AECOM

Preliminary Planning Estimate Of Tolling Potential for Selected NPS Roadways

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Section 1. Introduction and Purpose

The National Park Service (NPS hereafter) maintains approximately 12,500 miles of roads as part of its mission to connect the U.S. public with the nation's natural heritage, including 5,500 paved and 7,000 unpaved miles. The type and capacity of these roads vary from divided highways to comparatively remote unpaved access roads. The maintenance backlog for these roadways accounts for roughly half of NPS's nearly $12 billion backlog. In light of NPS' large transportation asset backlog, this analysis explores whether instituting tolls on select park highways could raise additional revenues and address maintenance costs.

The question is more than a hypothetical one in the Washington, D.C., area with the recent announcement that Maryland Governor Larry Hogan and U.S. Department of the Interior officials had agreed to study the revenue potential and institutional requirements needed to transfer ownership or long-term lease and apply a toll to the Baltimore-Washington Parkway.[1]

This technical memorandum describes the results of a preliminary, conceptual-level assessment of whether tolling could be a viable strategy to raise transportation funds to offset NPS roadway maintenance needs. Five NPS tollways were chosen for analysis in consultation with roadway experts, NPS specialists, and the client. The five facilities and their estimated maintenance backlog (in fiscal year 2017 dollars, rounded to nearest hundred thousand)[2] are listed below.

George Washington Memorial Parkway	$167.0 million
Baltimore-Washington Memorial Parkway	$27.7 million
Suitland Parkway	$9.5 million
Rock Creek and Potomac Parkway	$4.1 million
Blue Ridge Parkway	$325.1 million

The purposes of this study were to determine whether and under what conditions tolling might merit additional analysis and to perform a full, formal tolling and revenue study.

Of particular note, the results of this analysis for the Baltimore-Washington Parkway will not align with the eventual results of the Maryland-federal study, as that study

[1] Max Smith, "Feds, Md. Agree to Work Toward BW Parkway Toll Lanes," WTOP News, June 25, 2018, https://wtop.com/dc-transit/2018/06/feds-md-agree-to-work-toward-b-w-parkway-toll-lanes.

[2] Amounts obtained from NPS fiscal 2017 asset inventory data.

anticipates widening the roadway and operating it as part of a network of variable tolled lanes throughout the Baltimore-Washington region.[3]

Preliminary assessment vs. formal tolling study

This study is a preliminary assessment to determine whether it makes sense to invest further resources to investigate a tolling strategy; it is not a formal tolling study of each of the roads selected for analysis. As a result, many of the key assumptions that a tolling analyst would normally draw from a detailed, resource-intensive, stated preference survey of corridor travelers are instead drawn from existing literature and the findings of other planning studies.

For this assessment, the recent study "Minnesota Department of Transportation, Minnesota Tolling Study Report: Modern Tolling Practices and Policy Considerations" (January 2018) is the source of many assumptions as noted in the analysis. This report was selected because it is a recent and comprehensive study conducted for a state transportation department with experience in tolling. Moreover, unlike many tolling studies, the Minnesota effort provided specific numerical guidance on diversion rates, which are a key assumption in making an aggregate revenue estimate.

Additional information on the tolling industry was drawn from Fitch Ratings' "Peer Review of U.S. Toll Roads: Attribute Assessments, Metrics and Ratings" (September 2017) and the Pennsylvania Turnpike Commission's "Pennsylvania Turnpike 2018 Traffic and Revenue Forecast Study" (April 2018).

[3] An early consideration of tolling the parkways in the Baltimore-Washington region as part of a larger network of tolled facilities is described in "Evaluating Alternative Scenarios for a Network of Variably Priced Highway Lanes in the Metropolitan Washington Region," presented to the National Capital Region Transportation Planning Board (March 2008).

Section 2. Assumptions and Analysis

The NPS roads selected for analysis included a mostly-rural scenic route, an urban arterial, and several commuting highways of differing length. The five roadways are:

- **George Washington Memorial Parkway.** The George Washington Memorial Parkway is located in Virginia and extends from Mount Vernon to the Capital Beltway. Developed for recreational driving and to link the capital city with George Washington's home, the parkway has become a major commuter route and now connects to Reagan National Airport and the Pentagon.

