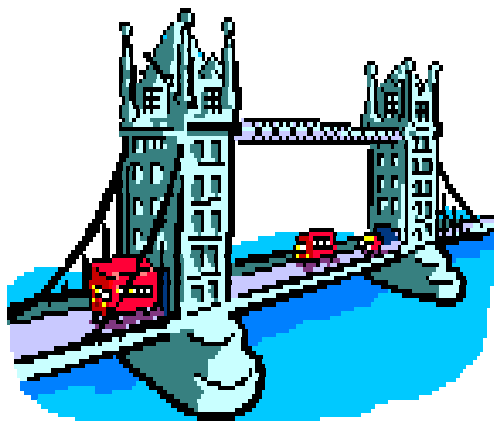


# Potomac River North Crossing



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## 1. Introduction

Residents of the Washington, DC / Metro area spend, on average, at least one hour per day commuting to work and back. In an effort to relieve the congestion in this area (known as the second worst commuting area in the nation, trading places back and forth with Los Angeles, California), Maryland and Virginia are currently exploring various options to improve the transportation situation.

An approach that is being considered involves the construction of a new bridge across the Potomac River. This new plan is sometimes known as the "Techway" or "Potomac River North Crossing". It is a very ambitious project that includes provisions for 6 lanes on each side, (with HOV lanes included in the six) to connect Dulles / Reston areas of Virginia to the Rockville / Gaithersburg areas of Maryland<sup>[1]</sup>. This project has a lot of potential to influence the social, economic, and environmental areas of local life. There have been cost estimates of about \$700 million just for the bridge<sup>[1]</sup>.

Our goal, as residents of Northern Virginia, is to provide a decision model which can assist in the "go / no-go" decision for building this bridge.

## 2. Approach

To facilitate the decision making process, we decided to utilize Expert Choice software. This software is based on an approach called the Analytical Hierarchy Process (AHP). AHP was first created by Dr. Thomas Saaty more than two decades ago. It was in the 1980's that Dr. Saaty and Dr. Ernest Forman, Professor of Management Science at George Washington University teamed together to develop the Expert Choice software based on the Analytical Hierarchy Process.

The AHP approach necessitates the development of structure in the decision process by requiring that goals, objectives, sub-objectives, and alternatives be defined. Expert Choice takes the abstract theory of AHP and gives it substance. The sub-objectives are first compared to one another to determine which are the most important and should, therefore, carry the most weight in the final decision. This procedure is called making pair-wise comparisons.

Expert Choice uses complex mathematical equations to derive ratios based on the outcome of the pair-wise comparisons. For example, if you feel that Blue Sky is moderately or strongly more preferred than Gray Sky, then you might end up with an answer that says Blue Sky is 60% more preferred than Gray Sky at 40%.

We are in touch with Ms. Judy McCary, Aide, at Congressman Frank Wolf's office and Ms. Norine Walker, Project Coordination Manager of Potomac

Crossing Consultants. Both are helping us with their valuable feedback on this issue.

## 3. Background

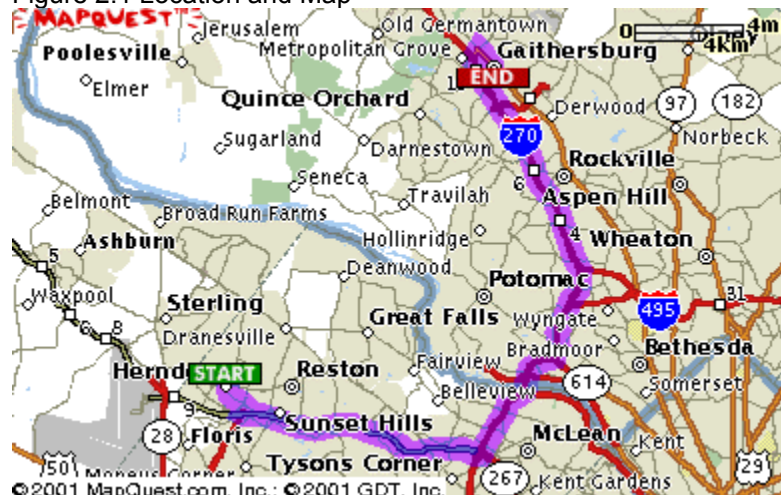
### a. Location and Accessibility

The current Maryland-to-Virginia Commuter Corridor begins with Rt. 70 in Maryland, which flows to Rt. 270, then Rt. 495 into Virginia to the Dulles Toll Road, then finally to Rt. 28. Some of the traffic that originates from Maryland, and vice versus from Virginia, is headed into Washington, DC. This traffic, for the most part, would not be increased or reduced by the building of a new bridge. Only the traffic that makes the complete trek would gain an advantage from the new bridge <sup>[8]</sup>.

This current flow from the Rockville / Gaithersburg area in Maryland and the Dulles / Reston areas in Virginia makes a nearly 30-mile horseshoe-shaped trip, which can take up to two hours each way. Because of the lack of alternatives for commuters, a single Beltway or bridge incident can cause complete paralysis, increasing the commute time exponentially. A new bridge would provide an alternative, reducing commuting time by nearly 2/3 and decreasing the distance traveled to 12-14 miles each way.

Almost twenty different new routes and locations are posted as the alternative to be followed for the new "Potomac River Crossing". The best possibilities show the route beginning in the Gaithersburg / Rockville area of Maryland and coming south through Maryland to connect either at Rt. 28 or at the Fairfax County Parkway at Rt. 7 in Virginia. Both of these possibilities connect Maryland to an existing Virginia thoroughfare that can easily channel the traffic to Dulles / Reston technical corridor <sup>[8]</sup>.

