Dulles Corridor Metrorail Project

A Cost-Benefit Analysis

Lauren Donnelly

This cost-benefit analysis studies several significant costs and benefits of the Dulles Corridor Metrorail Project. The two major costs of construction and operating expenses and the two major benefits of passenger benefits and car miles saved have been used to analyze the project over a 30-year period starting in 2009, to include four years of construction followed by 26 years of Metro operation. The project was determined to have a net cost of $1.78 billion. With the exception of the first four years, in which construction costs would be incurred but the other three costs and benefits would not yet be realized, the project creates annual benefits of $32 million or greater. Additionally, a break-even analysis was performed within the sensitivity analysis to determine the year in which net benefits would begin accruing on the project. This year was found to be 2063, or 54 years into the project (including four years of construction and 50 years of service). Any following years in which the Metrorail was still operating would create increasing net benefits.

Introduction

The Washington, D.C. metropolitan area has the third most congested highway network in the United States (NVTA). Existing roads are insufficient for the current volume of traffic in the area, and attempts to alleviate traffic congestion with road-based enhancements are not enough to keep up with the increasing volume. Traffic congestion is especially bad in

Northern Virginia, a rapidly developing suburb of the nation's capital. The average commuter in Northern Virginia spends nine working days per year stuck in traffic. Much of the congestion occurs in the Dulles Corridor, an area that stretches along Route 267 between Loudoun and Fairfax counties (FTA 2006).[1] Five of eight major Corridor roadways are expected to be in gridlock by 2010. Employment in the Corridor will increase by 63 percent; population will increase by 45 percent; and travel demand will increase by 45 percent in the next 20 years (DCMP). Because traffic congestion is only predicted to worsen as the area continues to develop, an expansion of the public transportation system is widely deemed necessary. Proposals to alleviate traffic congestion by expanding public transportation systems, however, have been held up for decades due to a struggle of competing state and regional interests as well as funding questions.

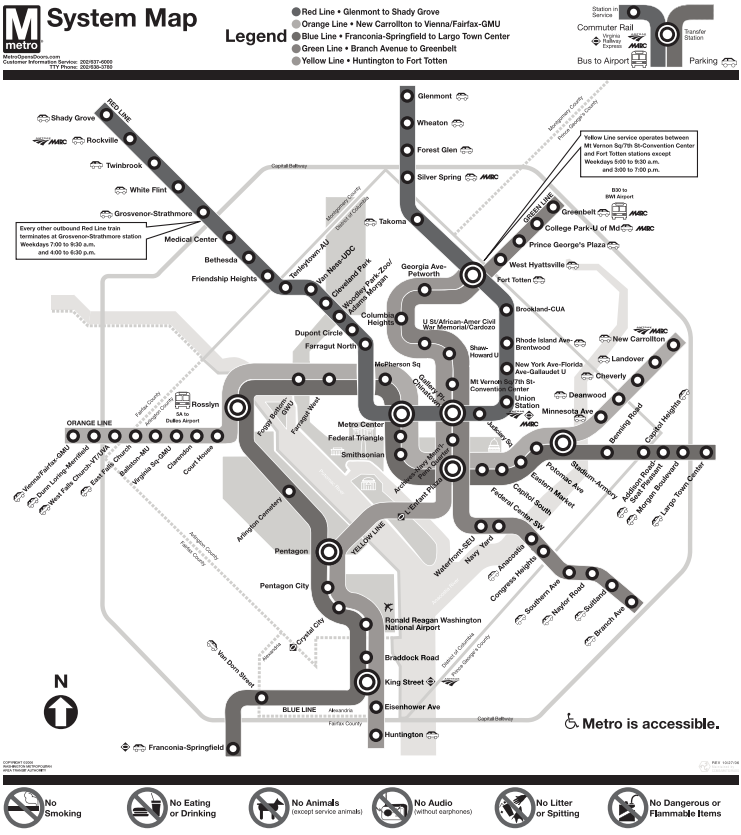
No public rapid transit options currently exist for the heavily populated areas along the Dulles Corridor. Such areas include Tysons Corner, a major shopping center and the nation's 12th largest business district; the town of Reston, Virginia; Dulles Airport; and eastern Loudoun County, Virginia. Public bus routes supplement the three existing Metrorail lines that run to limited portions of Northern Virginia, but buses are susceptible to traffic flow and congestion just like other motor vehicles on the roads.