- **Suitland Parkway.** Built during World War II, the limited-access scenic road was designed to provide a quick connection between Andrews Air Force Base, Bolling Field Air Force Base, and downtown Washington. Because of its role in connecting military facilities, the parkway is part of the National Highway System. Today, the parkway serves as a scenic route to the capital for dignitaries arriving at Andrews and is used for daily urban commuting.[4]

- **Baltimore-Washington Parkway.** Constructed as a scenic approach to the nation's capital, the parkway is designated as a historic district and is listed on the National Register of Historic Places. The parkway is used by commuters between Baltimore and Washington, and is a common route to Baltimore-Washington International Thurgood Marshall Airport as well as other destinations.

- **Rock Creek and Potomac Parkway.** Constructed in 1936 as a scenic connection between the Lincoln Memorial and the National Zoo in Washington, the parkway was later extended northward as Beach Drive. Today it is a major urban arterial that has significant management procedures in place, including restrictions of direction during peak hours.
- **Blue Ridge Parkway.** A scenic route intended to connect multiple national parks, the parkway still largely functions as a recreational driving corridor that stretches from Shenandoah National Park in Virginia to the Great Smoky Mountains National Park in North Carolina. As a recreational corridor, the parkway has an economic impact on the tourism industry of surrounding communities that the other four selected parkways lack. Traffic volume is typically higher on weekend days than weekdays.[5]

  The Blue Ridge Parkway Foundation estimates that parkway travelers account for $980 million annually in economic activity among the adjacent communities. The toll estimates in this report do not consider the potential impact on the tourist economy of the region.

It is important to note that a simple approach to the demographics of travelers (and the potential income burden of a toll) is used in this study. The simple demographic profile

[4] National Park Service, "Suitland Parkway Collection," last modified March 25, 2015, https://www.nps.gov/orgs/1802/nace_suit.htm.

[5] National Park Service, "Blue Ridge Parkway, Virginia and North Carolina, Final General Management Plan/Environmental Impact Statement" (2013), https://parkplanning.nps.gov/document.cfm?parkID=355&projectID=10419&documentID=51305.

includes employee, nonrecreational and recreational vehicles using the corridors.

For example, each of the military facilities, as well as the Census Bureau complex, that are located in the Suitland Parkway corridor are major employers, attracting workers from across the region at all levels of the federal pay spectrum. In these instances, the tolling policy would have to be evaluated for potential discounts for “captive” households and workers—those without alternative access to their residence or work. Alternative toll policies are not factored into the revenue estimates presented in subsequent sections; in general, such policies would reduce the revenue yield from the estimated value.

Alternatively, the demographics of the Blue Ridge Parkway are similarly challenging to summarize as visitors come from all over the U.S. to enjoy the corridor’s recreational options.

The objective of this analysis is to develop a preliminary estimate of the toll revenue that could be collected on each of the five parkways studied. This is intended to offer a first look at the revenue potential of this funding approach.

A subsequent, in-depth analysis of tolling would include specific recommendations and protections. Such a study would also assess sensitivity to any changes in tolling policy, which could include potential exemptions for captive travelers, application of tolls at peak times only (i.e., congestion pricing), different tolls for autos and trucks, etc.

Approach

There are five basic steps to creating the toll revenue estimate; each is described in the text below.

1. Determine the baseline traffic volume.
2. Select the toll rate.
3. Identify a diversion percentage based on the literature and experience elsewhere.
4. Apply the diversion percentage to the baseline volume to obtain the revised volume of traffic.
5. Adjust revenue yield to account for the costs of tolling operations.

Step 1: Determine the baseline traffic volume

The baseline traffic volumes were drawn from the most recent traffic count data available from the relevant jurisdiction, as the mix of roads includes urban and rural corridors. In some instances, a judgment was required as volumes varied over the length of the road. The value selected was chosen to be representative—setting aside small segments of very high or very low volumes relative to the bulk of the corridor. The assumed volume by facility and the source on which the assumption is based is summarized in Table 1.

Table 1: Summary of Baseline Volumes

Parkway	Baseline volume annualized*	Source
George Washington Memorial Parkway	16 million	Virginia Department of Transportation traffic counts
Baltimore-Washington Parkway	43.8 million	U.S. Department of Transportation's Volpe Center, National Park Service, Baltimore-Washington Parkway, Maryland Traffic Safety Plan
Suitland Parkway	16.3 million	Maryland and District of Columbia departments of transportation traffic counts
Rock Creek and Potomac Parkway	9.5 million	District of Columbia Department of Transportation traffic counts
Blue Ridge Parkway	645,700	Blue Ridge Parkway, Virginia and North Carolina, Final General Management Plan/Environmental Impact Statement

* Values are rounded. Counts are adjusted for differences in published year of counts. All counts annualized at 365 except for Blue Ridge Parkway, which is annualized by 261 weekdays and 104 weekend days because weekend days have higher traffic volumes.