Figure 2.1 Location and Map



## b. Congestion

While more than half of the region's population lives outside the Capital Beltway, only two of the total of ten Potomac bridges are located within a 20-mile stretch between the American Legion and Woodrow Wilson Bridges. The lack of bridges outside the Capital Beltway forces tens of thousands of area residents to make lengthy round-about trips. Over the course of a year, this wastes millions of hours and gallons of gas.

A Virginia Department of Transportation (VDOT) <sup>[4]</sup> study shows that a 4-lane "Techway" would carry more than 100,000 vehicles per day in 2020. Additional studies show a 6-lane "Techway" would have the capacity for 150,000 vehicles per day. At that point, as noted in the table below, the "Techway" bridge would carry the fourth greatest number of vehicles in the metro area.

Table 2.1

Facility	Current Daily Traffic Count
14th Street Bridge	246,000
American Legion Bridge	210,000
Woodrow Wilson Bridge	195,000
Techway Connector	150,000*
Theodore Roosevelt Bridge	100,000
Memorial Bridge	66,000
Key Bridge	65,000
Chain Bridge	22,000

\* 2020-2025 estimate based on 6-lane design Sources: D.C. Bureau of Traffic Services, Metropolitan Council of Governments

A new "Techway" and "Potomac River Crossing" would include peak-hour express bus, car and vanpool lanes, plus a medial for rail service. The six-lane "Techway" would be the ultimate suburb-to-suburb multi-modal facility.

Further, the "Techway" connector would relieve pressure on the Frederick upper Rt. 270 and Montgomery County Agricultural Preserve by helping focus more jobs and residences in the Rockville / Gaithersburg areas <sup>[4]</sup>.

## c. Feasibility Study

On October 10, 2000 Representative Frank R. Wolf, 10<sup>th</sup> District, Virginia wrote to the Secretary of the Department of Transportation regarding his support of a \$2 Million plan to study the feasibility of constructing a new bridge across the Potomac River north of the American Legion Bridge linking Maryland and Virginia <sup>[1]</sup>.

This 2-page letter outlined the many areas to be examined and the goals of the study. Key areas of concern centered on relief of the current congestion problems, forward planning for future directed growth, environmental issues, quality of life for Virginia and Maryland residents,

and costs that would be associated with the construction of a new bridge [2].

According to Ms. McCary, the initial study was supposed to be purely academic in nature, to look at all the possibilities and propose an unbiased answer to the question regarding a Techway. They were going to look at everything, environmental issues, land/property value issues, the need for such a road based on numbers of cars, economic issues, etc. There was no initial route for this road even proposed. But apparently there had been a road planned 20 years ago that was then removed from the planning / zoning maps.

## 4.Environmental Impact

The “Techway” connector is a national model for environmentally smart Parkways. This would be a limited access parkway, with no interchanges allowed between the Rockville / Gaithersburg area of Maryland and the Reston / Dulles area in Virginia, so it should not attract much additional development on either side of the route for it’s entire length. Further, wide (150’ to 250’) landscapes and view sheds on either side of the travel lanes, bike and pedestrian trails and design that includes depressed travel ways, beaming and neighborhood screening will help insure that the “Techway” will be a parkway that meets the highest environmental standards [1].

### a. During Construction

#### i. Air

During construction, a lot of air pollution may be caused by the transportation of construction material and by operating heavy equipments like bulldozers, cranes, etc. Ms. Norine Walker informed us that there would be work hour restrictions while using heavy equipment. This is to help control the equipment noise to avoid disturbance in the neighborhoods.

#### ii. Soil

The new bridge will be built over the agricultural areas of Maryland and Virginia. Pillars supporting the bridge would require placing the construction material several feet below the surface. The various environmental studies have indicated that this might change the chemical composition of the fertile soil.

#### iii. Water

The supporting pillars would also be sunk into the riverbed itself. There is some concern that construction materials might mix with the water of the Potomac River and may become hazardous to humans,

as well as marine and other life. The Chesapeake Bay Foundation and several other organizations are actively conducting more research on this particular issue.

## b. After Construction

### i. Air

Analysis conducted by the Washington Airports Task Force estimates that the “Techway” connector would remove 86 tons of regional air pollutants per year by shortening the travel distance between Montgomery County and Dulles Airport. However Ms. McCary pointed out that, the initial plans for the Techway quickly made it into a limited access, no trucks, parkway. So those trucks would not be able to use the Techway and the automobile traffic alone would not make that significant an impact on reduced pollution.

### ii. Soil

Once the bridge is built over the agricultural reserves the continuity of the fertile land will be lost. However, the pollution of the soil should be very minimal after the excess of construction material is removed from the site.

### iii. Water

After the construction is completed, it is expected that there will be periodic removal of the hazardous material from the water e.g. construction material. The marine life should be restored once the bridge is complete.

## 5. Constituency

For many people in the area, this bridge has a lot of importance. For some it is going to save time, for a few it is going to save some money, and for others it is going to be devastating. It is very important to consider the views of all the people whose lives will be affected by the “go / no-go” decision of the bridge. The three major stakeholders in the decision are Commuters, Displaced Families and The Governments.

### a. Commuters

We all have seen a series of bumper stickers that say “ I would be rather .....ing” (such as fishing, golfing, swimming, etc.). For these commuters between the Rockville/Gaithersburg area in Maryland and the Dulles/Reston area in Virginia this bridge represents a wish come true situation as it would give them the time for “rather .....ing” activities. A

new bridge could reduce the travel length by 10-12 miles and travel time by nearly two-thirds <sup>[9]</sup>. By incorporating bicycling and hiking paths, the “Techway” will be a vital new link in a regional trail network. It would provide more time for families, recreation, community service, or a host of other activities, all preferable to wasting time sitting in traffic.