The Washington Metropolitan Area Transit Authority (WMATA) operates the second largest rail system in the country and the fifth largest bus system.[2] Currently, average weekday ridership is nearly 1.2 million passenger trips between Metrorail (the portion of Metro which uses the rail system) and Metrobus (the portion of Metro which provides transportation via bus). Metro has over 1,100 rail cars, which provide over 200 million trips annually. The Metro system has brought economic development to areas around its stops as well. WMATA claims that Metro has generated over $25 billion of economic development at or adjacent to Metro property due to ease of movement, reliability, and convenience for all of its users (WMATA). Metro currently has five rail lines that run throughout Washington, D.C. and into Maryland and Virginia, with nearly 80 stops, many of which service several lines (see Figure 1). The Metrorail provides 135 hours of service per week, with Metrobus following approximately the

same schedule. During rush hour, Metrorail service is frequent with trains coming as often as every one or two minutes. During non-rush hour times, service is considerably less frequent, with 15 to 20 minutes between trains. To supplement the rail service, WMATA also operates buses that mainly run to areas where it is too far to walk to the metro. Lastly, WMATA has MetroAccess, a paratransit service for people who have disabilities that prevent them from using public transportation.

Figure 1:

Current Metrorail System Map

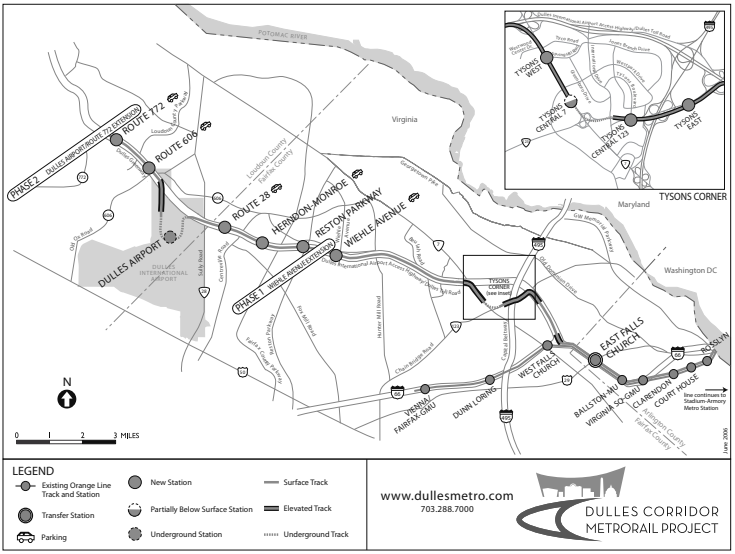


Source: *WMATA 2009*

A Metro extension into Northern Virginia has been contemplated for many years, and the most current project proposal includes a two-phase design and construction plan that will be called the Silver Line of the Metro (see Figure 2). Phase I, which began construction in March 2009, consists of the construction of five Metrorail stations and 11.6 miles of mostly above-ground track that will connect the Dulles Corridor with the pre-existing Orange Line near the East Falls Church Metrorail station, and share the track with the Orange Line route through downtown Washington, D.C. Service is scheduled to commence in 2013. An additional six stations and 11.5 miles of track will be added during Phase II, which has a preliminary completion date of 2015 (see Figure 2).

While it brings many benefits to its users, a public transportation system is costly to operate. Low fares are necessary to keep ridership up, but do not generate enough revenue to maintain the system. Furthermore,

Figure 2:
Proposed Silver Line Construction, Phases 1 and 2



Source: *Dulles Corridor Metrorail Project 2009*

building a public transportation system requires billions of dollars of initial investment for construction and associated costs.