Step 2: Select a toll rate

The analysis assumes that if tolling were implemented in the five NPS corridors, the parkways would use electronic toll collection (ETC) tolling. New greenfield toll systems are almost entirely electronic, reducing the operational costs relative to manual collections via tollbooths and improving system mobility as cars can register the toll while moving and do not need to queue and stop to pay the toll. Legacy cash toll systems have been gradually converting to electronic systems, so this assessment assumes a newly tolled road would use an electronic system.

A toll is collected using an electronic reader located above the road. The reader sends a signal to the microchip inside the sticker or transponder located on the vehicle, and tolls are automatically deducted from the vehicle owner's prepaid account. Readers are posted at each entrance and exit to the tolled facility to track each vehicle's miles traveled.[6]

Toll rates are typically expressed on a per-mile basis. Table 2 illustrates both the cost to drive along a corridor and how the toll per mile varies across facilities in different locations. The toll per mile reported in the table is calculated for a trip that traversed the full length of the facility. For ETC tolling (assumed for the parkway implementation), the range is 4 to 12 cents per mile for the facilities reported. Using this range as a starting point, the toll revenue yield was calculated for each of the NPS facilities at 4, 8 and 12 cents a mile, plus one additional higher toll of 16 cents a mile—in the midrange of all U.S. toll facilities (see Exhibit A).

The toll range selected is consistent with the toll charges on a number of publicly owned and operated ETC facilities, as summarized in Table 2[7] and Exhibit A. The range of tolls per

[6] When a motorist enters a tolled lane without a sticker or transponder, a video camera captures information from the license plate and the motorist receives a bill in the mail. The cost to the motorist is much higher than the typical fee to offset the cost of the additional processing. The cost of the video capture is 35 cents but this excludes the back-office cost.

[7] These are estimated toll charges for a motorist traveling "end to end" and thus the minimum possible toll per mile. Shorter trips will have an effectively higher

mile collected across all U.S. toll facilities is wider than that illustrated in Table 2, when all toll facilities are considered, especially those owned and operated by a private concessionaire.

NPS facilities are public; therefore, a comparison with publicly owned and operated facilities at the lower end of the toll spectrum seemed most applicable. If a higher toll was adopted, the revenue yield would be greater than projected here.

As the roadway transitions from free to tolled, some travelers will divert to avoid the toll. Step 3 assesses this behavior.

Table 2. Illustrative Tolls and Rates per Mile

Toll facility	Length (miles)	2-axle vehicles			
		Full-length toll		Toll per mile	
		ETC	Cash	ETC	Cash
Indiana Toll Road	157	$10.75	$10.70	$0.07	$0.07
Kansas Turnpike	236	$10.60	$13.75	$0.04	$0.06
West Virginia Turnpike	88	$3.90	$6.00	$0.04	$0.07
Ohio Turnpike	241	$12.75	$18.75	$0.05	$0.08
Oklahoma Turnpike System	477	$29.55	$32.80	$0.06	$0.07
Will Rogers Turnpike	88	$4.50	$4.75	$0.05	$0.05
Turner Turnpike	86	$7.15	$7.65	$0.08	$0.09
Cimarron Turnpike	59	$3.30	$3.75	$0.06	$0.06
Indian Nation Turnpike	105	$6.20	$7.00	$0.06	$0.07
H.E. Bailey Turnpike	86	$5.10	$6.15	$0.06	$0.07
Muskogee Turnpike	53	$3.30	$3.50	$0.06	$0.07
Illinois toll roads	640	$53.08	$83.95	$0.08	$0.13
Jane Addams Memorial Tollway (I-90)	76	$3.95	$7.90	$0.05	$0.10
Reagan Memorial Tollway (I-88)	96	$5.10	$10.20	$0.05	$0.11
Tri-State Tollway (I-94/I-294/I-80)	78	$3.20	$6.40	$0.04	$0.08
Veterans Memorial Tollway (I-355)	33	$3.80	$7.60	$0.12	$0.23
Pennsylvania Turnpike	360	$37.03	$51.85	$0.10	$0.15
Northeast Extension	110	$10.16	$15.00	$0.09	$0.14

Source: Minnesota Department of Transportation, “Minnesota Tolling Study Report: Modern Tolling Practices and Policy Considerations,” Table 12: Toll Rates per Mile in Other Jurisdictions (January 2018), https://www.dot.state.mn.us/newsrels/18/01/26toll.html

toll per mile as the fixed cost of processing a transaction is spread across a shorter distance.

