FEASIBILITY OF INTERSTATE TOLLING

Traffic and Revenue Summary Document

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Prepared for:
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PREFACE

This Traffic and Revenue Summary Document provides information related to the estimation of traffic and revenue for tolling Wisconsin's Interstates. HNTB and Stantec prepared the document in response to WisDOT project #0900-04-025, addressing the feasibility of state-sponsored Interstate tolling. This document, in conjunction with other analyses, is intended to partially fulfill the requirements of the Transportation Fund Solvency Study as outlined in Section 9145 (5f), 2015 Wisconsin Act 55. Stantec, as a sub-consultant to HNTB, is responsible for the methodology, modeling, and results of the traffic and revenue analysis.

This summary of the study's traffic and revenue modeling is one of the three main deliverables of WisDOT's Interstate Tolling Feasibility Study. The other deliverables include a Tolling Resource Guide and Policy Considerations document. Traffic and revenue analyses typically have three levels of effort based on the complexity and sophistication of the evaluation. The traffic and revenue analysis for this study represents an initial Level 1 type of study for the State's entire Interstate system, which provides an order of magnitude analysis comparing multiple Interstate corridors. Traffic and revenue estimates presented in this report should not be construed to represent a detailed Level 2 evaluation or a comprehensive, Level 3 investment grade toll study. Actual toll implementation would require these more detailed investment grade analyses.

Stantec modeled Wisconsin's entire 875-mile Interstate system estimating traffic and tolling revenue from years 2020 to 2050. Stantec used existing WisDOT and Southeastern Wisconsin Regional Planning Commission (SEWRPC) travel model datasets to create one statewide tolling model for this study. Stantec calibrated the tolling model to mimic actual traffic volumes and speeds on the Wisconsin roadway network. Stantec developed traffic and revenue estimates based on accepted industry best practices and processes. Many variables affect actual traffic and revenue for a tolled roadway including fuel prices, personal income, economic growth, efficiency of competing routes, and land use changes. As a result, traffic and revenue estimates change over time. The estimates in this report represent a snapshot view using the latest available information to estimate traffic and revenue for a 31-year time period at a level of detail consistent with a Level 1 study. Appendix A provides the details of Stantec's traffic and revenue analysis.

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1. EXECUTIVE SUMMARY

WisDOT commissioned a study to evaluate the feasibility of tolling the Interstate highway system throughout the state of Wisconsin. For reporting purposes, the study team organized the 875 miles of Wisconsin Interstates into eleven analysis corridors, as shown in Figure 1-1, with the exception of I-535 from Duluth, MN to Superior, WI which was eliminated from this study. Generally, each corridor spans from system interchange to system interchange or major city to major city. Urban portions of corridors leading into and out of the Milwaukee metropolitan region together represent the Metro Milwaukee Corridor.

If Wisconsin were to toll the entire Interstate system for the 31-year period from 2020 through 2050, the study team estimates tolling could generate between $18B and $46B (in 2016 dollars) gross revenue and between $14B and $41B in net revenue depending upon the chosen toll rate as shown in Table 1-1. The upfront capital costs to implement tolling on Wisconsin's Interstates would range between $350M - $400M. In general, the highest Interstate traffic volumes are in the southern portion of Wisconsin. The study estimates 49% of tolling revenue would be from southern Interstate routes leading into and out of Milwaukee and Madison on roads that represent just 37% of the Interstate roadway mileage.

Tolling the Wisconsin Interstate System would cause some drivers to divert to alternate, non-tolled routes. Depending upon the corridor and chosen toll rate, vehicle diversion estimates range from 9% to 51% with truck diversion being slightly higher than passenger vehicle diversion. Much of the diversion consists of short trips ten miles or less where drivers elect to remain on the local road network rather than paying a toll for a short Interstate trip.

The study team also forecasted the annual costs associated with maintaining the tolling infrastructure and operating a toll system to generate a net revenue forecast. Net revenue estimates depend on corridor specific operation and maintenance requirements but are generally 40% - 95% of gross revenue. Corridors with closely spaced interchanges, as in Milwaukee County, have higher upfront capital costs and lower net revenue estimates as a percentage of gross revenue due to a significantly higher amount of toll transactions to manage.

The study assumes toll rates remain constant over the 31-year modeling period and that traffic volumes increase annually. The study's annual revenue estimates increase over time as traffic volumes increase and tollway usage "ramps up" during the period of time when drivers increase their transponder usage and lose hesitation with using the toll system. Table 1-2 shows revenue growth in 10-year increments over the 31-year study period.

Table 1-1: Years 2020 – 2050 Interstate System Revenue Estimates, Phase I

	4 cents per mile	8 cents per mile	12 cents per mile
Gross Revenue Estimate Years 2020 – 2050 (billions)	$18	$34	$46
Range of 2020 Diversion (Reduction of VMT)	9%-22%	16%-36%	25% - 51%
Net Revenue Estimate (billions)	$14	$29	$41

Table 1-2: 10 Year Interstate Gross Revenue Growth Estimates, Phase I

	4 cents per mile	8 cents per mile	12 cents per mile
Gross Revenue Estimate Years 2020 – 2030 (billions)*	$5.6	$9.9	$12.4
Gross Revenue Estimate Years 2031 – 2040 (billions)	$6.0	$11.2	$15.2
Gross Revenue Estimate Years 2041 – 2050 (billions)	$6.7	$13.1	$18.7

* 11 years included for this time period to account for the “ramping up” of tollway usage over the first 3-4 years after opening

Federal tolling programs related to Interstates currently allow state departments of transportation to convert high-occupancy vehicle (HOV) lanes to high-occupancy toll (HOT) lanes and to toll existing bridges and tunnels that have been reconstructed. The Interstate System Reconstruction and Rehabilitation Pilot Program (ISRRPP) was created by the Transportation Equity Act for the 21st Century (TEA-21) in June, 1998 and allows tolls to be implemented on three reconstructed Interstate facilities across the United States. The states that originally applied for and received the three available slots have not yet moved forward under the ISRRPP program. In December, 2015 the Fixing America’s Surface Transportation Act (FAST Act) made changes to the program that will open the three slots to new applicants if the original states do not meet the new requirements of the program. As a result of these and other expected changes, the number of state departments of transportation that have tolling operations is expected to expand in the coming decades as state departments of transportation consider other possible funding options. Tolling is one of several funding options available to help support the construction, maintenance, and operating costs of providing a safe and efficient roadway network to meet Wisconsin’s current and future surface transportation needs. As with other funding options, a thorough analysis of the policy and legal framework under which tolling would operate is necessary before implementation may begin. Implementing a tolling system without careful consideration of these issues could potentially result in legal challenges that may lead to costly project delays or adverse legal judgments that may impact the State’s ability to enforce toll payment.

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Figure 1-1: Wisconsin Interstate Analysis Corridors

2. REVENUE AND FEASIBILITY ANALYSIS

2.1 Estimating Traffic and Revenue

The purpose of the traffic and revenue forecasting process is to develop a methodology sufficient to provide estimates consistent with a preliminary feasibility evaluation of converting portions of Wisconsin's Interstate roadway network to a network of tolled facilities. The analysis is meant to be illustrative in nature and provide a typology of sorts of possible outcomes through the implementation of tolls. Thus, the forecasting process is a Level 1 traffic and revenue analysis that generates order-of-magnitude forecasts suitable for screening analyses and preliminary financial feasibility evaluations. While many Level 1 studies utilize a simplistic spreadsheet-based approach, this study relied on travel demand model traffic forecasts for the entire state. These models provided a platform to conduct the traffic analysis that considered routes for traffic to divert to. The study team merged four travel demand models representing the urbanized areas of Southeast Wisconsin, Northeast Wisconsin, Dane County, and Rock County with the model data of the Wisconsin statewide travel demand model as shown in Figure 2-1. This merged travel demand model formed the basis of all traffic and revenue estimates for this study.