The major traffic congestion and rapid rate of growth in Northern Virginia have led to increasing support for an expansion of the Metrorail. Although public transportation systems often fail cost-benefit analyses due to high construction and operating expenses and smaller quantifiable benefits, many groups feel that the high cost of a Metrorail expansion is justified to create a foundation of mobility and congestion relief for future growth.[3] This article will examine the projected costs and benefits of Phase I of the Dulles Corridor Metrorail Project. Although transportation projects are generally good candidates for cost-benefit analysis due to their large costs and the amount of people affected, to the best knowledge of the author, no publicly released CBA has been performed on the Dulles Corridor Metrorail Project. While CBA can be difficult to perform because of the complexity in quantifying many benefits and costs, it is a useful evaluation tool to establish a measure of feasibility for the project. Some factors, especially benefits, are difficult to quantify, and are widely susceptible to interpretation. These will be discussed further in the "Other Considerations" section of this paper.

Background

There is a wealth of information available on the internet about the Dulles Metrorail Expansion project due to its high visibility and relevancy. Local newspapers such as the *Washington Post* and the *Washingtonian* have published many editorials and articles related to the project. There is a website dedicated solely to the project, which contains a great deal of the information used in this CBA.

In "Rail transit: The people's choice," Flem and Schiemeyer (1997)argue that public investments in transportation systems serve society by increasing transportation capacity and improving air quality and safety. However, debate exists on whether public transport should be publicly funded. "You Ride, I'll Pay," a 1992 article from the *Brookings Review*, discusses the arguments against subsidizing transport systems and compares them to the

implications of closing down the transportation systems, which would include increased traffic, worsened congestion, decreased air quality, and loss of land to car-related infrastructure. While the topic of public funding is still ripe for debate, this article will instead focus on whether the costs and benefits to the riders and community justify the costs overall.

A review of the Tysons Tunnel Engineering and Environmental Studies that was completed in 2007 considered the feasibility of boring a large tunnel through Tysons Corner, including technical feasibility, risk factors, and whether the tunnel would meet the Federal Transit Administration's (FTA) Cost-Effectiveness ratio criteria. The FTA uses these criteria to rate projects for its New Starts program. The review concluded that there is a significant risk that it would not meet the cost-effectiveness ratio criteria, thereby compromising federal funding for the project (Carter & Burgess, Inc. 2007). Although at one point the project failed the New Starts criteria and federal funding was indeed an issue, this has since been resolved.

Methodology

Ex ante perspective

This CBA takes an ex ante, or forward-looking, perspective of the project because, while preliminary engineering has been completed and construction has begun, service has not commenced. As mentioned previously, on a straight construction and operation expenditure versus revenue analysis, building the Metrorail extension would not seem to be worthwhile. However, as this paper will explain, there are several benefits and costs that are not directly evident and quantified. Using certain assumptions, some of these costs and benefits are quantifiable and, furthermore, they are necessary factors to consider when deciding if this project is worth undertaking. In order to be so, the project must be expected to improve efficiency and/or overall social welfare.

As stated previously, this CBA looks only at Phase I of the Dulles Corridor Metrorail project. It assumes that service will begin at the first five new Metrorail stations on time and within budget in 2013.

Standing

Expansion of the Metro through the Dulles Corridor affects many people and groups. While all residents of the United States have standing as federal taxpayers, those who are most affected by the project are detailed in this analysis. Residents of Virginia, Washington, D.C., and Maryland who live or work near the new stations will have the advantage of increased transportation options and reduced environmental pollution. These residents will also bear the cost of noise pollution and unsightly tracks. Businesses in the region, especially those close to the Metrorail stops, will benefit from increased economic activity. People traveling within the Washington, D.C. area, especially through Tysons Corner, will experience the benefits associated with an extra mode of transportation. Any businesses that must ship their goods to or through the D.C. metro area and any traffic passing through the D.C. metro area, whether business- or pleasure-related, will benefit from any potential reduction of traffic congestion.

Another important group with standing consists of those funding the project, such as the federal government, the Commonwealth of Virginia, Fairfax and Loudoun counties in Virginia, the town of Herndon, the users of the Dulles Toll Road (as tolls are being dedicated to the project), and several local organizations and private enterprises involved in the funding.