Step 3: Identify a diversion percentage

Traffic diversion occurs when some travelers seek to avoid the toll road by choosing another route or not making the trip at all. Diversion rates vary, with many factors such as the size of the toll, the income of the travelers, the level of congestion in the corridor, travelers' perception of need for tolling and equity, the ability to avoid the toll by using another route, and whether the existing roadway is upgraded and offers a travel time savings when the toll is applied.

This preliminary estimate applies the schedule of diversion rates developed for a recent Minnesota Department of Transportation study of tolling. The diversion rates included in Table 3 are presented in a range to capture variations in road type, availability of alternative routes, and potential size of toll increase.

Given this information, the potential toll diversion rates were assigned for each of the five parkways. Table 4 summarizes how each facility was assigned or mapped.

Table 3. Diversion Rates by Type, Availability of Alternatives and Toll Increase

Facility type	Frontage road availability	Nearby competing facility	Low toll increase	Medium toll increase	High toll increase
Urban interstate	Yes	Yes	24%	30%	36%
	Yes	No	16%	20%	24%
	No	Yes	20%	25%	30%
	No	No	12%	15%	18%
Rural interstate	Yes	Yes	28%	35%	42%
	Yes	No	20%	25%	30%
	No	Yes	24%	30%	36%
	No	No	16%	20%	24%
Urban freeway	Yes	Yes	28%	35%	42%
	Yes	No	20%	25%	30%
	No	Yes	24%	30%	36%
	No	No	16%	20%	24%
Rural freeway	Yes	Yes	32%	40%	48%
	Yes	No	24%	30%	36%
	No	Yes	28%	35%	42%
	No	No	20%	25%	30%

Source: Minnesota Department of Transportation, "Minnesota Tolling Study Report: Modern Tolling Practices and Policy Considerations," Appendix A: Diversion Rates (January 2018), https://www.dot.state.mn.us/newsrels/18/01/26toll.html

Table 4: Mapping NPS Facilities to Diversion Rates

Parkway	Facility type	Frontage road	Nearby alternative?	Low diversion	Medium diversion	High diversion
George Washington Memorial Parkway	Urban freeway	No	Yes, but alternatives are less available to the north than the south	24	30	36
Baltimore-Washington Parkway	Urban freeway	No	Yes, but the alternative is also congested and unreliable	24	30	36
Suitland Parkway*	Urban freeway	No	Yes, but the alternative is also congested and unreliable	24	30	36
Rock Creek and Potomac Parkway*	Urban freeway	No	Yes, but the alternative is also congested and unreliable	24	30	36
Blue Ridge Parkway	Rural freeway	No	No	20	25	30

* Freeway is the closest road category with a diversion rate to the two facilities, but segments are closer to major arteriesals.

Step 4: Apply the diversion percentage to obtain the revised volume of traffic

Based on the characteristics of the selected parkway corridor, the diversion percentage reported in Table 3 was applied to obtain the revised volume of traffic using the NPS facilities for each of the four toll rates selected: 4 cents (low), 8 cents (medium), 12 and 16 cents (high).

The estimate of the total revenue generated is calculated by applying the expected vehicle miles traveled by the per-mile rate to obtain the projected range of toll revenue for each of the five facilities assessed. Because it is unlikely a traveler will traverse the full length of the corridor, an assumption was made on the typical trip length.

Table 5 summarizes the physical length of each facility and the assumed trip length. With two exceptions, the assumed trip length was half the corridor on average in the absence of any travel market data. For the Rock Creek and Potomac Parkway, which is very short, a higher percentage of the total corridor was assumed. For the Blue Ridge Parkway, an average trip of three hours of scenic driving at 45 miles per hour (maximum speed) was assumed—135 miles.