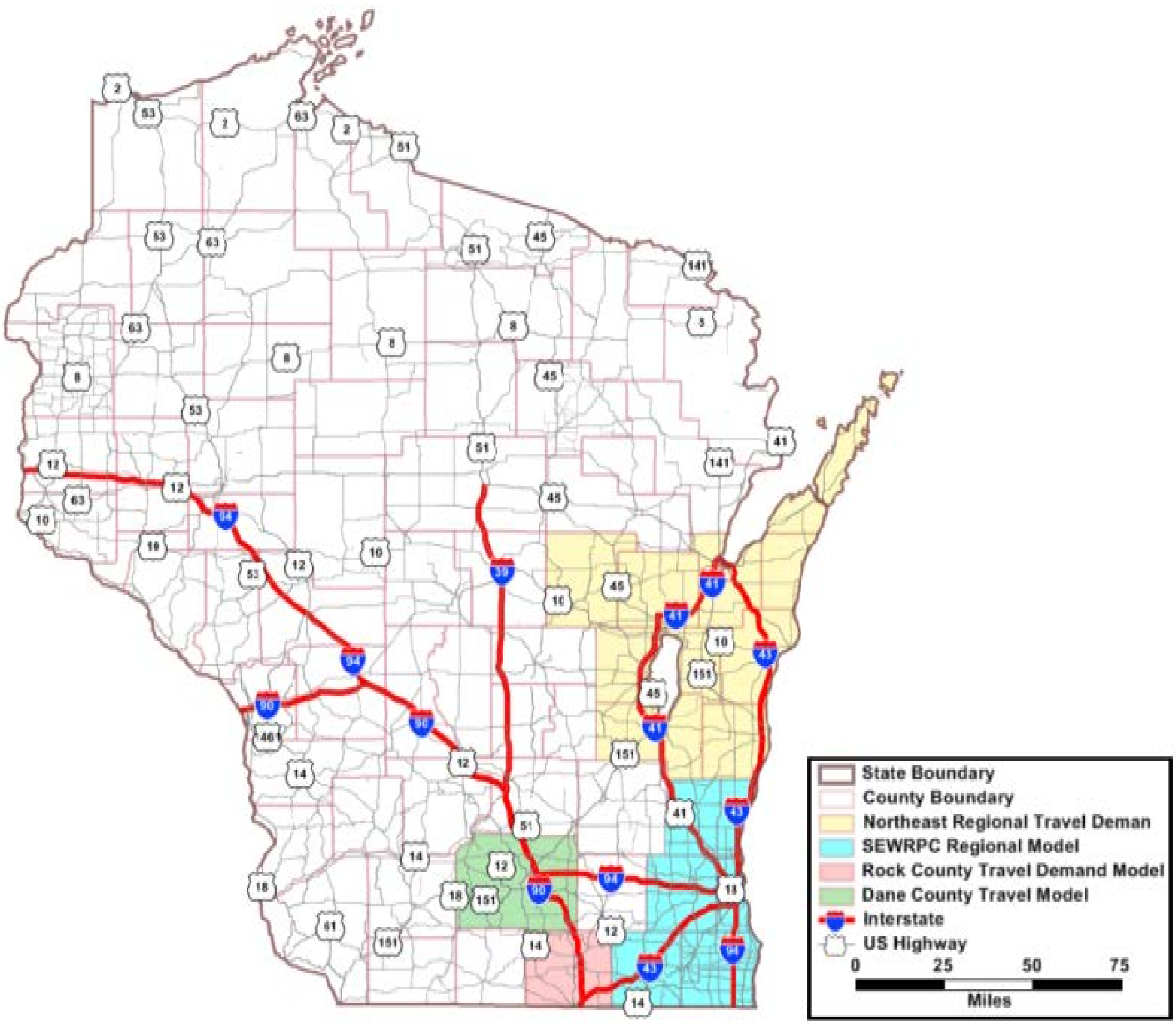
The travel demand model includes both transportation network and socio-economic data including housing and employment totals by geographic area. The model also includes data about anticipated changes in the transportation network and socio-economic data. Regarding the transportation network, the future model networks include only enumerated (funded for construction) future major and mega WisDOT transportation improvements (see Table 15 of Appendix A). This approach avoids assuming increased Interstate system capacity and subsequent toll revenue resulting from potential expansion projects that do not currently have committed construction funds. The future-year (2020 and 2040) travel demand model sets also incorporate previously developed independent traffic forecasts on the Interstate system. This provides a set of non-tolled demand volumes that are consistent with previously developed traffic forecasts.

After the travel demand model has been run, it identifies the route, or series of routes, through the roadway system for which the user pays the lowest overall cost to complete their trip from point A to point B. With the implementation of tolls, the dollar value of tolls, and the value of the travel time are converted to similar units, which is the value of time[1], expressed in dollars per hour. This programs the model to identify the portion of trips that will elect to use the tolled route as well as those trips diverting to the non-tolled roadways. The value of time varies depending on the purpose of the trip and the county from which the trip originates. Appendix A, pages 16 and 17, includes additional information regarding the value of time and median income by County.

The study team reviewed toll costs from various national existing toll facilities to develop the conceptual study toll rates. Toll rates nationally generally range from three cents per mile to twelve cents per mile for All Electronic Tolling (AET). This study assumes an AET system for all Wisconsin Interstate routes without cash collection in the lane.

[1] The value of time is generally defined as the opportunity cost of the time a motorist spends on his/her trip

Figure 2-1: Travel Demand Model Sources



The study team conducted the traffic and revenue analysis in two phases. Phase I assumed tolling implementation on all Interstate facilities across the state of Wisconsin, except on I-535 from Duluth, MN to Superior, WI. Phase I also assumed the tolling purely on a per mile basis, which is not practical for actual implementation, but provides a basis for evaluating long-distance corridors relative to one other. The study also considered multi-axle charge rates, which is the multiple that commercial trucks pay relative to passenger vehicles, and free passage at the state borders in the phase I analysis. Phase I modeling tested three toll rates, with gross revenue results in 2016 dollars shown for each corridor in Table 2-1.

Table 2-1: Phase I Gross Revenue Estimates by Corridor

	Gross Revenue ($M in 2016 dollars)		
	4 cents per mile	8 cents per mile	12 cents per mile
Corridor	2020 - 2050 Total Revenue		
Northwest 1	$89 / $3,670	$144 / $6,831	$147 / $8,905
Northwest 2	$12 / $505	$20 / $921	$22 / $1,188
North Central	$22 / $1,005	$37 / $1,851	$42 / $2,467
Northeast 1	$69 / $2,971	$119 / $5,512	$142 / $7,445
Northeast 2	$33 / $1,402	$54 / $2,557	$61 / $3,356
Central	$27 /$1,178	$42 /$ 2,174	$44 / $2,846
South Central	$28 / $1,217	$46 / $2,262	$49 / $2,967
Southeast 1	$14 / $624	$24 / $1,125	$27 /$1,486
Southeast 2	$13 / $601	$23 / $1,101	$26 / $1,469
Metro Milwaukee	$101 / $4,132	$186 / $7,983	$247 / $11,493
South Milwaukee	$23 / $1,021	$41 / $1,931	$52 / $2,696

Stantec performed a Level 1, phase II analysis to illustrate the process and impacts of selecting potential tolling locations and rates on specific corridors and evaluating the results against the broader phase I evaluation. The phase II corridors do not represent routes demonstrating higher feasibility or higher likelihood for implementation, but rather represent corridors with more complex operational considerations. The phase II analysis refined the tolling plans for three selected corridors (Metro Milwaukee, South Milwaukee/I-94 N-S from the Illinois state line to Seven Mile Road, and I-90 from Beloit to Tomah) by implementing specific toll collection points within each corridor. These corridors provide additional information on how the placement of tolling zones may affect traffic diversion.

Many assumptions have been made for the phase II analysis to convey the complexity of system-level decisions. The more detailed phase II tolling plans allow for the modeling of a completely “closed” system in which all users pay a toll as well as a “partially open” system that allows some free movements. Two of the corridors, I-90 and South Milwaukee, included both a closed and partially open tolling plan analysis while Metro Milwaukee included only a partially open system analysis due to dense interchange spacing. In highly urbanized areas where distances between interchanges are very small, closed tolling systems are not feasible because constructing so many toll zones is cost prohibitive. Table 2-2 below displays gross revenue in 2016 dollars estimated from the phase II revenue modeling.

Separating truck traffic and automobile users is a common practice in tolling analysis. Table 2-3 shows diversion rates for auto and truck users separately by corridor. Note that truck diversion is greater than autos in both the South Milwaukee and Metro Milwaukee corridors, where convenient non-tolled routes are located closer to the toll facilities.

Table 2-2: Phase II Gross Revenue Estimates

Corridor	2020-2050 Gross Revenue ($M in 2016 dollars)			
	4 cents per mile Closed	4 cents per mile Partially Open	6 cents per mile Closed	6 cents per mile Partially Open
I-90	$4,047	$3,461	$5,353	$4,535
South Milwaukee	$1,311	$1,187	$1,771	$1,610
Metro Milwaukee	$6,195		$7,222	

Table 2-3: Phase II Auto and Truck Diversions by Corridor

	Diversion from No Toll Condition (%)-Year 2020			
	4 cents per mile Closed	4 cents per mile Partially Open	6 cents per mile Closed	6 cents per mile Partially Open
Corridor	Auto/Truck	Auto/Truck	Auto/Truck	Auto/Truck
I-90	37% / 32%	31% / 30%	42% / 40%	36% / 40%
South Milwaukee	34% / 41%	31% / 40%	38% / 46%	35% / 44%
Metro Milwaukee	24% / 36%		26% / 40%	

2.2 Net Revenue Results

Net revenue accounts for the costs to maintain and operate the tolling infrastructure. The net revenue forecast is calculated by subtracting the operating, maintenance, and lifecycle costs of the toll system from gross revenues. Toll implementation also requires upfront tolling capital costs including purchasing and installing the toll equipment and establishing a back office to process transactions and provide customer service. The upfront capital costs to toll Wisconsin's Interstates are not annualized and thus are not reflected in the net revenue estimates. Corridor length and the number of tolling points on the roadway affect upfront and ongoing capital costs. Net revenue estimates in this study are dependent upon the assumptions made during this study and industry accepted sketch level operational, maintenance, and lifecycle costs. Table 2-4 and Table 2-5 below summarize the net revenue results in 2016 dollars for the phase I and phase II modeling for the first year of tolling and the total 31-year time period.