Relatively less travel and more time would also alleviate the stress and foster safety on the roads. More than 60% of the accidents that occur on the Capital Beltway are during the rush hours due to excessive numbers of cars per mile. In its 2020 Report National Highway Traffic Safety Administration NHTSA states, “The nearly 1 billion vehicles world-wide in 2020 will lead to stifling levels of congestion. If driver stress resulting from this congestion leads to aggressive driving, America could see a significant increase in unsafe driving behaviors.”

## b. Displaced Families

In order to improve the quality of life of commuters, some will have to sacrifice the entire neighborhood. There are as many as 20 different plans and sites suggested for the new bridge. Depending upon which plan is selected; different parts of Maryland and Virginia are affected <sup>[7]</sup>.

Most people will have to deal with the stress that results from changing everything around them like their homes, neighbors, schools and, for some, their work places too.

Most of the land in Maryland where the bridge sites are proposed is an “agriculture reserve”, whereas in Virginia they are business and residential areas. Many Marylanders believe that the historical and heritage land of Maryland should not be destroyed for the bridge. The time to cope with stress will vary from person to person.

According to data from the 1997 Census Update, just 8% of Montgomery workers commute to Virginia. For residents living in the I-270 Corridor above Rockville, just 8,293 out of 106,321 workers commute to all Virginia work destinations. These locations include Tyson’s Corner, Arlington and the Pentagon, not just the Dulles Corridor. In turn, just 4 percent of Northern Virginia work trips in 2020 would go to Montgomery County.

Ms. MaCary’s description of the response that Congressman Wolf’s office received makes it obvious that the people that live along all the possible routes are very anxious and are up in arms in protest against the bridge. They pointed out the loss of flood plains, regional parks, and Historical sites if the bridge were constructed. Mr. Wolf’s office received phone calls from people considering buying homes and land along the guessed-at routes to ask whether or not the road was going to be built in that area. People were complaining that their ability to sell their land and homes was



being seriously impacted because buyers did not want to make a purchase that was going to be near the Techway.

## c. Governments

Both Maryland and Virginia Government Officials are very cautious about their returns on investment for the new bridge. Virginia Representative Congressman Mr. Frank Wolf Frank R. Wolf, 10<sup>th</sup> District, Virginia wrote the Secretary of the Department of Transportation regarding his support of a \$2 Million plan to study the feasibility of constructing a new bridge across the Potomac River north of the American Legion Bridge linking Maryland and Virginia on October 10, 2000. This 2-page letter outlined, in great detail, the many areas to be examined and the goals of the study.

However, On June 3, 2001 Representative Frank R. Wolf, 10<sup>th</sup> District, Virginia published a retraction of his support for the \$2 Million plan to study the feasibility of constructing the new bridge. The article focused on his concern regarding the displacement of families, the degradation of property values and concern about the final benefits that a new bridge / Techway would provide <sup>[2]</sup>.

With the increasing tension among the affected population regarding whether or not the bridge should be built, the Virginia House of Delegates said that they would not authorize their share of the funds. Fairfax and Loudon County stepped up and said, “No”, along with Montgomery County. Then the Federal Dept of Transportation said that the maximum possibility that the road would be approved to be built was a 10% chance. So Mr. Wolf cancelled the study.

Despite many controversial views among the different stakeholders of the bridge, AAA Mid – Atlantic’s Transportation Poll reveals an interesting statistics.

AAA Mid – Atlantic’s 2001 Transportation Poll:  
Building another Potomac River Crossing: Do you favor or oppose construction of a “High Techway” to connect the Dulles Airport area with I – 270?

Table 5.1

	Metro Area	Montgomery County	Northern Virginia
Strongly favor	64%	59%	67%
Somewhat favor	20%	22%	19%
Somewhat oppose	7%	12%	3%
Strongly oppose	5%	6%	4%
Don't Know/Refused	4%	2%	6%

## 6. Cost

Currently, this new “Techway” or “Potomac River Crossing” is estimated to cost about \$700 million <sup>[1]</sup>. The cost for this project could be offset by tolls collected from users of this bridge, thereby not diverting funds from other regional priorities.

Further, by constructing the “Techway”, it would become unnecessary to follow through with the planned widening of Northern Virginia’s portion of the Beltway. A portion of the \$2 Billion planned for that effort could be redirected to the “Techway” project. This approach also provides more bang for the buck since the “Techway” would carry more than vehicles per lane than new Beltway lanes.

### a. Commuters

For the commuters the new bridge will save some money on their gas and car maintenance bills, as they will not have to make the extra 20 mile ride in each direction. However they would be paying tolls while using the Techway and paying extra taxes to the government for building the facility.

### b. Displaced Families

Displaced Families would be compensated by the Government for the loss of their home or business. Only in cases where Residents were not satisfied with the amount they were paid would they possibly incur personal expense in relocating their home or business.

### c. Governments

To provide the Techway facility, the Governments would incur cost to purchase the land from the current owners, as well as the cost to construct the new bridge. There would also be associated costs to cover cleaning and restoring the construction site after the construction is completed. Ms. Walker informed us that to make up for the lost agricultural, historical lands parks and nature preservation sites such as sanctuaries, wetlands etc., the Government is expected to replace the land in multiple ratios (e.g. 1:5 in case of Woodrow Wilson Bridge). For Techway as well the Government will buy similar land that is away from the bridge site and bear the cost of it.