Table 5: Assumptions on Typical Trip Length

Facility	Length (miles)	Assumed trip length (miles)
George Washington Memorial Parkway	15.1	7.5
Baltimore-Washington Parkway	29.0	14.5
Suitland Parkway	9.1	4.6
Rock Creek and Potomac Parkway	2.9	1.9
Blue Ridge Parkway	469.0	135.0

Step 5: Adjust revenue yield to account for cost of tolling operations

The toll selected for a roadway is composed of the fixed cost of processing transactions and a marginal cost for using the road. Other factors that may influence the cost of the road are whether the state provides a subsidy, operations and maintenance (O&M) costs, and any debt or capital costs borne by the system operator. O&M costs are influenced by the age and condition of the facility and whether it has a maintenance backlog or is in good repair when the toll is set.

The estimated transaction processing cost (10 cents for an electronic transaction) does not include the upfront capital cost of installing a system. This cost varies with each corridor according to its length, number of lanes, and volume of entrance and exit points. The larger the facility, the higher the upfront capital cost to transition to tolling.

The break-even cost varies across facilities, with the market served (long or short trips, diversion options), and the typical operating cost per transaction.[8]

Finally, because there is a cost to maintaining a toll operation, the total revenues estimated for each facility were adjusted for the estimated transaction cost, assumed to be 10 cents per transponder transaction.[9]

Sample Tolling Approach

Because of the interaction between toll rate, operating costs and travel patterns (average trip length), the toll rate needed to break even varies by facility. The following outlines a sample approach:

At 10 cents per transaction (setting aside other operating costs that vary with each facility and cannot be estimated here), $1,000 of cost translates into 10,000 transactions.

$1,000 / $0.10 = 10,000 transactions.

Based on 10,000 transactions, if each trip was 2.5 miles, the gross revenue from a 4-cent-per-mile toll would be $1,000; from an 8-cent-per-mile toll, $2,000; from a 12-cent-per-mile toll, $3,000; and from a 16-cent-per-mile toll, $4,000.

In this simple example, 4 cents is the break-even toll to cover the transaction cost, leaving nothing for additional operating costs. For example:

2.5 miles X $0.04 X
10,000 transactions or trips = $1,000.

If the trip was doubled to five miles, the toll needed to cover the transaction costs would drop because each trip would produce more revenue. For example:

5 miles X $0.02 X
10,000 transactions or trips = $1,000.

[8] Transaction cost is used here as a proxy for the marginal cost of the tolled operation, but there would be other operating costs, such as equipment maintenance and the administration. The larger the facility and the more access points, the higher the operating costs.

[9] Minnesota Department of Transportation, "Minnesota Tolling Study Report: Modern Tolling Practices and Policy Considerations" (January 2018), 61, https://www.dot.state.mn.us/newsrels/18/01/26toll.html. Video transactions would have a higher cost, around 35 cents, but this analysis assumes all transponder transactions for simplicity.

Section 3. Findings

The findings for each facility are summarized in Table 6. Results vary significantly across the facilities studied. The application of high diversion rates results in lower returns on tolls, while the application of a low diversion rate results in a higher return on applied tolls. Therefore, more revenue is collected for low diversion rates simply because fewer motorists divert to other routes (e.g., has a low diversion rate).

To facilitate comparison with the maintenance backlog estimates, they are restated here. The five facilities and their estimated maintenance backlog (in fiscal 2017 dollars, rounded to nearest hundred thousand)[10] are listed below.

George Washington Memorial Parkway	$167.0 million
Baltimore-Washington Memorial Parkway	$27.7 million
Suitland Parkway	$9.5 million
Rock Creek and Potomac Parkway	$4.1 million
Blue Ridge Parkway	$325.1 million

[10] Amounts obtained from NPS fiscal 2017 asset inventory data.

Table 6: Sketch Planning Revenue Estimates (annual)