Table 2-4: Phase I Net Revenue Estimates

Corridor	Phase I Modeling Net Revenue - $M in 2016 dollars (year 1 / 2020-2050)		
	4 cents per mile	8 cents per mile	12 cents per mile
Northwest 1	$77 / $3,324	$135 / $6,516	$140 /$ 8,628
Northwest 2	$10 / $434	$17 / $856	$21 / $1,129
North Central	$16 / $812	$32 /$ 1,674	$38 / $2,308
Northeast 1	$48 / $2,205	$92 / $4,622	$121 /$ 6,644
Northeast 2	$23 / $1,083	$46 /$ 2,271	$55 / $3,107
Central	$21 / $991	$38 / $2,003	$41 / $2,694
South Central	$23 / $1,054	$42 /$ 2,113	$46 / $2,837
Southeast 1	$12 / $537	$21 /$ 1,047	$26 /$ 1,418
Southeast 2	$10 / $500	$20 / $1,009	$24 / $1,388
Metro Milwaukee	$40 / $2,146	$102 /$ 5,335	$211 / $8,958
South Milwaukee	$16 / $772	$31 / $1,598	$48 / $2,389

Table 2-5: Phase II Net Revenue Estimates

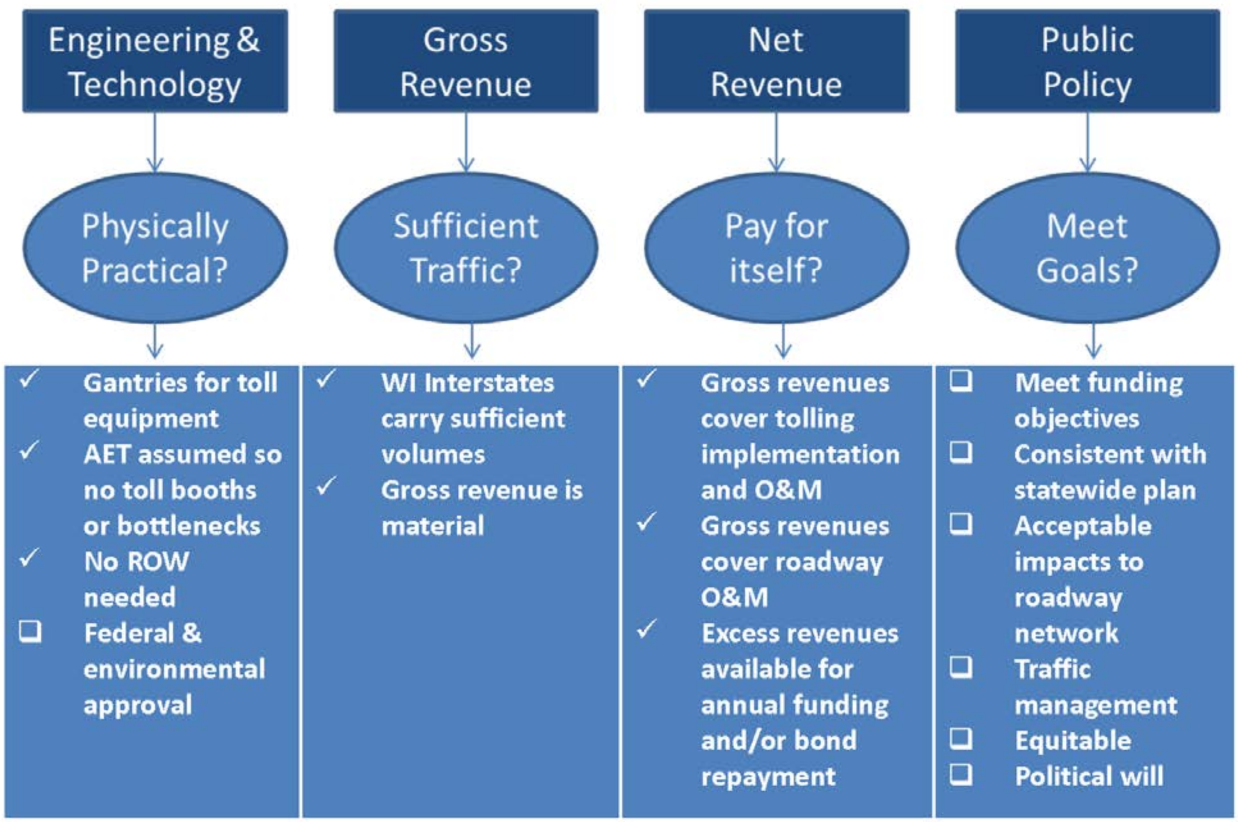
Corridor	Phase II Modeling Net Revenue - $M in 2016 dollars (year 1 / 2020-2050)			
	4 cents per mile Closed	4 cents per mile Open	6 cents per mile Closed	6 cents per mile Open
I-90	$70 / $3,164	$63 / $2,833	$101 / $4,524	$88 / $3,957
South Milwaukee	$21 / $961	$14 / $745	$32 / $1,440	$24 / $1,190
Metro Milwaukee	$54/$3,345		$79/$4,448	

2.3 Financial Feasibility

Toll facilities have a long and successful history of operating in the United States. Recent technological advances such as the advent of AET have allowed for toll implementation on a variety of different facility types, which would not have been feasible in a cash collection environment. *Feasibility* has different meanings for every tolled facility but, at minimum, it requires the gross revenues to exceed the cost to collect the toll revenue. Once this minimum requirement is met, policy makers have the option to decide if the net revenue collections, and all other factors involved, warrant implementing tolling. Since every toll facility is unique and serves distinct users, a variety of factors should be evaluated based on the goals and operating characteristics of the roadway. For example, with the emergence of managed lanes, tolling as a traffic management tool is another factor to consider along with revenue generation. Figure 2-2 illustrates the major components of toll feasibility and provides comments on the applicability to Wisconsin's Interstate system.

This evaluation did not quantify the roadway operations and maintenance (O&M) costs on the Interstates or competing routes. This analysis also did not consider ongoing implementation of projects and any possible scenarios for allocations of programs or funds. HNTB utilized Stantec's gross toll revenue forecast to develop a tolling O&M cost forecast and the resulting net revenue forecast. Each corridor has positive net revenue. On its surface, this analysis was very basic in nature to capture the requirements of phase I and phase II while being able to access feasibility independent of interdependent system goals. While the minimum engineering and revenue feasibility tests are important, a myriad of additional qualitative factors ultimately affects tolling feasibility for a given corridor. Table 2-4 and Table 2-5 above summarize the net revenue potential for each corridor.

Figure 2-2: Components of Tolling Feasibility*



*checkmarks indicate feasible components as determined through the study, boxes unchecked are components which need further analysis and/or action

3. CORRIDOR MAPS AND REVENUE RESULTS

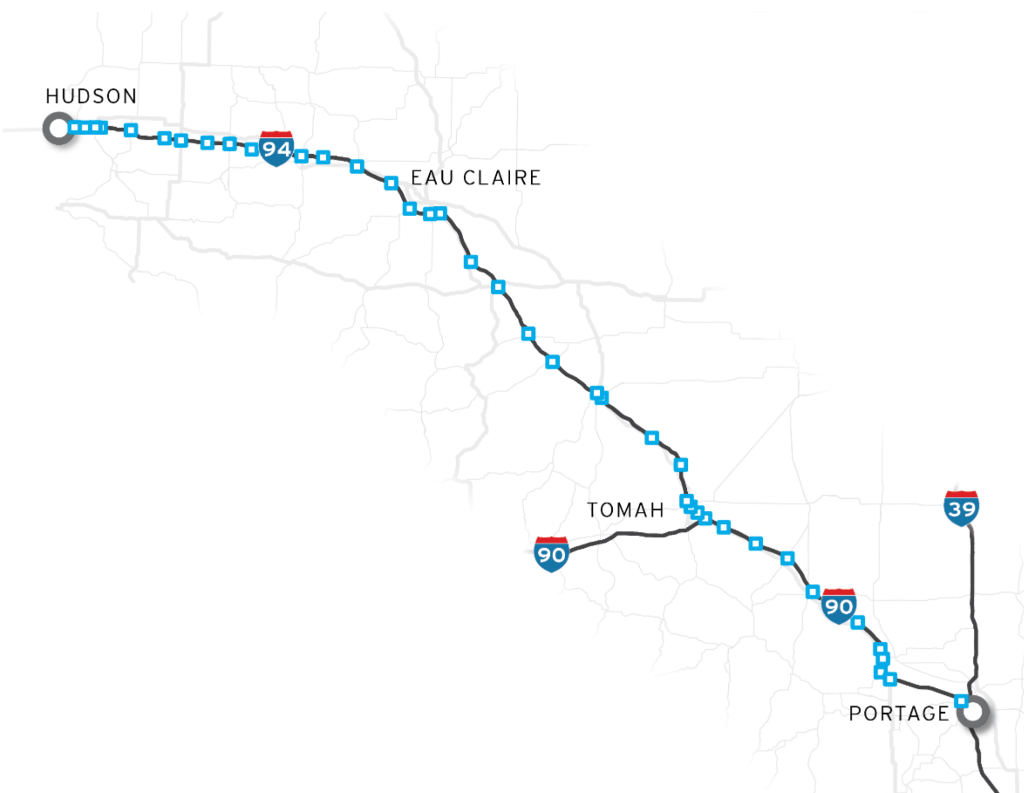
3.1 Northwest 1: I-94 Hudson to Portage

NW 1

I-94 HUDSON TO PORTAGE

208 MILES	2,228 MILLION ANNUAL VEHICLE MILES TRAVELED
39 INTERCHANGES	5.3 MILES PER INTERCHANGE

Interchange location



TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile	3,670	3,324	17.0%
8 cents/mile	6,831	6,516	26.0%
12 cents/mile	8,905	8,628	37.9%