## 7. Economic Impact

Maryland and Virginia are home to booming information technology and biotechnology businesses. The information technology firms located along

the Dulles Corridor in Northern Virginia and the bio-tech companies along the I-270 Corridor in Maryland are the engines driving the economy in the metropolitan Washington region.

## a. Maryland

Maryland has already invested millions of dollars to preserve their agricultural land. There is some concern that this investment will have been wasted if the land is taken for the bridge and parkway. They feel it will render the preserve useless. However, other states have experienced similar situations without detrimental results. "Iowa built highways through farmland and nothing changed," said Larry Cartano of Pleasants Development in Clarksburg, who is originally from Iowa <sup>[8]</sup>.

Further, while construction of a new bridge would not directly affect the accessibility to the BWI airport, it might cause some Marylanders to choose to use Dulles airport instead of BWI because of the better accessibility.

However, on the plus side, with the new bridge more technology jobs will be generated along I-270. Currently, only half the number of people travel from Virginia to Maryland as compared to that of people traveling from Maryland to Virginia each day. This new bridge could change this situation.

## b. Virginia

Accessibility to airports is vital to facilitate economic growth in a region. The new bridge will directly improve accessibility to the Washington International Dulles Airport (IAD). And accessibility to the Ronald Regan Washington National Airport (DCA) should be improved due to the reduction of congestion on Rt. 495 <sup>[3]</sup>.

In addition, access to Tyson's Corner is worsening. By taking traffic off the Beltway and the American Legion Bridge and providing another "door" to Tyson's Corner, the Techway Connector would improve access to Northern Virginia's "central business district" from the north, west and south <sup>[3]</sup>.

For both Maryland and Virginia a "Techway" Connector would promote greater Tech Community synergy. While helping shrink the world electronically, Virginia and Maryland technology firms are worlds apart geographically. A "Techway" Connector would facilitate greater interaction between these technology sectors.

## 8. Analytical Hierarchy Process Model

This section shows the results of employing the Analytical Hierarchy Process with the help of Expert Choice® Software.

### a. Objectives and Alternatives

The Figures 7.1 and 7.2 indicate the tree view of the Objectives and Alternatives respectively in the Expert Choice Software

Figure 7.1 Objectives and Sub-objectives of the AHP Model

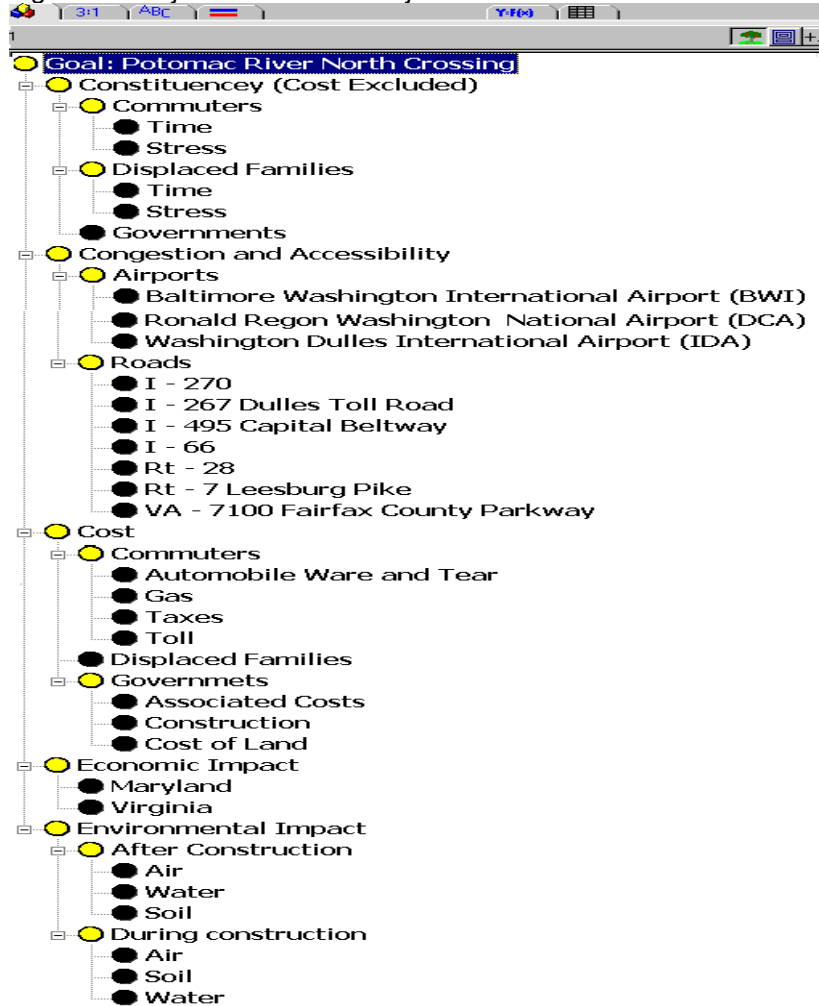
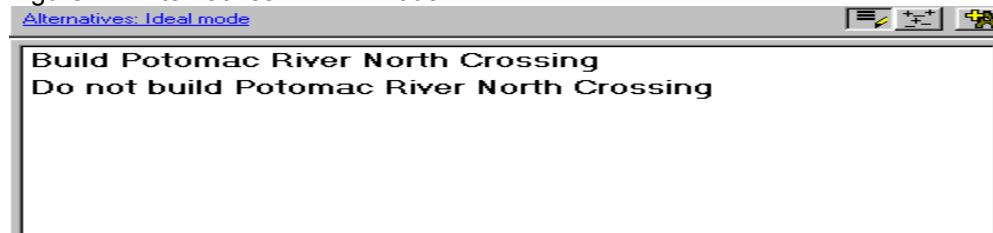


