in their accuracy, the study team found that the combination of tools and the scenario approach promoted the communication of results, helping residents envision the range, timing, and likelihood of potential impacts. Another key lesson illustrated by the study is the value of public involvement as a tool to inform, shape the course a technical study, develop recommendations, and promote consensus building.

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**TABLE 1**  
**Estimated Distance, Travel Time, and Time Equivalent of Toll by TAZ**  
**Eastern Shore to Virginia Beach, 2025**

Traffic Analysis Zone	Distance to Virginia Beach (miles)	Travel Time to Virginia Beach (minutes)	Travel Time Incorporating Time Equivalent of Toll (minutes)		
			No-Action	Commuter	Maintenance
1	27.0	46.29	86.29	72.29	57.29
2	41.7	71.49	111.49	97.49	82.49
3	49.4	84.69	124.69	110.69	95.69
4	53.5	91.71	131.71	117.71	102.71
5	58.4	100.11	140.11	126.11	111.11
6	62.7	107.49	147.49	133.49	118.49
7	66.8	114.51	154.51	140.51	125.51
8	75.6	129.60	169.60	155.60	140.60
9	85.2	146.06	186.06	172.06	157.06

Source: HRPDC, 2001; A-NPDC, 2001

FIGURE 1

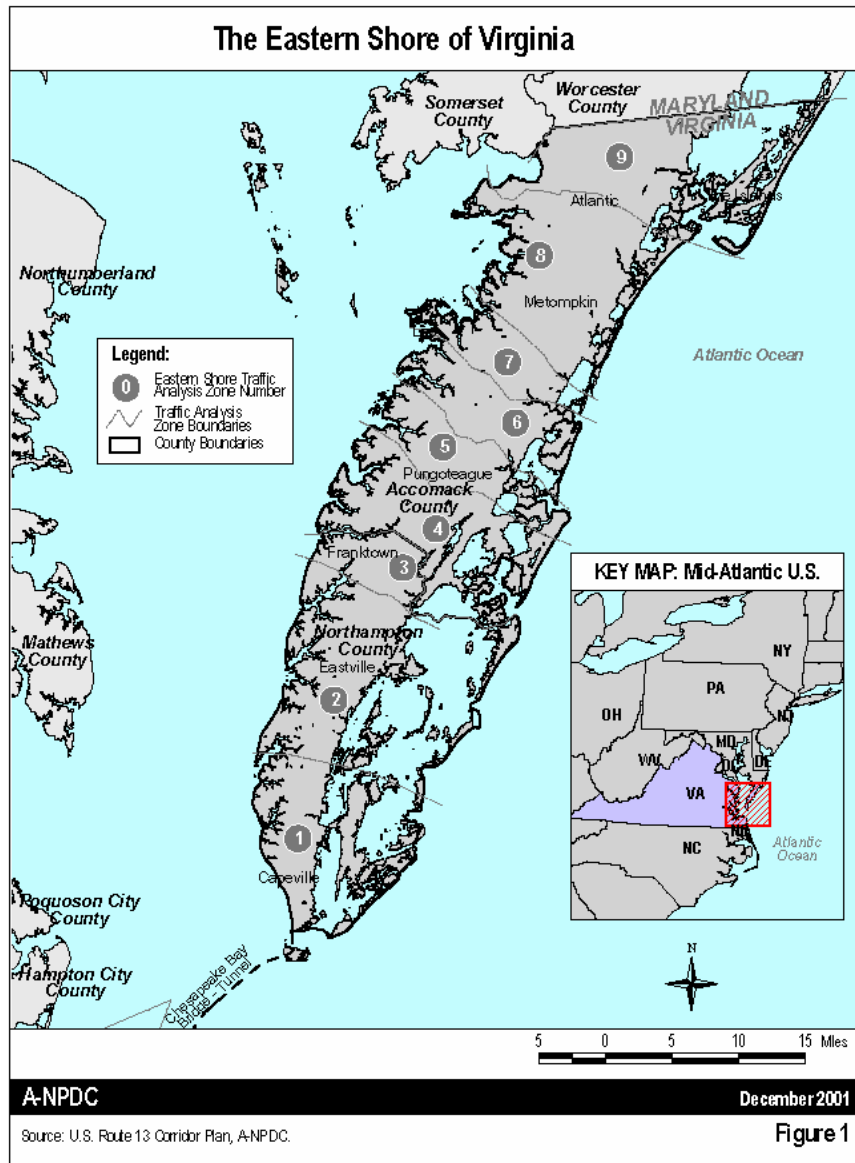
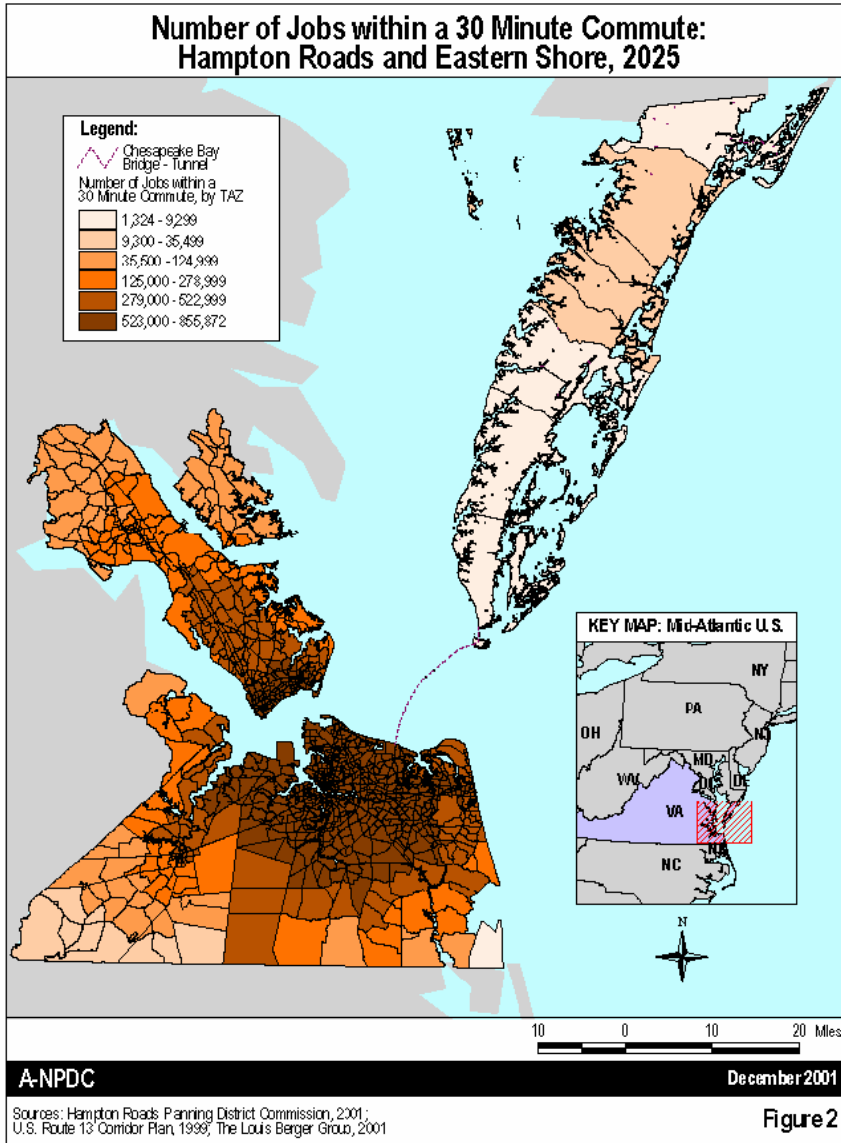
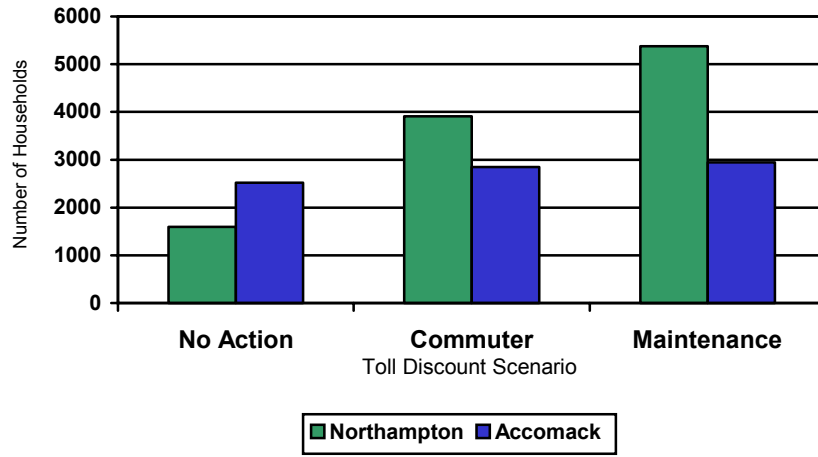


FIGURE 2



**FIGURE 3 Estimated Growth in Households  
Northampton and Accomack Counties, 1990-2025**



Source: Chesapeake Bay Bridge-Tunnel Commuter Toll Impact Study, Final Report, ANPDC, 2001