3.2 Northwest 2: I-90 La Crosse to Tomah

NW 2

I-94 LACROSSE TO TOMAH

45 MILES	342 MILLION ANNUAL VEHICLE MILES TRAVELED
10 INTERCHANGES	4.5 MILES PER INTERCHANGE

Interchange location

TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile	505	434	18.0%
8 cents/mile	921	856	27.1%
12 cents/mile	1,188	1,129	37.0%

3.3 North Central: I-39 Portage to Wausau

NC

I-39 PORTAGE TO WAUSAU

111
MILES

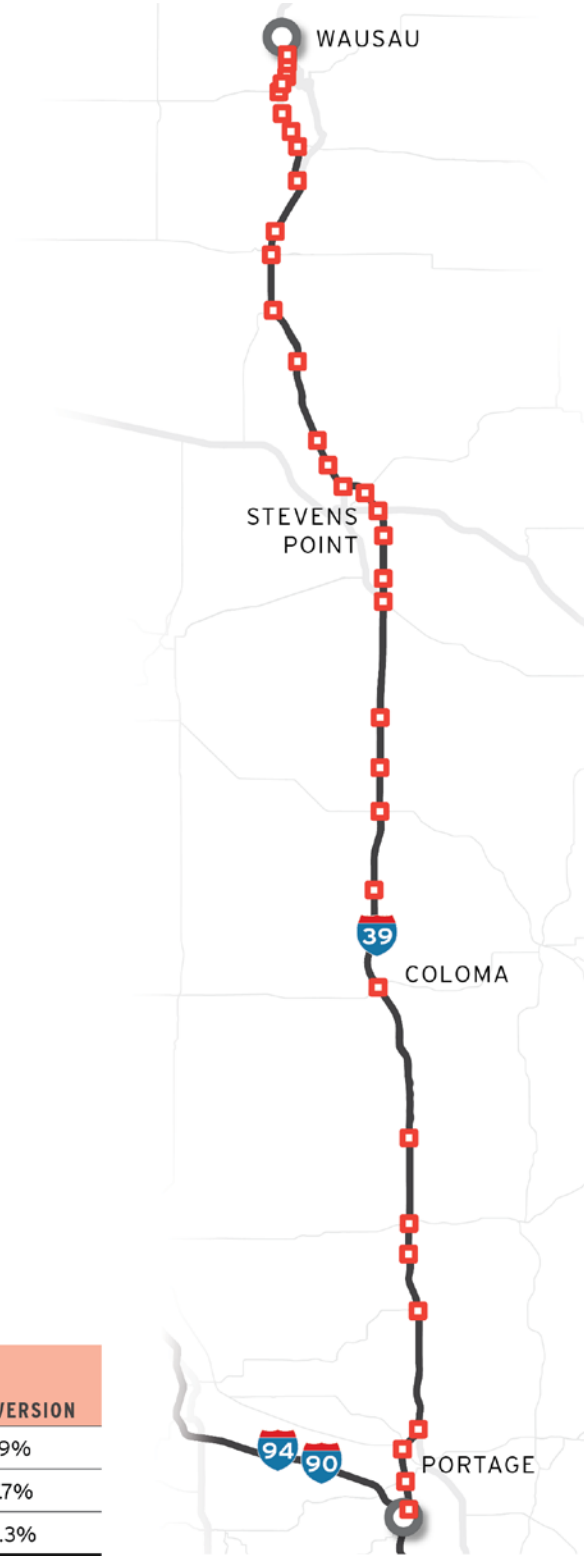
775 MILLION
ANNUAL VEHICLE MILES TRAVELED

34
INTERCHANGES

3.3 MILES
PER INTERCHANGE

Interchange location

Number of interchanges within close proximity to one another



TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile	1,005	812	16.9%
8 cents/mile	1,851	1,674	25.7%
12 cents/mile	2,467	2,308	36.3%

3.4 Northeast 1: I-41 Germantown to Green Bay

NE 1

I-41 GERMANTOWN TO GREEN BAY

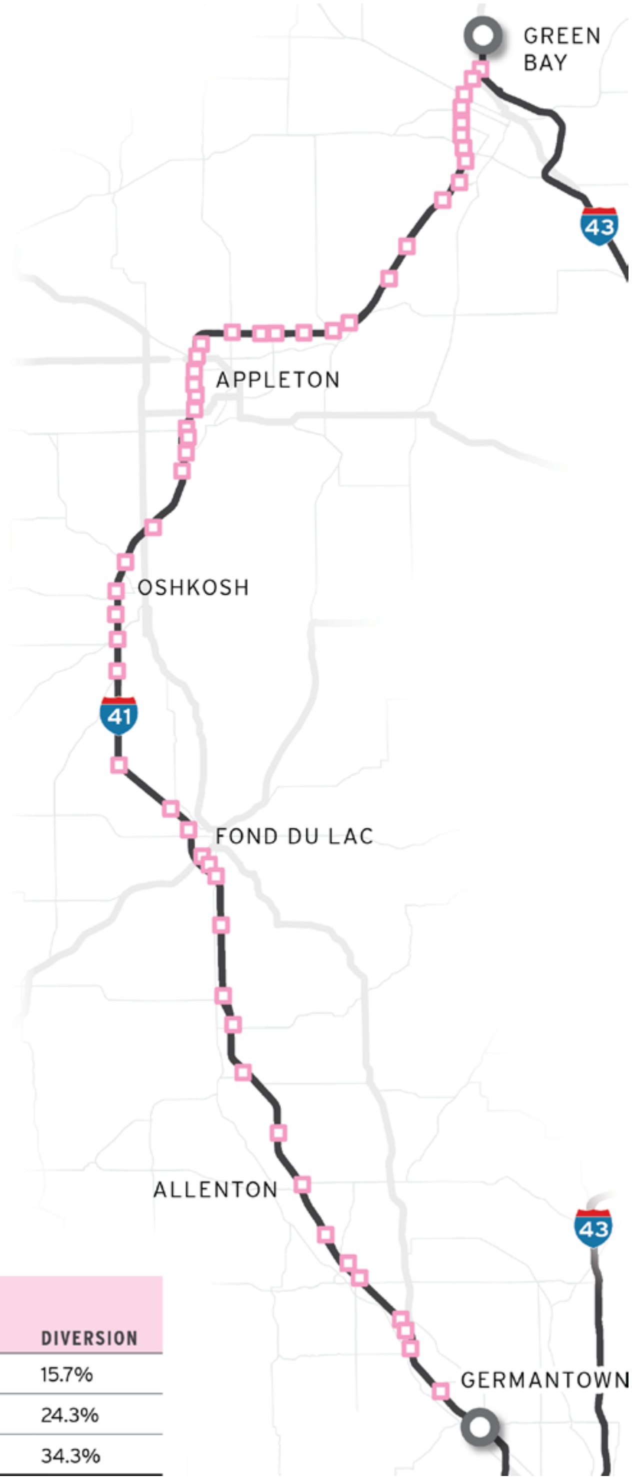
119
MILES

2,078 MILLION
ANNUAL VEHICLE MILES TRAVELED

53
INTERCHANGES

2.2 MILES
PER INTERCHANGE

Interchange location



TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile	2,971	2,205	15.7%
8 cents/mile	5,512	4,622	24.3%
12 cents/mile	7,445	6,644	34.3%