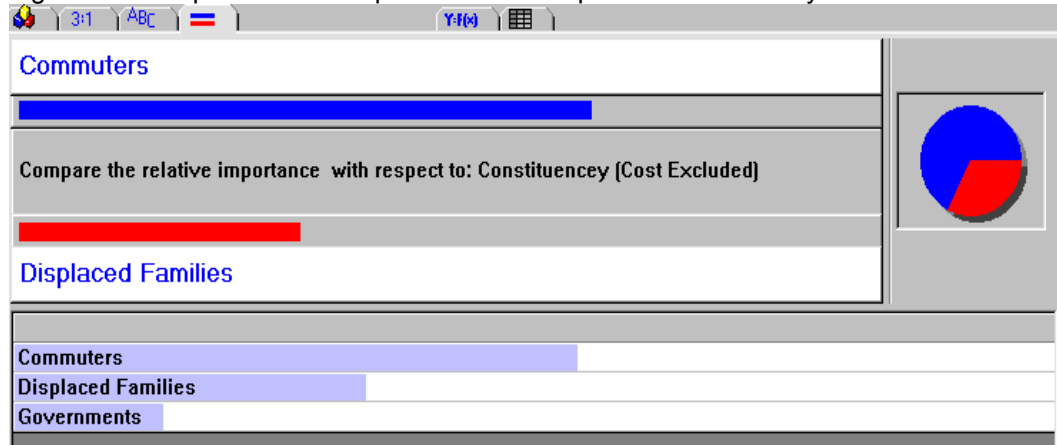
Figure 7.2 Alternatives in AHP Model



b. Priorities

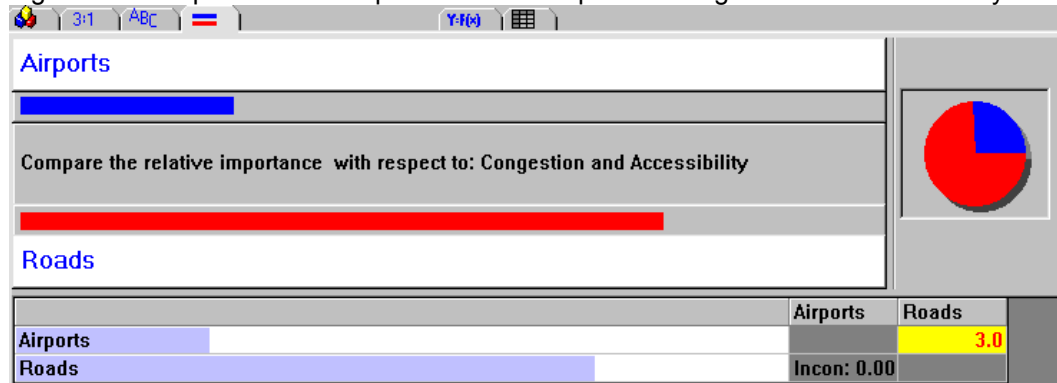
The priorities were derived using pair-wise comparisons between the alternatives and sub-objectives. Initially, pair-wise comparisons for sub-sub-objectives were done followed by sub-objectives and objectives. The pair wise comparison for the main goal was done last. Thus, the bottom-up approach was used for the pair-wise comparisons.

Figure 7.3 Compare relative importance with respect to Constituency.



For the Objective “Constituency” the most important sub-objective derived is “Commuters” followed by “Displaced families”, and then “Governments”. (Figure 7.3)

Figure 7.4 Compare relative importance with respect to Congestion and Accessibility.



Congestion and Accessibility to Roads is preferred over Congestion and Accessibility of Airports. See Figure 7.4

As far as cost is concerned, Cost of Commuters was the most important. Cost for Displaced Families was then considered, followed by the Cost that the governments will have to pay if the bridge is built. Please refer to Figure 7.5.

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Figure 7.5 Compare relative importance with respect to Cost.

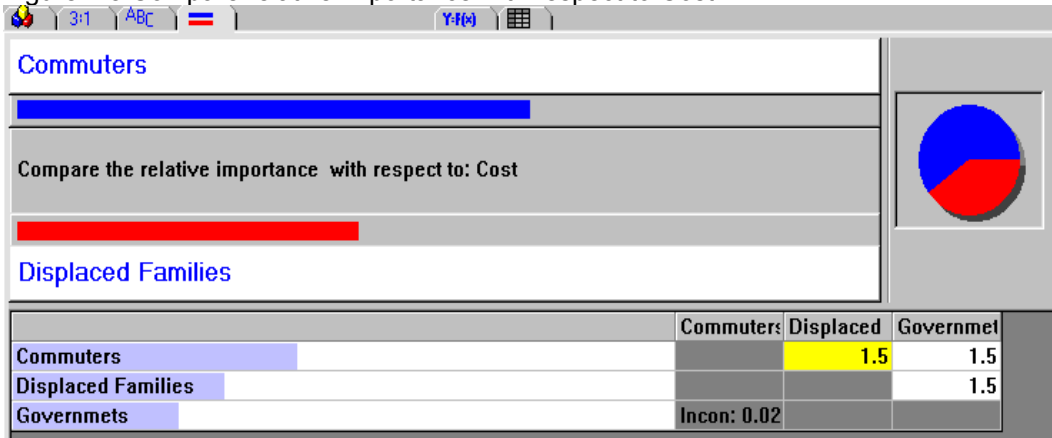
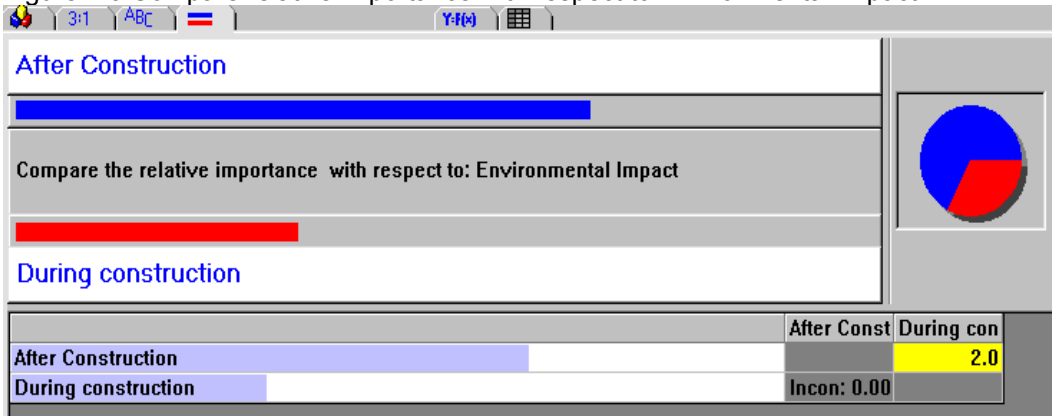