Data

Data for this CBA has been collected from primary sources, such as the Dulles Corridor Metrorail Project website and government websites, wherever possible. Because many of the cost and benefit factors are susceptible to assumptions, perspective and bias, a sensitivity analysis will be presented before the conclusion. The point of the sensitivity analysis is to take alternative perspectives or numbers and see how they affect the conclusion.

Circular A-4 from the Office of Management and Budget provides guidance to federal agencies on the development of regulatory analyses. This CBA follows the Circular, which dictates that CBAs use a real discount rate of 7 percent as a base and that sensitivity analysis use a real discount rate of 3 percent.

Findings

Costs

The greatest cost of the project is construction, which is estimated to be between $2.4 billion and $2.7 billion. This CBA used a figure of $2.55 billion, the mean of these two figures. The partial sensitivity analysis, presented later, uses both the lower and higher figure to determine the change from the original findings. This figure consists of a $1.635 billion "firm fixed price" design-build contract with Dulles Transit Partners, and includes all of the major construction on projects such as the guideway, the five new Metrorail stations, a 2,100-foot tunnel under Tysons Corner, the electric power system, and specialized subcontracting (MWAA 2007). The remainder of the money will go to utilities relocation, project management and contingency, startup of operations, testing of the railcars, widened pedestrian bridges, and streetscaping and landscaping along the Metrorail path (DCRA).

WMATA currently serves the Dulles Corridor area with buses. Once the new rail is built and functioning, some of the buses will be re-routed, and no new buses should be needed. Therefore, there are no new expected operating expenses for buses. Once Metrorail service begins in 2013, operating expenses at the five new stations will be a significant cost. The estimated operating expenses are calculated as a percentage of the FY08 operating expenses for existing rail and Access systems of $828.8 million. The Dulles Corridor project will add 11.6 miles to the existing 106 miles of Metrorail track (10.9 percent), so the estimated operating costs are $90.339 million in 2008 dollars, or 10.9 percent of $828.8 million (WMATA).

Benefits

The metropolitan Washington, D.C. area has average annual traffic delays estimated to be 69 to 72 hours per traveler (DCMP). This figure is further validated by the Dulles Corridor Metrorail Project website, which states that the average Northern Virginia commuter spends nine working days in traffic per year, approximately 72 hours (Tysons Task Force). One method for quantifying traffic delays into dollar values is by using the value of travel time savings (VTTS). The Virginia Department of Rail and Public Trans-

portation (DRPT) estimates the cost of congestion in Washington, D.C. at $2.5 billion. Reducing delay times by providing an alternative mode of transportation is a large benefit of this project. The VTTS for nonwork travel time (commuting or leisure) is 50 percent of the average after-tax wage rate per hour saved, whereas the VTTS for work travel time is 100 percent of the before-tax wage rate. Time spent in traffic congestion is valued as two times the VTTS, valued as such to account for the frustration traffic congestion causes (Boardman et al. 2006). If this frustration from traffic in Northern Virginia can be eliminated by providing an alternative form of passive transportation, such as Metro, frustration will be reduced greatly. Because people travel in the Dulles Corridor for different reasons and all of the value of travel time savings above apply, this CBA equated the value of time to the average hourly wage in the D.C. metropolitan area ($24.80) as a rough average of these VTTS (Boardman et al. 2006). This hourly wage figure shall be used to estimate the transportation benefits from the project, called passenger benefits.

According to a FTA report issued in 2007, it is estimated that there will be 69,600 passenger rides per weekday in 2013. Ridership is expected to increase to 85,700 by 2030. This increase in ridership is reflected in three stages within the CBA (FTA 2006). Weekend and holiday ridership is estimated at one-fourth of the average weekday trips, so for each time frame, corresponding figures are calculated for the 114 weekend and holiday days in each year. Assuming the passenger rides figure estimates one-way trips, and the average rider takes two trips per day, the number of passengers receiving benefits is estimated at 34,800 per weekday in 2013, increasing to 42,850 by 2030. This number can be assumed to represent the average number of people sitting in traffic, either in personal vehicles or public transportation (buses), every day. In other words, this figure presumably represents the number of people experiencing annual delays of 69–72 hours due to traffic in the Dulles Corridor (Tysons Task Force). The Bureau of Labor Statistics estimates the mean hourly earnings for workers in the D.C. metropolitan area to be $24.80 per hour in 2008 dollars. The hourly value of time saved is equal to the average hourly wage (BLS 2009). Thus, the value of time saved is calculated to be $60.413 million annu-