3.5 Northeast 2: I-43 Mequon to Green Bay

NE 2

I-43 MEQUON TO GREEN BAY

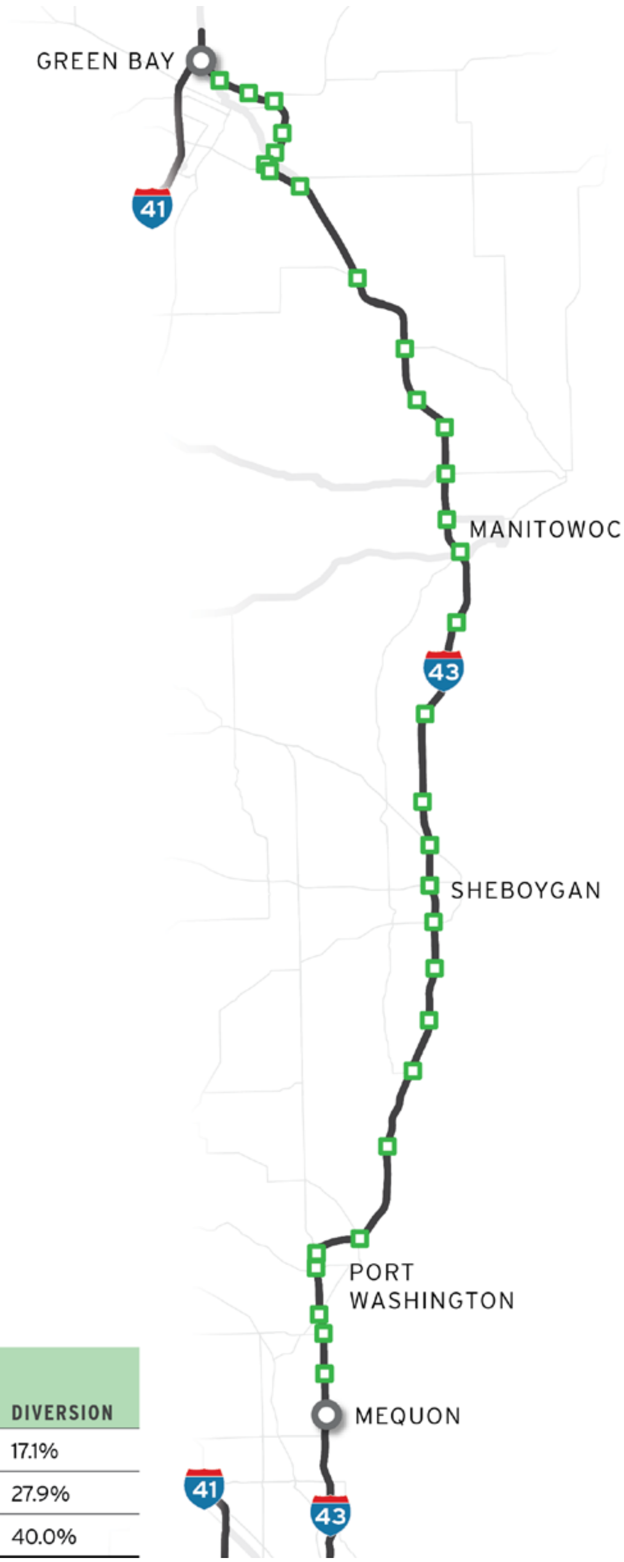
105
MILES

1,077 MILLION
ANNUAL VEHICLE MILES TRAVELED

31
INTERCHANGES

3.4 MILES
PER INTERCHANGE

Interchange location



TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile	1,402	1,083	17.1%
8 cents/mile	2,557	2,271	27.9%
12 cents/mile	3,356	3,107	40.0%

3.6 Central: I-39/90 Madison Beltline to Portage

CE

I-39/90 MADISON BELTLINE TO PORTAGE

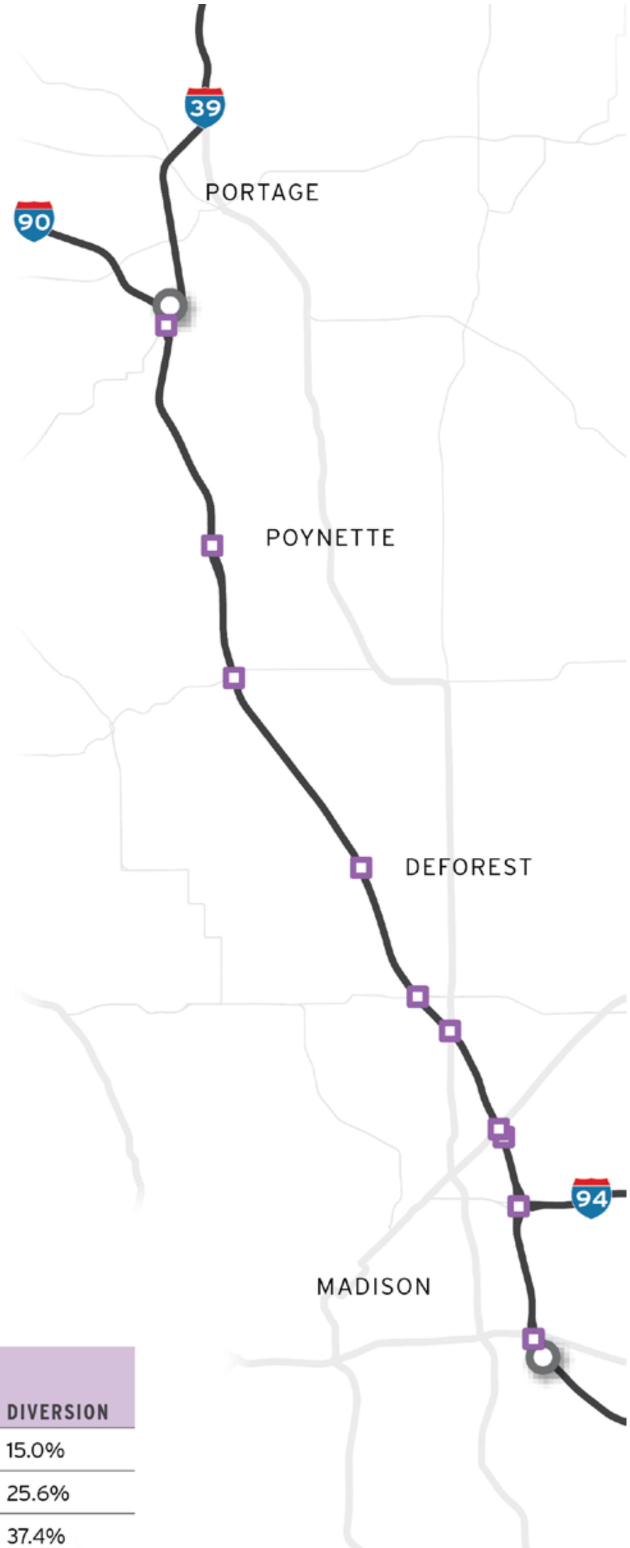
34
MILES

725 MILLION
ANNUAL VEHICLE MILES TRAVELED

10
INTERCHANGES

3.4 MILES
PER INTERCHANGE

Interchange location



TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile	1,178	991	15.0%
8 cents/mile	2,174	2,003	25.6%
12 cents/mile	2,846	2,694	37.4%

3.7 South Central: I-39/90 Beloit to South of Madison Beltline

SC

I-39/90 BELOIT TO SOUTH OF MADISON BELTLINE

45
MILES

760 MILLION
ANNUAL VEHICLE MILES TRAVELED

10
INTERCHANGES

4.5 MILES
PER INTERCHANGE

Interchange location

TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile	1,217	1,054	16.8%
8 cents/mile	2,262	2,113	25.8%
12 cents/mile	2,967	2,837	37.6%

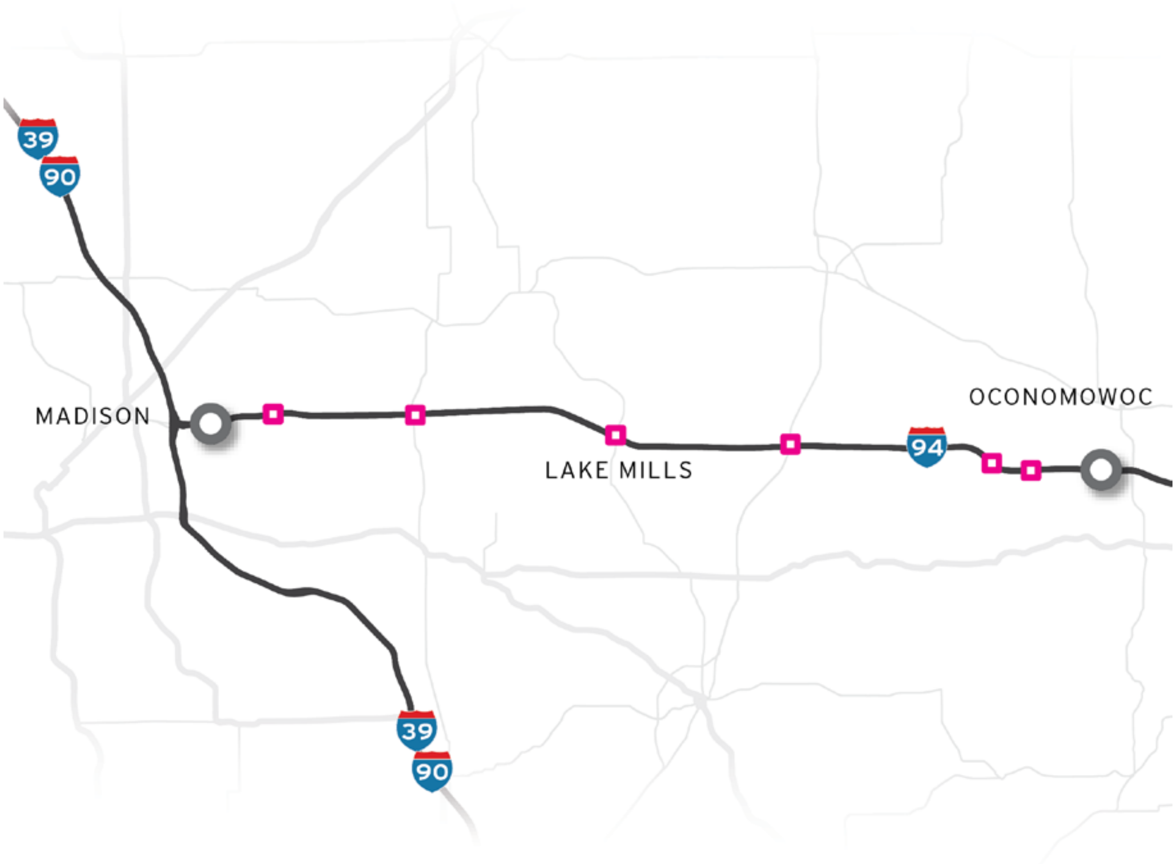
3.8 Southeast 1: I-94 Madison to Oconomowoc