Facility	Toll rate per mile	Average toll[a]	Low range of net revenue estimate, 2018	High range of net revenue estimate, 2018	Low range of net revenue estimate, 2038	High range of net revenue estimate, 2038	Flat $1/vehicle (utilizing medium diversion)	Flat $3/vehicle (utilizing medium diversion)
George Washington Memorial Parkway	4 cents	$0.30	$2,154,000	$2,558,000	—	—	$10,507,139	$33,856,338
	8 cents	$0.60	$5,375,000	$6,383,000	—	—		
	12 cents	$0.90	$8,597,000	$10,209,000	—	—		
	16 cents	$1.20	$11,818,000	$14,034,000	—	—		
Baltimore-Washington Parkway	4 cents	$0.58	$13,455,000	$15,978,000	—	—	$27,594,000	$88,914,000
	8 cents	$1.16	$29,714,000	$35,285,000	—	—		
	12 cents	$1.74	$45,972,000	$54,592,000	—	—		
	16 cents	$2.32	$62,231,000	$73,899,000	—	—		
Suitland Parkway	4 cents	$0.18	$882,000	$1,048,000	—	—	$10,590,939	$34,126,357
	8 cents	$0.37	$2,840,000	$3,373,000	—	—		
	12 cents	$0.55	$4,799,000	$5,698,000	—	—		
	16 cents	$0.74	$6,757,000	$8,024,000	—	—		
Rock Creek and Potomac Parkway	4 cents[b]	$0.08	$(142,000)	$(169,000)	—	—	$6,195,398	$19,962,950
	8 cents	$0.15	$345,000	$409,000	—	—		
	12 cents	$0.23	$832,000	$988,000	—	—		
	16 cents	$0.30	$1,319,000	$1,566,000	—	—		
Blue Ridge Parkway	4 cents	$5.40	$2,396,000	$2,738,000	$2,923,033	$3,340,610	$435,849	$1,404,403
	8 cents	$10.80	$4,836,000	$5,527,000	$5,901,218	$6,744,249		
	12 cents	$16.20	$7,277,000	$8,317,000	$8,879,403	$10,147,889		
	16 cents	$20.25	$9,718,000	$11,106,000	$11,857,588	$13,551,529		

[a] The average toll amount is calculated from the assumed trip length presented in Table 5 multiplied by the per-mile toll rate listed in column 2 of this table (rounded up to the nearest penny).

[b] It is initially surprising that the Rock Creek and Potomac Parkway loses more money under the high net revenue scenario than the low net revenue scenario at the 4-, 8-, and 12-cent-per-mile toll estimates. The greater loss is driven by the higher diversion rate. Given a typical trip length of 1.9 miles, a 4-cent toll produces 7.6 cents in revenue, but the transaction costs 10 cents. Every trip loses the facility 2.4 cents. Under the high net revenue scenario, there are more trips because the assumed rate of diversion is low. Thus, there are more money-losing transactions than under the low net revenue scenario.

Initial conclusions

The range of revenues reported in Table 6 support some initial conclusions about the feasibility of implementing tolls to address the NPS maintenance backlog for road facilities.

- Some facilities are much better candidates than others. Given heavy existing traffic volumes, the Baltimore-Washington Parkway is the leading candidate in terms of revenue potential, followed by the George Washington Parkway and Suitland Parkway.

- By contrast, Rock Creek and Potomac Parkway and the Blue Ridge Parkway are less promising in terms of revenue potential and would face greater implementation challenges. The short length of the Rock Creek and Potomac Parkway, and its integration with the larger District of Columbia roadway network, limit the revenue potential unless a high per-mile toll was charged. The large number of alternative routes to evade the toll suggests a high diversion rate, spilling over onto District streets and contributing to urban congestion. On the other hand, the low traffic volumes and extensive length of the Blue Ridge Parkway limit its potential as a tolled facility. While the parkway yields positive revenue under the tolled scenarios, the capital cost of converting the facility could be substantial given multiple access points and the technical difficulty of maintaining access to the many free public natural areas along the route.

- Two of the highest net revenue yields are estimated on urban commuter highways with few quality alternatives—the Baltimore-Washington Parkway and the George Washington Parkway. For example, while Interstate 95 is a natural alternative to the Baltimore-Washington Parkway, it, too, is frequently congested, making it a risky route to avoid tolls. At 16 cents per mile, both facilities would generate roughly $10 million or more per year, with the Baltimore-Washington Parkway generating $62 million to $73 million, depending on the rate of diversion applied.

- The lowest net revenue yields would be expected on the Rock Creek and Potomac Parkway, where the shortness of the road limits the vehicle miles traveled that can be charged. To make a toll feasible, the cost would have to be at least 16 cents per mile or 30 cents for the assumed length. In fact, at a rate of 4 cents per mile, the cost of the transaction (10 cents) would exceed the toll revenue collected. Given the short length of the parkway, a flat rate of $1 or $3 would be more feasible.