ally in 2013, increasing to $74.388 million by 2030, in 2008 dollars. The Preliminary Engineering Report estimates the travel time benefit from the Metro expansion to be 19,700 hours each workday (FTA 2006). Using the same average wage and 251 weekdays in the year (excluding weekends and holidays), a figure is calculated at $122.629 million. Both this figure and the first figure calculated to be $60 million, are assumed to represent the same thing: the value of time saved. The great discrepancy between the two is interesting to note. The lower of these two numbers is used in the CBA, and the higher is used in the sensitivity analysis.

People who will be traveling on the new Dulles Corridor Metrorail extension would presumably otherwise be driving all or at least some portion of their trip. Not only does driving in congestion cause frustration, car usage also has tangible costs. The most apparent cost of driving is gasoline; however, there are many other fixed and variable costs associated with driving. The U.S. General Services Administration (GSA) has a Mileage Reimbursement Rate for Privately Owned Vehicles that it updates at least every year.[4] This rate is supposed to represent the average per-mile cost of operating a vehicle, including the variable costs of gas, oil, tires, routine

Table 1:
Summary of Costs and Benefits (in millions per year)

	2009–2012	2013–2020	2021–2029	2030–future
Costs				
Construction	$637.500			
Operating		$90.339	$90.339	$90.339
Benefits				
Passenger Benefits		$60.413	$67.400	$74.388
Car Savings		$62.056	$69.233	$76.410
Annual Net Benefits	*($637.500)*	*$32.130*	*$46.294*	*$60.459*
30-year Net Benefits of Project				*($1,783.930)*

Source: Author's calculations.

maintenance, and repairs, and the fixed costs of depreciation, insurance, registration and license fees, and personal property taxes. This does not include the cost of ownership. Using the GSA's current rate of $0.55 per mile (GSA 2009) and assuming that a driver would drive at least the 11.6 miles of the extension, that the weekday ridership figure of 69,600 represents one-way trips, and an average car capacity of two people, the cost saved by taking the Metro rather than driving is $62.056 million per year in 2013 and increases to $76.410 million by 2030.[5]

There are several costs and benefits not included in this CBA that will be examined further in the "Discussion" section below.

Analysis of Results

The Dulles Corridor Metrorail Project was initially analyzed in this CBA using a 30-year framework. It analyzed the two major costs of construction and operating budget and the two major benefits of passenger benefits and car savings. Other possible costs and benefits are assumed to be difficult to quantify and questionable in assumption. Over the 30-year period, this CBA assumed construction would occur for the first four years (2009–2012) and operation of the Metrorail would commence in 2013, with operation through at least 2038. This CBA concluded that over this 30-year period (four years of construction and 26 years of operation), the Dulles Corridor Metrorail Project would generate net costs of $1.78 billion. As mentioned in the "Benefits" section above, each year of operation (once construction is completed) produces annual net benefits. Thus, as the Metrorail operates beyond these 30 years, the net costs would continuously decrease, as shown in Table 1.

Originally a break-even analysis was planned to determine whether or if the net costs would ever change over to net benefits, and after how much time. However, because of the large initial construction costs compared with the relatively small annual net benefits spread into the future, a break-even analysis indicates that even 100 years into the project, or 96 years into operation, the net benefits would not turn from negative to positive

because the yearly net benefits would not accumulate enough to outweigh the large upfront costs of construction.

Table 1 shows the yearly costs and benefits, broken down by the period in which they occur. The table shows that from 2013 on, net benefits are accumulated from an annual standpoint, but over a 30-year time frame net costs are still $1.78 billion.