SE 1

I-94 MADISON TO OCONOMOWOC

38 MILES	505 MILLION ANNUAL VEHICLE MILES TRAVELED
6 INTERCHANGES	6.3 MILES PER INTERCHANGE

Interchange location



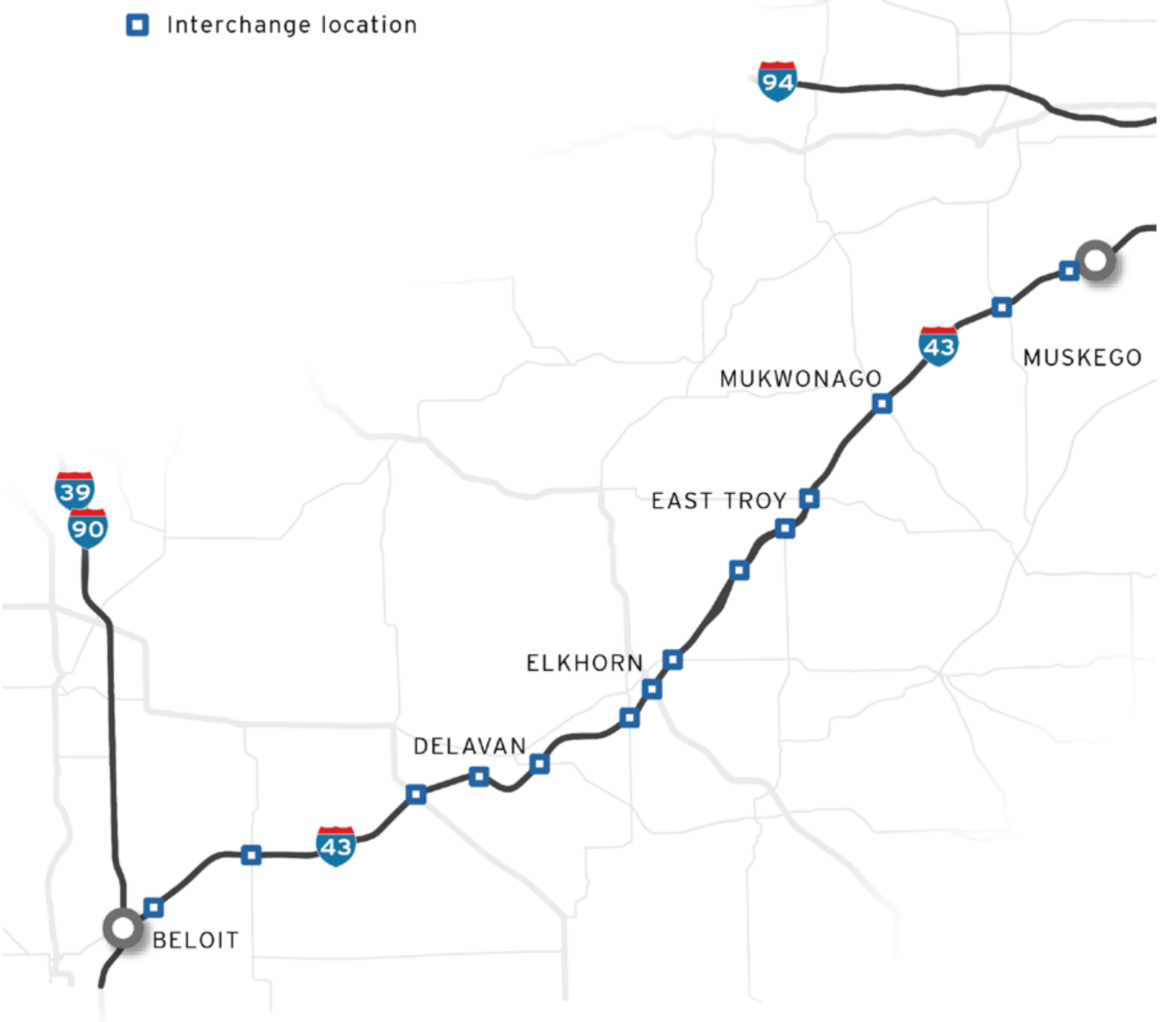
TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile	624	537	18.2%
8 cents/mile	1,125	1,047	29.2%
12 cents/mile	1,486	1,418	40.2%

3.9 Southeast 2: I-43 Beloit to Muskego

SE 2

I-43 BELOIT TO MUSKEGO

57 MILES	489 MILLION ANNUAL VEHICLE MILES TRAVELED
14 INTERCHANGES	4.1 MILES PER INTERCHANGE



TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile	601	500	16.8%
8 cents/mile	1,101	1,009	28.3%
12 cents/mile	1,469	1,388	38.5%

3.10 Metro Milwaukee: I-41/43/94/894/794 Waukesha, Milwaukee, and Southern Ozaukee County

MM I-41/43/94/894/794 WAUKESHA, MILWAUKEE AND SOUTHERN OZAUKEE COUNTIES

93 MILES	3,544 MILLION ANNUAL VEHICLE MILES TRAVELED
75 INTERCHANGES	1.2 MILES PER INTERCHANGE

TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile	4,132	3,193	5.9%
8 cents/mile	7,983	5,335	11.5%
12 cents/mile	11,493	8,958	16.4%

Milwaukee Metro corridor

3.11 South Milwaukee: I-94 Illinois State Line to Seven Mile Road

SM

I-94 ILLINOIS STATE LINE TO SEVEN MILE ROAD

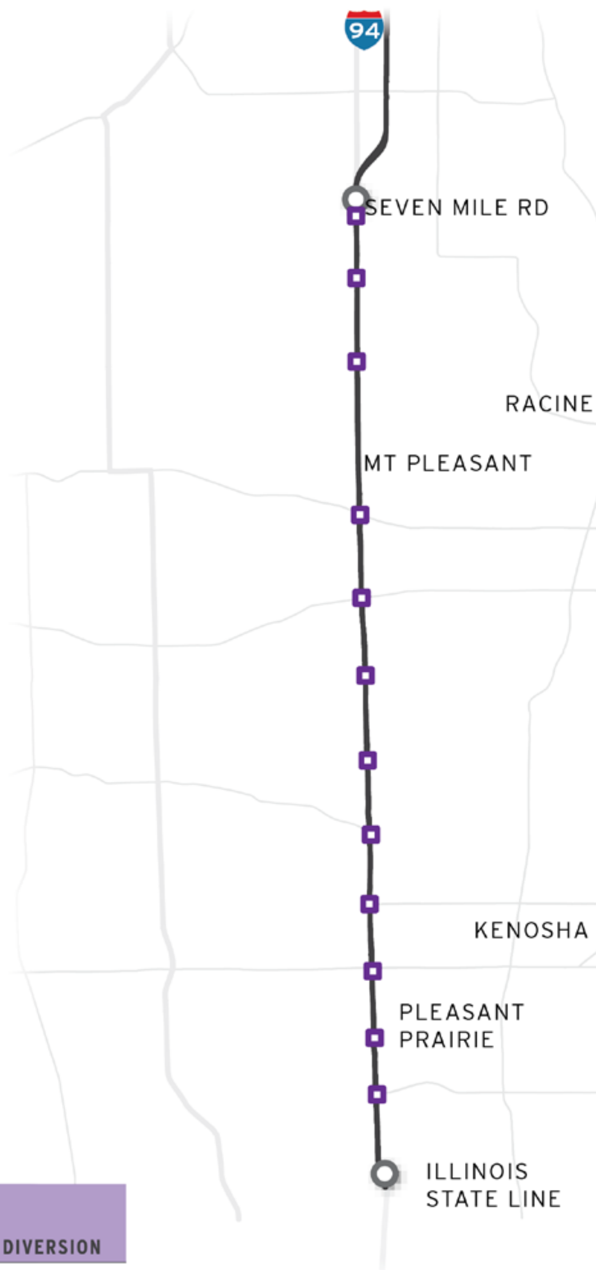
24
MILES

757 MILLION
ANNUAL VEHICLE MILES TRAVELED

12
INTERCHANGES

2 MILES
PER INTERCHANGE

Interchange location



TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile	1,021	772	13.1%
8 cents/mile	1,931	1,598	19.9%
12 cents/mile	2,696	2,389	27.7%