- Because of its length and the number of access points, the Blue Ridge Parkway would be difficult and costly to convert to a tolled facility, an alternative approach was considered: a flat $1 and $3 charge to drive on the facility for any length of trip. This approach yielded comparable sums in several of the corridors. A $1 to $3 toll was selected because it is easy to pay and a relatively modest sum.

- Finally, each of the corridors was assessed for capacity to accommodate future growth. However, all but the Blue Ridge Parkway are at or close to their capacity for most of the day, limiting their prospects for growth without additional investment. Only the Blue Ridge Parkway had clear capacity for growth given its largely rural setting. A 1 percent annual growth rate was applied to the 2018 value to assess how revenues for this roadway might change over time and projecta 2038 estimate. A 1 percent rate was chosen because the area is largely rural with a slower rate of population growth than the national average and because the cumulative average five-year growth rate across all segments for which traffic volumes are reported is just under 0.9 percent.

Estimated revenue and deferred maintenance backlog

Table 7 develops an illustrative comparison between the revenue estimates and the backlog estimates for each facility. Because of the number of toll scenarios estimated, not all can be applied in the table. The illustration in the table applied the flat $1-per-trip fee and the high revenue range of the 16-cent-per-mile toll. The illustration thus avoids evaluating feasibility by considering the top range of tolls considered.

Although full system operating costs are not known, the revenue estimates are adjusted down by 20 percent to avoid overestimating the revenue that could be available to address the maintenance backlog. The illustration shows that even with these assumptions, the Baltimore-Washington Parkway, the Suitland Parkway, and the Rock Creek and Potomac Parkway could eliminate their backlogs in 15 years or less, not taking into account accruing repairs during that period. Bonding against the revenue stream, raising the toll or cross-subsidizing facilities could accelerate this timeline.

Finally, if the NPS elects to transfer any of its strongest revenue-generating facilities to another owner that will toll the facility, NPS should recognize the value of its assets and negotiate an ongoing share of the revenue stream as part of the transfer. The simple elimination of a facility's maintenance backlog and ongoing responsibility for its operation significantly understates the long-term value of some of NPS's facilities when user fees are applied.

Across the five facilities assessed, the Baltimore-Washington Parkway is the standout in terms of revenue potential. This is also the corridor currently under consideration for transfer to the Maryland DOT for tolling. The revenues estimated here consider each facility as a stand-alone facility. Were the Baltimore-Washington Parkway to be evaluated as part of a larger system of tolled roads across the District, Maryland and Virginia, the revenues would likely rise. For example, Fitch Ratings reports that the healthiest (highest-rated) toll roads are those that "are generally part of the large network subset, usually benefitting from a relatively wide geographic footprint and diversified journeys by start and end points as well as journey type (e.g. commuter, commercial and leisure). They will typically have low or moderate current toll rates and be considered to have ample legal, economic and political ratemaking flexibility to counteract potential demand contractions in the future."[11]

Although developed on a conceptual level, the findings described here indicate that a user fee approach merits additional study as a means to address the NPS maintenance backlog for several facilities. Moreover, if the parkways were converted to tolled facilities, it would benefit NPS to retain an interest in the facilities as several of them have the potential to generate revenues beyond those needed to address the facility's own backlog.

[11] Fitch Ratings, "Peer Review of U.S. Toll Roads: Attribute Assessments, Metrics and Ratings" (September 2017), 3.

Table 7: Comparison of Revenue Estimates with Maintenance Backlog Estimates by Facility

Facility	12 cents/mile high range annual revenue	$1 flat fee annual revenue	12 cents/mile high range, reduced by 20% for operating costs	$1 flat fee, reduced by 20% for operating costs	15 years @ 12 cents/mile high range reduced by 20% for operating costs	15 years @ $1 flat fee reduced by 20% for operating costs	2017 maintenance backlog	Comments
George Washington Memorial Parkway	$10.2 million	$10.5 million	$8.2 million	$8.4 million	$122.5 million	$126.1 million	$167 million	Both the fee and the rate approach could address more than half of the road portion of the backlog in 15 years.[a]
Baltimore-Washington Parkway	$54.6 million	$27.6 million	$43.7 million	$22 million	$655.1 million	$331 million	$27.7 million	The 12-cent-per-mile toll would generate excess revenue to exceed the estimated backlog in 15 years.[a] This illustrates that this parkway is a valuable NPS asset, and tolling is an approach worth studying further.
Suitland Parkway	$5.7 million	$10.6 million	$4.6 million	$8.5 million	$68.4 million	$127.1 million	$9.5 million	Both the per mile and flat fee approaches could address the estimated backlog within a few years, generating excess revenue in the other years.