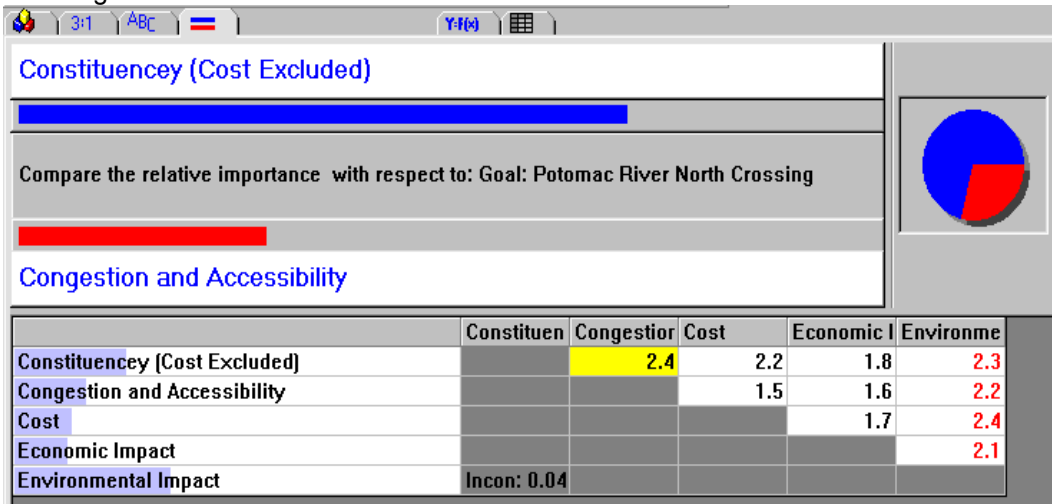
Figure 7.6 Compare relative importance with respect to Environmental Impact.



While considering the environmental impact of the new bridge, the impact after construction is twice more important than that the impact during the construction. See Figure 7.6

For the main goal –“Potomac River North Crossing” the most important derived priority is the Environmental Impact of the new bridge. The second most important priority is Constituency (i.e. meaning the impact of the bridge on the commuters, displaced families and governments). The third consideration is Congestion and Accessibility, followed by the Cost and the Economic Impact. Please refer to Figure 7.7

Figure 7.7 Compare relative importance with respect to Goal: Potomac River North Crossing.



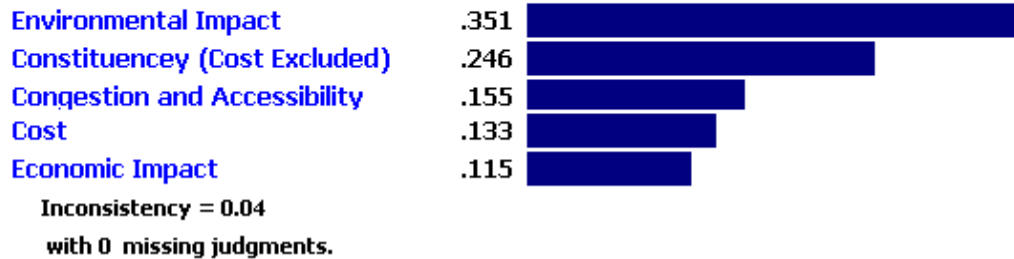
### c. Synthesis

Using the synthesis for the AHP Model with Expert Choice®, the following results were derived.

Figure 7.8 Synthesis (Priorities)

**Priorities with respect to:**

**Goal: Potomac River North Crossing**



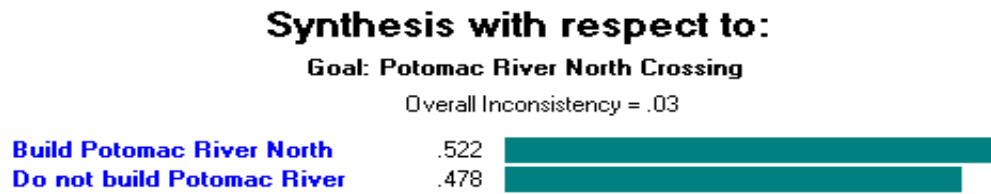
The Figure 7.8 shows the priorities between the objectives are:

Environmental Impact:	35.10%
Constituency:	24.60%
Congestion and Accessibility:	15.50%
Cost:	13.30%
Economic Impact:	11.50%

The Figure 7.9 shows the overall preference between the alternatives.