Sensitivity Analysis

In order to account for the impact of upper and lower bounds of the estimates above, one variable was altered at a time, so as to show a range of net costs and determine if the project would potentially break even using other estimates. This CBA focuses on two major costs (the large upfront costs of construction and the operating budget) and two major benefits (car savings and passenger benefits) of the Dulles Corridor Metrorail Project. The sensitivity analysis altered two variables for which varying information existed: construction expenses and passenger benefits.

The project has benefits and costs that span into the future as long as the Metro is in operation, but has very large upfront costs before other benefits and costs begin to accumulate; therefore, the discount rate can have a significant impact on the future projections. The larger the discount rate used, the longer it will take for the project to break even. The original analysis used a real discount rate of 7 percent, and per OMB's Circular A-4 the analysis also used a rate of 3 percent. Typically in a scenario in which there is a high initial cost and then smaller benefits in the years following, a lower discount rate will produce higher net benefits (or lower net costs) than a higher real discount rate. While the initial construction cost of $2.55 billion dwarfs the annual benefits of $32.13 million that begin accruing in 2013, using the lower discount rate yields smaller net costs. If the project took on a longer time frame, the 3 percent discount rate would yield even lower net costs. Thus, each variable that was altered in the sensitivity analysis was discounted at both 7 percent and 3 percent.

The cost of construction used in the original analysis is the mean of the range of the expected cost, so both the high and low estimates of the cost

are evaluated in the sensitivity analysis to obtain a range of net benefits.

There were two estimates for the transportation benefits. The original conclusion utilized the smaller number to err on the side of caution. The sensitivity analysis used the larger number, which showed the project having a much lower net cost over 30 years. Using a 3 percent discount rate with the average $2.55 billion construction cost and the higher passenger benefits figures, the project could be expected to break even in 2063, 54 years into the project and 50 years into service, under those assumptions. Table 2 illustrates the net costs for the 30-year time frame.

Table 2:
Partial Sensitivity Analysis Findings: Net Costs (in millions)

	7% Discount Rate	3% Discount Rate
Original CBA Consideration	–$1,783.93	–$1,663.40
$2.7 billion construction estimate	–$1,910.95	–$1,802.79
$2.4 billion construction estimate	–$1,656.91	–$1,524.01
Higher passenger benefits figure	–$1,264.83	–$771.85

Source: Author's calculations.

Discussion

The Dulles Metrorail Project failed this cost-benefit analysis. This is not a big surprise, because rail investments are often not economically justified from a CBA perspective. This is why private enterprise tends not to invest in public transportation projects. Thus, because these projects do not stem from private initiative, they become somewhat of a public good, and government entities become active in ensuring funding. As mentioned briefly before, there were several important yet unquantifiable benefits that should be considered. An attempt could be made at quantifying these ben-

efits, but there comes a point where measuring them in terms of costs becomes less and less scientific and therefore more refutable. To attempt to quantify them would involve making would involve making unfounded or questionable assumptions. While several key assumptions have been made throughout this analysis, they are done so cautiously, explained thoroughly, and based upon reliable factual research. For this reason, the author elected to discuss "unquantifiable" benefits here rather than attempt to put them in dollar terms.

Unquantifiable Considerations

The costs and benefits not quantified within this paper are important to understand because the project is on track to be fully constructed by the end of 2012. Some benefits include environmental benefits from reduced congestion on area roads, a reduction in automobile accidents, and job creation. Costs include inconvenience during construction and decreased property value along the line due to noise pollution. Finally, revenue from fares of Metro riders is briefly considered as a distributional concern.

Benefits

One benefit of the project might be a reduction in vehicle emissions. If the number of vehicle miles is reduced by the use of the Metro, the emissions should be reduced accordingly. This would produce an environmental benefit. Northern Virginia is experiencing significant growth that is expected to continue into the foreseeable future. Even with the Metrorail extension in place, it is assumed that more cars will be on the road, and congestion will eventually increase once again to its current levels. Without the Metrorail extension, however, traffic congestion would grow more severe.