3.12 Phase II I-90: Beloit to Tomah

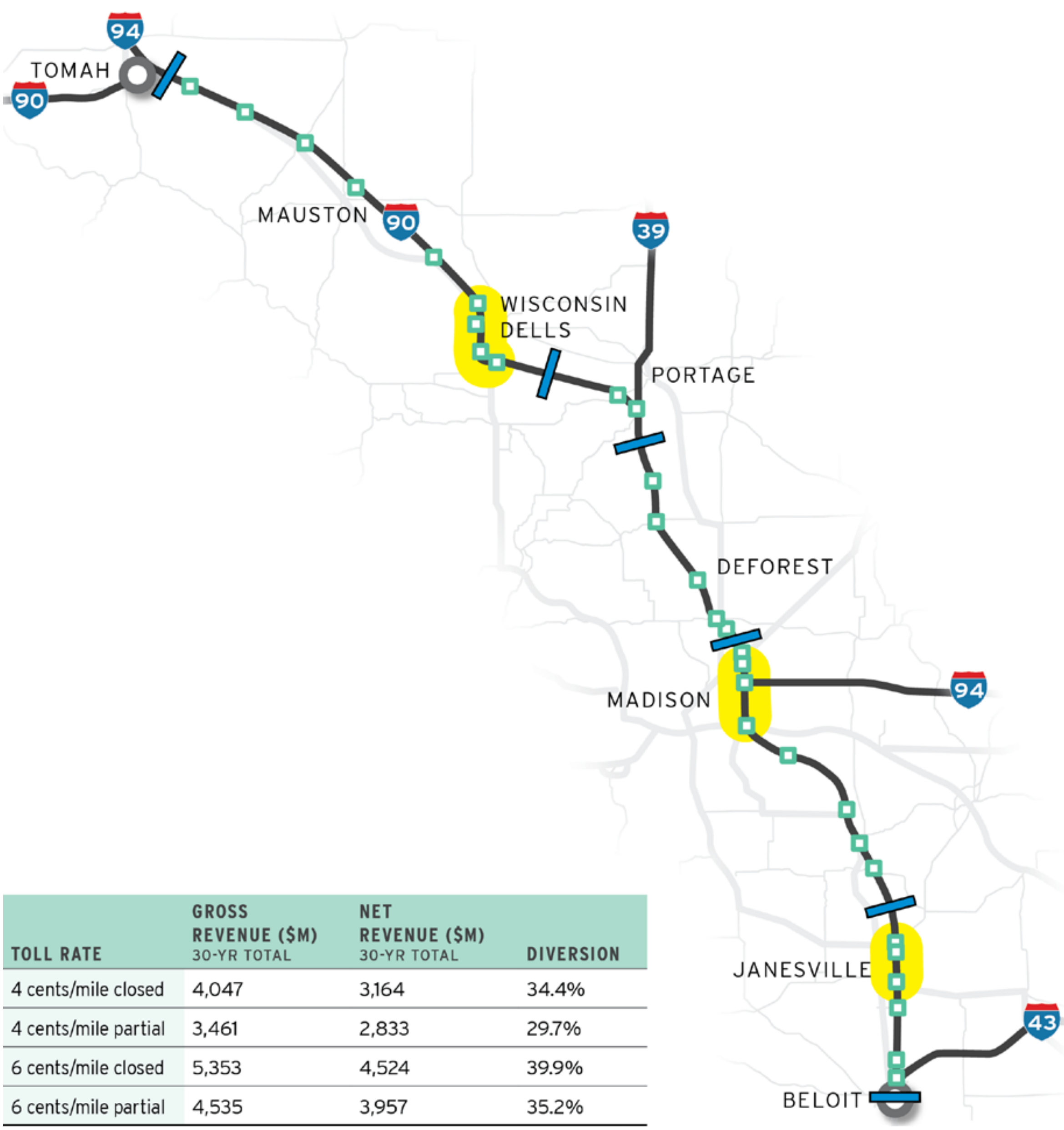
90 I-90 BELOIT TO TOMAH

143 MILES	2,234 MILLION ANNUAL VEHICLE MILES TRAVELED
30 INTERCHANGES	4.8 MILES PER INTERCHANGE

Interchange location

Open/free movements under partial tolling plan

Toll gantry location



TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile closed	4,047	3,164	34.4%
4 cents/mile partial	3,461	2,833	29.7%
6 cents/mile closed	5,353	4,524	39.9%
6 cents/mile partial	4,535	3,957	35.2%

3.13 Phase II South Milwaukee: I-94 Illinois State Line to Seven Mile Road

SM

I-94 ILLINOIS STATE LINE TO SEVEN MILE ROAD

24
MILES

757 MILLION
ANNUAL VEHICLE MILES TRAVELED

12
INTERCHANGES

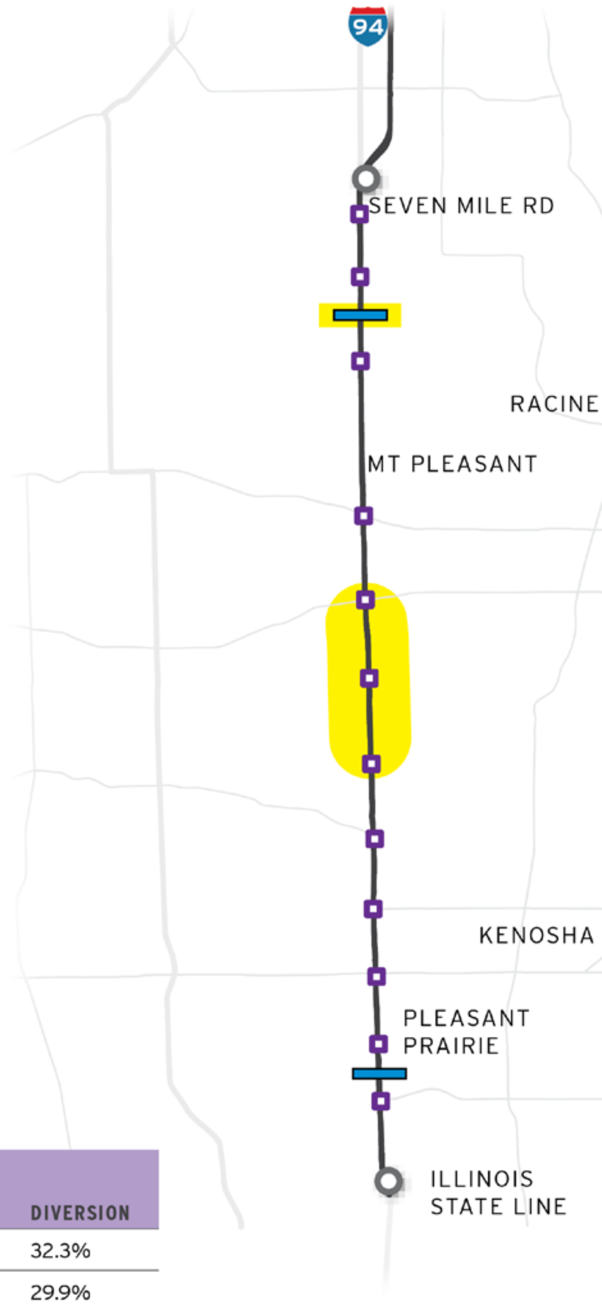
2 MILES
PER INTERCHANGE

Interchange location

Open/free movements under partial tolling plan

Toll gantry location for both closed and partially open plans

Toll gantry locations for just partially open plan



TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile closed	1,311	961	32.3%
4 cents/mile partial	1,187	745	29.9%
6 cents/mile closed	1,771	1,440	36.6%
6 cents/mile partial	1,610	1,190	33.8%

3.14 Phase II Metro Milwaukee: I-41/43/894/794 Waukesha, Milwaukee, and Southern Ozaukee County

MM

I-41/43/94/894/794 WAUKESHA, MILWAUKEE AND SOUTHERN OZAUKEE COUNTIES

93 MILES	3,544 MILLION ANNUAL VEHICLE MILES TRAVELED
75 INTERCHANGES	1.2 MILES PER INTERCHANGE

TOLL RATE	GROSS REVENUE ($M) 30-YR TOTAL	NET REVENUE ($M) 30-YR TOTAL	DIVERSION
4 cents/mile partial	6,173	3,345	36.6%
6 cents/mile partial	7,210	4,448	33.8%

Milwaukee Metro corridor

Toll gantry location

4. KEY TRAFFIC AND REVENUE MODELING ASSUMPTIONS

A Level 1 traffic and revenue forecast was performed as a separate part of the overall feasibility study. This forecast is a high-level analysis of revenue generating capacity used to determine if tolling is feasible at a basic level. The forecast can be used to investigate whether the tolling concept warrants subsequent Level 2 and Level 3 forecasting. This section captures the options and rationale behind the forecast's major assumptions. The tolling framework and assumptions established for this forecast do not constitute a set of policy decisions that must carry forward through to toll implementation should that decision be made. Rather, the purpose of making these assumptions is to provide the necessary direction and boundaries required to conduct a preliminary toll revenue forecast. Policymakers can and should question, challenge, and change tolling assumptions as needed in future traffic and revenue forecasts should a decision be made to move forward with Interstate tolling. It should also be noted that policy decisions will play an important role in determining a project's ultimate traffic and revenue potential, and could materially impact the results of this and future studies.