Build Potomac River North Crossing:	52.20%
Do not build Potomac River North Crossing:	47.80%

Figure 7.9 Synthesis (Alternatives)



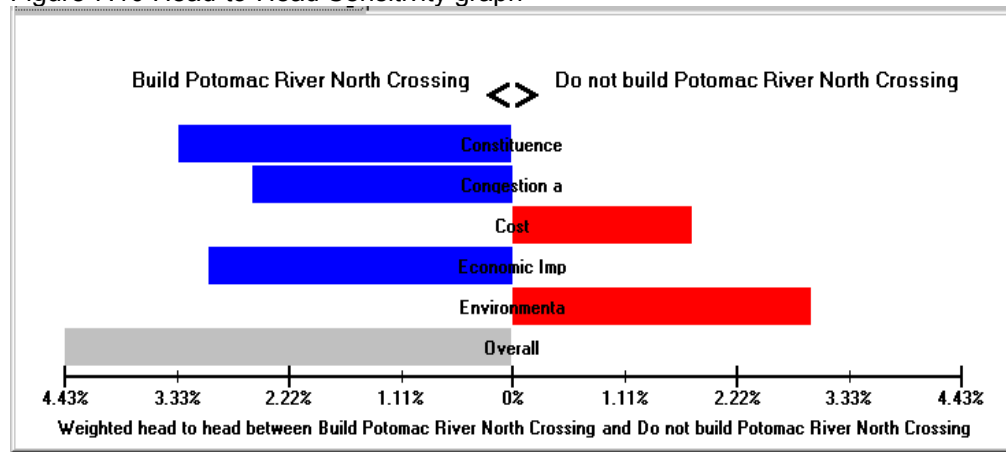
## d. Sensitivity

Sensitivity Analysis was used to observe the performance as well as the sensitivity of the alternatives with respect to each goal. The performance of the alternatives is how well each alternative is supported for the given objective. The sensitivity shows how the performance of the alternatives is changed if the priority of the objectives is changed.

### i. Head-to-Head Sensitivity

In the graph below the performance of two alternatives can be observed for the each objective.

Figure 7.10 Head-to-Head Sensitivity graph



From the Figure 7.10, we can see the difference between the weights for each objective e.g. the difference between the weights for build and not build for the objective environmental impact is approximately -3 %. The above graph shows that building the bridge is preferred for Constituency by 3.33%, for Congestion and Accessibility 2.75 % and for Economic Impact by 3.00%. Not building the bridge is preferred for Environmental Impact by 3.00%, and for Cost by 2.00%.



## ii. Dynamic Sensitivity

Using dynamic sensitivity graphs the relative importance between the objectives can be studied. The current decision to “Build the Bridge” is based on certain objectives being deemed more important. If, however, cost became the most important priority then the decision would change.

Figure 7.11 Dynamic Sensitivity with original importance to the Cost

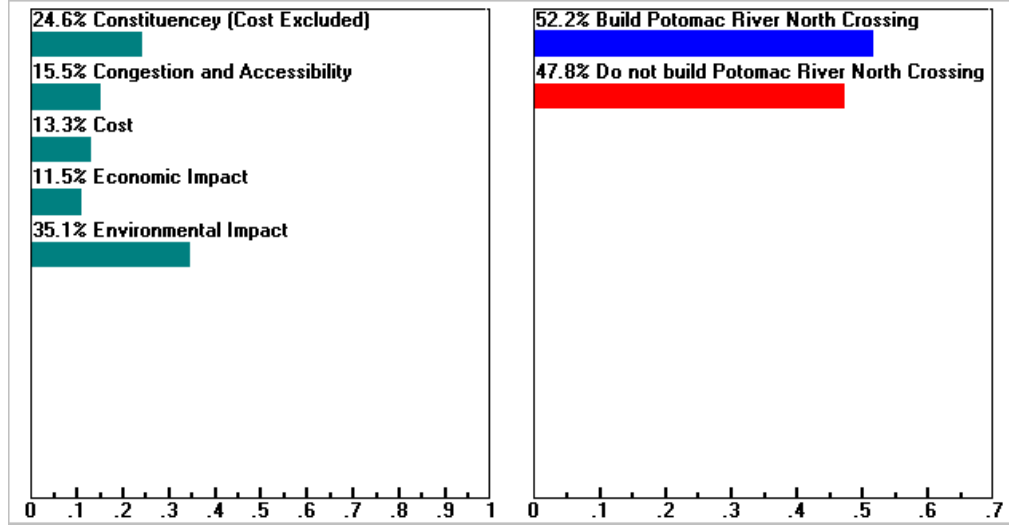
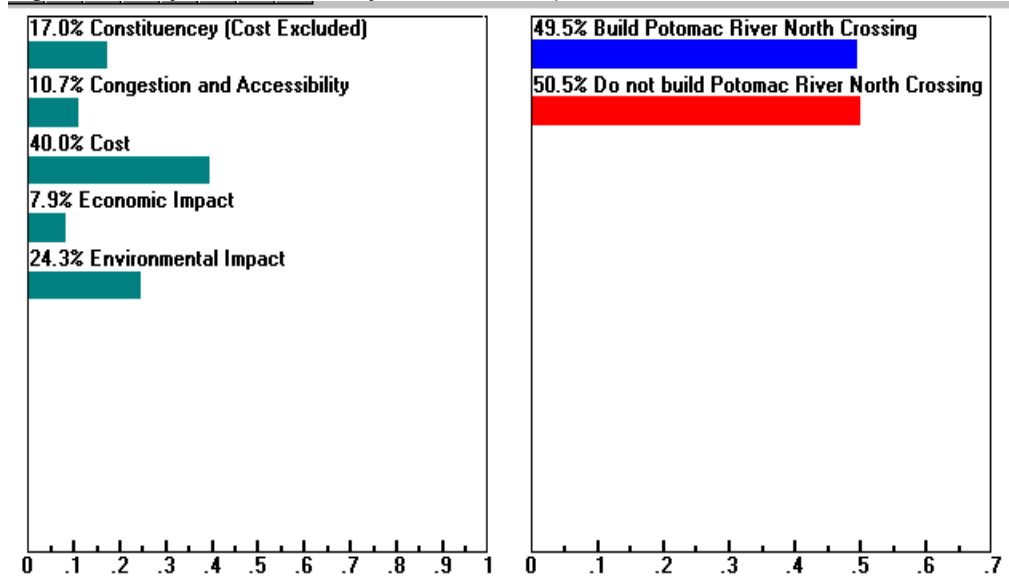