A reduction in traffic that leads to a reduction in automobile accidents would create benefits quantified by the value of a statistical life or the value of a statistical year. Again, conjecture would be required to estimate whether any accidents—and thus any deaths or injuries—would be avoided, especially if congestion eventually increased back to current levels, so this potential benefit is not quantified within this CBA.

When construction projects such as this one are contemplated, people

often believe that a benefit is job creation. As Boardman et al. (2006) point out, in a sector of the economy with low unemployment, job creation from one project is unlikely to reduce the number of people unemployed (unemployment), as these workers are simply moving from one construction project to another. The employment of resources and people in a time of economic recession, or in a period of high unemployment, may change the unemployment rate, as laborers are often hired from the ranks of the unemployed. This fact may increase benefits for the Dulles Corridor Metrorail Project, which broke ground during an economic downtown. However, for the sake of being as clear as possible, this theory was not utilized, and the benefits of employment have been treated as a transfer.

Costs

A small but important cost is the inconvenience experienced by local businesses and anyone traveling through the construction area during the construction period. The project is designed to be as minimally intrusive as possible, and as traffic is already congested and unpredictable, it is difficult to quantify the costs such a project would impose on businesses and travelers.

Another factor considered but not incorporated directly into the quantitative analysis is the rail system's effect on Dulles Corridor property values. Once the construction is completed, the Metro is expected to provide benefits for an indefinite number of years into the future. Because the Metro is planned to be above ground for most of the 11.6 miles, it will produce noise pollution. This might be considered a cost of decreased property value, similar to how airport noise has been determined to negatively affect property values; however, it is believed that this decreased property value because of noise pollution will actually not occur or at least be outweighed by increased property value of the properties in proximity of the Metrorail stations. Property values in close proximity to Metrorail stations can be expected to increase. Due to the already high value of property in Northern Virginia, and the diversity in property types making property value difficult to quantify on a whole, the potential increase in property value was another benefit not incorporated into this CBA, but important to consider.

Distributional Effects

Transfer payments are defined by Circular A-4 as "monetary payments from one group to another that do not affect total resources available to society" (OMB 2003). In other words, what is a benefit for one party is an equal cost for another party. While transfers do not contribute to the net benefits of a project, they are important to consider. The most important transfer in the Dulles Corridor project is fare revenue. Because the revenue comes from fares collected from riders, it cannot be taken into consideration as a benefit within the confines of CBA. However, it is important to consider

Table 3:
Expected Revenue from Dulles Corridor Metrorail Project

	Average Boarding	Days per Year	Total Annual Revenue[1] (in millions)
2013–2020			
Weekdays	69,600	251	$44.198
Weekends, Holidays	17,400	114	$5.019
Total per year		365	$49.217
2021–2029			
Weekdays	77,650	251	$49.310
Weekends, Holidays	19,413	114	$5.599
Total per year		365	$54.909
2030–future			
Weekdays	85,700	251	$54.422
Weekends, Holidays	21,425	114	$6.179
Total per year		365	$60.601

1. At $2.53 average fare; see discussion.

Source: Author's calculations.

the fares within the analysis because WMATA, even after fare revenue is taken into account, continually faces a budget deficit. The expected revenue of fares collected from the new line is shown in Table 3.

Revenue generated by Metro was estimated to be $2.08 per fare in 2008. This rate was before the fare increase effective January 2008 that increased fares by 30 to 60 cents per direction, depending on the length of the trip. This CBA assumes that the average fare rose by the median of 30 and 60 cents, or 45 cents, to an average fare of $2.53. Trips between the new addition and the city will be on the higher end of the pricing schedule, generating larger revenues. Based upon ridership as mentioned in the "Findings" section above, ridership will increase from 69,600 rides in 2013 to 85,700 by 2030.

While these figures are not incorporated into the calculation of the net present value for determining the conclusion of this CBA, they are important to note because they are a direct factor in WMATA's budget.

Financing Considerations

Unless the project can be paid for in full at start of construction, upon completion, or throughout the four years of construction, at least part of it will have to be financed, causing interest expenditure. However, the U.S. Department of Transportation states that expenses associated with financing should not be included in a CBA (FHA).