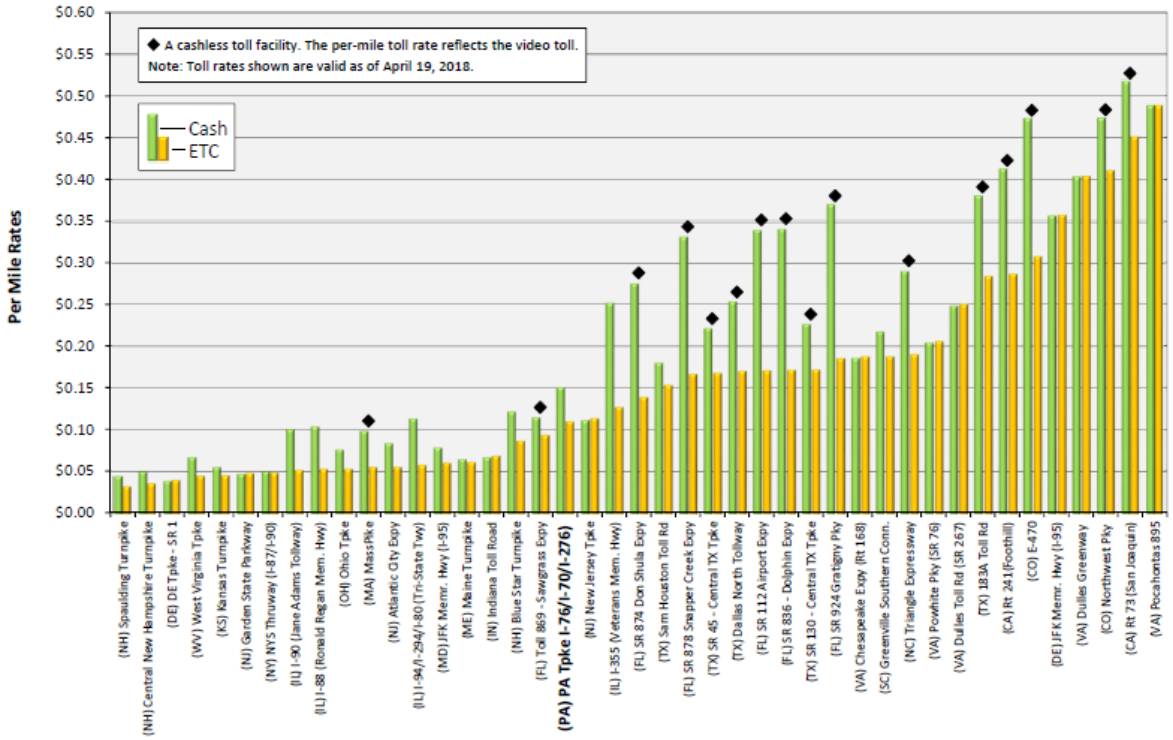
Rock Creek and Potomac Parkway	$990,000	$6.2 million	$790,000	$5 million	$11.9 million	$74.3 million	$4.1 million	A flat fee for use could address the backlog, but implementation is challenging given the length of the roadway and the existence of competing routes, as described in the narrative.
Blue Ridge Parkway	$8.3 million	$440,000	$6.7 million	$350,000	$99.8 million	$5.2 million	$325.1 million	Not a good candidate for a per mile user fee but could be a candidate for a modest flat fee.

[a] Estimates not adjusted for net present value.

Exhibit A. Range of Toll Rates in the U.S.

The range of toll-per-mile rates collected across all U.S. toll facilities, when all toll facilities are considered, is illustrated below. The range of rates is greatest when tolls owned and operated by a private concessionaire are considered.
Based on these rates, the potential toll rates identified for the NPS parkways included in this report are consistently within the lower and upper ranges.

Comparison of 2018 Passenger Car per-Mile Through-Trip Toll Rates



Source: Pennsylvania Turnpike Commission, “Pennsylvania Turnpike 2018 Traffic and Revenue Forecast Study” (April 2018), https://www.paturnpike.com/pdfs/business/documents/PTC_2018_Traffic_&_Revenue_Study_4202018.pdf.

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