Figure 7.12 Dynamic Sensitivity with added importance to the Cost



## iii. Gradient Sensitivity

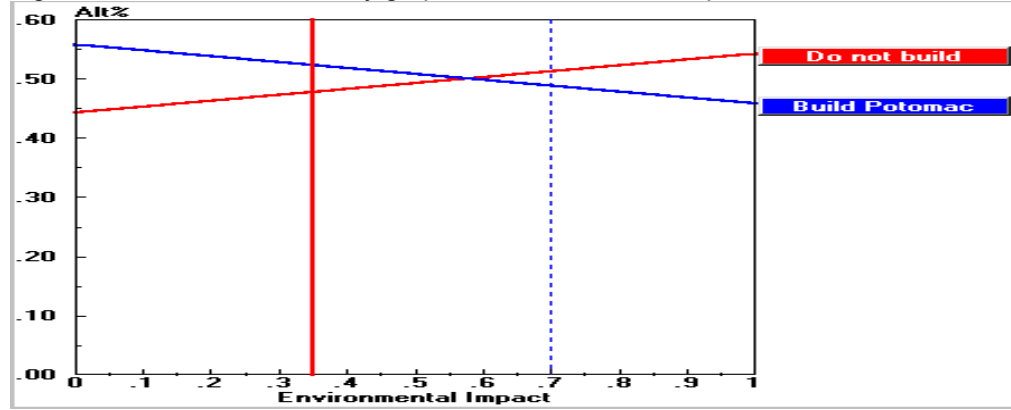
To study how the change in importance of the Environmental Impact Objective would cause the change in the alternative selected, the gradient sensitivity graph can be used. If the importance of

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Environmental Impact is decreased, then the alternative to “Build Potomac River North Crossing” is favored. If the importance of Environment Impact is increased, the alternative ‘Do not build Potomac River North Crossing’ is favored.

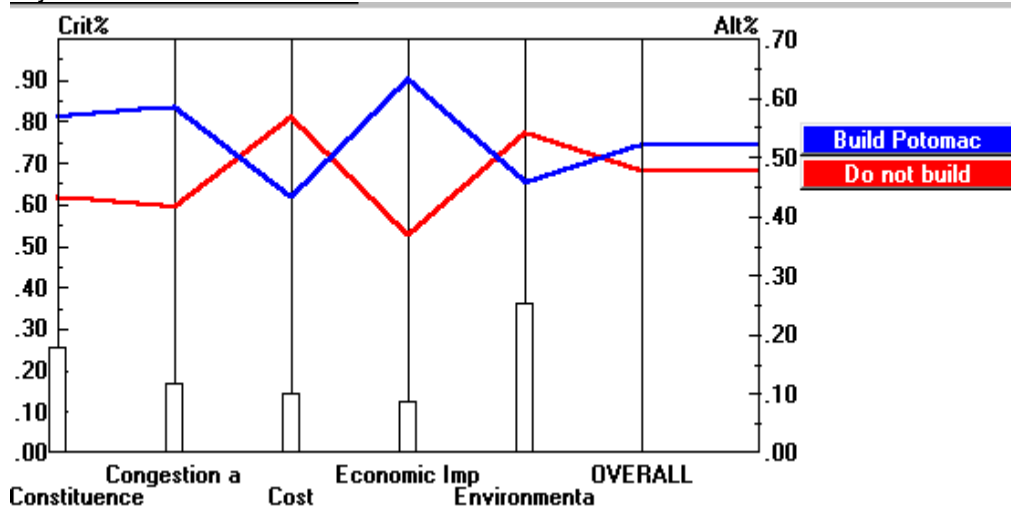
Figure 7.13 Gradient sensitivity graph for Environmental Impact



## iv. Performance sensitivity

With the use of Performance Sensitivity Graph we observe how each alternative performs on each of the objectives, and how important the objectives are. (Figure 7.14). For example, over all importance of the objective ‘Congestion and Accessibility’ is approximately 15% and it favors building the bridge more at 60% than not building the bridge at 40%.

Figure 7.14 Performance sensitivity graph with original importance of the each objective.



## 9. Conclusion

Based on the overall results of this AHP model, the decision should be made to construct the Potomac North River Crossing. Environmental Impact and Cost are two objectives that do not favor building the new bridge. However, when all the objectives are considered - Constituency, Congestion and Accessibility, and Economic impact, the final outcome is to “Build Potomac River North Crossing”.

## 10. Appendix A: References

1. Letter from Congressman Wolf to Secretary of Transportation
2. Federal Highway Administration
3. Virginia Department Of Transportation
4. Maryland Department Of Transportation
5. Marylanders For A Second Bridge
6. Chesapeake Bay Foundation Report
7. Coalition For Smart Growth
8. Northern Virginia Transportation Alliance
9. Washington Post and Washtech