For Further Discussion

While this CBA was able to quantify certain costs and benefits and is therefore helpful in examining the project, it can not be assumed to fully represent all considerations. This project has been debated by parties in Northern Virginia for decades, and the debate does not end here, just as it did not end with the signing of the design-build contract, nor with the decision by the former Secretary of Transportation Mary Peters to support the project and the subsequent signing of the full funding agreement by Secretary of Transportation Ray LaHood. There is clearly a strong popular case for the existence of the Dulles Metrorail extension, despite the lack of economic justification.

Conclusion

While from a pure CBA standpoint, this analysis has found the project to have large net costs over a 30-year time frame, when other factors are accounted for, the project becomes much more worthwhile. The initial cost of construction is very high compared to the annual net benefits in post-construction years (starting in 2013); however, the Metrorail extension can be expected to generate continually lower net costs the more years it is in operation. WMATA will bear the burden of operating expenses that exceed revenue, so the yearly operating budget will be negative, requiring a subsidy. This mirrors WMATA's current practice and is acceptable because the revenues generated from passenger fares are not the only factor associated with public transportation. This CBA found that yearly passenger benefits and car savings will exceed the operating expenses, so that each year of operation actually generates annual net benefits by at least $32 million. Accumulated over years of Metrorail service, these annual net benefits may eventually outweigh the high upfront construction cost of $2.55 billion.

In addition to weighing the costs and benefits of the project, this CBA also attempted to determine a time frame whereupon the Dulles Corridor Metrorail Project Phase I would break even, and then to decide if this time frame was acceptable. This would mean trying to determine a reasonable life cycle of the Metro. The Washington D.C. area Metro is over 30 years old and still functions as it was meant to, New York's subway system has been in use for over 100 years and is equally well maintained, and Chicago's elevated metro is about 70 years old, although recent funding issues have placed its necessary maintenance funding in question. These examples are useful as references to determine whether this break even point would be feasible. Because of the high upfront cost of construction and the small annual net benefits thereafter, even when put within a 100 year time frame, the net benefits of the project are still negative, except in the most optimistic calculations in the sensitivity analysis, in which it would break even in 2063, 50 years into operation. Although this conclusion was gathered, the unquantifiable benefits of the Dulles Metro line are increasingly valuable to the regional economy.

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Notes

1. From dullesmetro.com: "The Dulles Corridor is home to several of the Washington D.C. metropolitan region's most dynamic and rapidly growing activity centers, including Tysons Corner, the Reston-Herndon area, Dulles International Airport and the emerging activity centers in eastern Loudoun County."
2. Within this paper, both "Metro" and "Metrorail" refer to the rail portion of the WMATA system, and "WMATA" refers to the organization that operates Metro.
3. This is assumed to be a commonly held belief among the public, as well as the implicit belief of the partners in this project: the federal government, the Commonwealth of Virginia, Loudoun County, Fairfax County, and Metropolitan Washington Airports Authority, among others.
4. The Internal Revenue Service actually calculates the rates, and the U.S. General Services Administration uses them. Part III Administrative, Procedural, and Miscellaneous 26 CEF 601.105: Examination of returns and claims for refund, credit, or abatement; determination of correct tax liability. Rev. Proc. 2007-70 from http://www.irs.gov/pub/irs-drop/rp-07-70.pdf. AAA also calculates a similar rate in their annual publication "Driving Costs 2008" from http://www.aaaexchange.com/Assets/Files/20084141552360.DrivingCosts2008.pdf
5. "The Project Update," prepared by the Tysons Task Force on November 7, 2005, estimates annual delays of 69 hours per traveler in the Washington region. General data, collected from the Dulles Corridor Metrorail Project website, estimates that the average Northern Virginia commuter spends nine working days a year stuck in traffic. Nine eight-hour days is 72 hours.

Lauren Donnelly is a graduate of The George Washington University where she received her Master's of Public Policy in May 2008. She graduated with B.A. in Economics and Spanish from Bucknell University in 2005. She began her career at the U.S. General Services Administration as a Contract Specialist, working there for over three years before recently starting work at the Federal Railroad Administration under the U.S. Department of Transportation as an Industry Economist

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