This Level 1 traffic and revenue forecast was performed in two phases. The main purpose of the first phase was to provide the revenue and traffic diversion projections. The second phase focused on establishing proposed tolling locations for three corridors to better evaluate tolling capital and transaction costs and the impacts of diversion. Forecast assumptions can and often do change between phases, especially with respect to base toll rates. Based on collaborative discussions with WisDOT, the chart below outlines the agreed upon major assumptions for both phase I and II.

Table 4-1: Major Assumptions Established Through Coordination with WisDOT

ELEMENT	ASSUMPTION
Payment Method	All Electronic Tolling
Video Toll Rate Surcharge	50% (example – a tolling location that charges $3 for transponder transactions would charge $4.50 for video transactions)
Vehicle Classification Method	Axle-Based (sensors in the pavement will identify the number of axles for each passing vehicle and charge a toll according to how many axles are identified)
3 & 4 Axle Toll Policy	Number of axles (the base toll rate charged for a two axle passenger vehicle is multiplied by 1.5 for a three axle vehicle/truck charge and by 2 for a four axle vehicle/truck charge)
5+ Axle Toll Policy	Number of axles minus one (to determine the toll charge for a 5+ axle truck, the base toll rate charged for a two axle passenger vehicle is multiplied by the number of truck axles minus one; as an example, with a $3 base charge, a five axle truck would be charged a toll of $12 ($3* (5-1) = $8)

ELEMENT	ASSUMPTION
Phase I Base Toll Rates	4 / 8 / 12 cents per mile
Phase II Base Toll Rates	4 and 6 cents per mile
Toll Rate Inflation	No escalation over time
Openness of the Toll System	Closed for phase I, phase II modeling includes options for a closed system (no free movements) and a partially open system (some movement are free)
Phase I System Limits at WI Border	One free movement at border
Phase II System Limits at WI Border	Tolling starts at the border

4.1 Payment Method

One fundamental assumption that must be made to generate a traffic and revenue forecast is whether the toll system will allow customers to pay with cash as they drive the roadway or not. Tolling systems that do not allow for cash payment on the roadway are commonly referred to as All-Electronic Tolling (AET) systems.

Most new toll facilities are being constructed using AET. Additionally, many traditional toll systems that have historically accepted cash payments on the road are increasingly converting to the use of AET. There are several advantages to using AET including the elimination of traffic bottlenecks at toll booths, improved safety, improved air quality from reduced vehicle emissions, reduced labor expenses from collecting and transporting cash, reduced right of way needs at tolling locations, and operational and maintenance savings from not having traditional toll booths. An AET system can still accommodate cash customers by accepting cash payments at customer service centers or kiosks, just not on the actual roadway itself.

Many older toll systems were developed before technology had evolved to the point that AET was a viable option. As such, these systems accepted cash out of necessity. Constructing a new toll facility to allow for cash collection at the roadside would be highly capital intensive in terms of required right of way and construction of toll plazas and booths. The increased traffic congestion that accepting cash at the roadway would bring could make it difficult to obtain federal approval of tolling. With established toll authorities like the New York State Throughway, Ohio Turnpike, Pennsylvania Turnpike, Kansas Turnpike, and Oklahoma Turnpike either pursuing or considering conversion to AET, there is a clear industry trend in this direction. For these reasons, the traffic and revenue forecast assumes the use of AET.

4.2 Video Surcharge

In an AET environment where cash payment on the roadway is not an option, customers may choose to pay their tolls in one of two ways. The preferred method is with a transponder, which is a small device generally affixed to the vehicle windshield. Customers open a tolling account, deposit funds into a debit account, place the transponder in their vehicle, and as they drive the roadway the transponder is automatically recognized and the appropriate toll deducted from the customer's account.

For customers that choose not to use a transponder, the second method of payment available is to drive the roadway and have a video camera capture an image of the license plate. For customers using this video-based payment method, the toll agency must identify the registered owner of the vehicle and then mail them an invoice for the appropriate toll. Because this method of payment is costlier for the toll authority to process, toll rates for video-based customers are generally higher than for transponder-based customers. This "video surcharge" is used to both offset the higher costs of collection, and to incentivize customers to open a transponder-based account thereby driving down collection costs for the agency. The surcharge also helps offset the cost for those transactions that are uncollectible.

Video surcharges are very common in AET systems across the country. Although some agencies use a "flat dollar" surcharge, it is more common for the surcharge to be a percentage of the transponder-based rate. The video surcharge percentages typically range from 25% to 100%, with 33% and 50% being the most common. The traffic and revenue forecast assumes a 50% video surcharge. Refer to section 2.5.1 in the Policy Document for video billing considerations related to Wisconsin Statutes and privacy.

4.3 Vehicle Classification Method

A third assumption that is necessary to perform a traffic and revenue forecast is the method for classifying vehicles. In an AET environment, the assigned toll rate for a vehicle is a function of payment method as previously discussed, vehicle classification, and toll rates.

Toll authorities classify vehicles into a series of groups for the purposes of determining the toll rate. Larger vehicles, in nearly all cases, pay higher toll rates to partially compensate for the additional damage they do to the roadway. The two most common methods for classifying vehicles for tolling purposes are axle based classification, and shape-based classification. Axle-based classification is simply counting the number of vehicle axles. Most of the technology used to accomplish the axle count, like inductive loops, is underneath the roadway pavement. As a result, axle-based classification includes higher capital and operation and maintenance costs. This is particularly true in northern areas of the country where snow and ice removal are routine.

Shape-based classification employs cameras and lasers to try to infer the "shape" of a vehicle. This allows for a more refined set of vehicle classifications than simply counting axles. As an example, a box truck and a passenger car both have two axles, but by detecting vehicle's shape, a distinction can be made and the box truck charged a higher toll rate. Shape-based classification is still evolving and is not yet as reliable as axle-based classification.

Axle-based classification is more common because it is simpler to explain to customers, more reliable, and with being more reliable, it more easily withstands legal challenges. Furthermore, the use of height sensors in an axle-based classification scheme can allow for refinement of vehicle classifications similar to the effect obtained by using a shape-based system. Vehicle classification is more of an implementation decision that does not have a material impact on traffic and revenue forecasts. However, to provide as much clarity as possible, the assumption for this study was that vehicle classification would be axle-based.

4.4 Toll Rate Formula

Closely related to the vehicle classification assumption is an important assumption about the toll rate formula. Having assumed vehicles will be classified by axle count, an assumption must be made about how the toll rates will be applied to each axle. Two main toll rate formulas are commonly used in tolling. Table 4-2 below illustrates how the two main toll rate formulas operate under a hypothetical toll rate structure.

The first toll rate formula is a straight-line cost per axle, referred to as the "number of axles" or sometimes the "N" formula. As depicted in the graphic below, each axle costs the same amount. If we assume a $3 toll for an automobile, we are in essence saying that each axle costs $1.50 cents, such that a five-axle vehicle (semi-truck) will pay $7.50 (five times $1.50) or two and a half times that of a passenger car.

The second toll rate formula is a straight-line multiple of the assumed automobile rate. This formula is often called the "N minus one" formula. Here, for each additional axle above two, the toll rate paid increases by the auto rate. In our previous comparison of a regular passenger car to a semi, we now calculate the rate for a semi by subtracting one from its count and multiplying the result by the auto rate. This means a semi pays $12 ((5-1)*3), or four times more than a passenger car.

Using the first, or "N" formula results in less truck revenue, but also less traffic diversion. Using the second, or "N minus one" formula, produces additional truck revenue, which is more consistent with the increased wear those vehicles do to the roadway and bridges.

For purposes of the traffic and revenue forecast, an assumption was made that three and four axle vehicles would be tolled using the "n" formula, and vehicles with five or more axles would be tolled using the "n minus one" formula. One consideration in assuming the lower "n" formula for three and four axle vehicles was the high volume of passenger vehicles towing boats and trailers during peak summer and hunting seasons.

Table 4-2: Toll Rate Formulas under a Hypothetical $3 Toll

Formula			Auto	Truck Toll			
Name	Basis	Structure	Toll	3-Axle	4-Axle	5-Axle	6-Axle
N	Toll per Axle	N*Axle Rate	**$3.00**	$4.50	$6.00	$7.50	$9.00
		Multiplier of Auto		1.5	2.0	2.5	3.0
N-1	Toll Cost	(N-1)* Auto	**$3.00**	$6.00	$9.00	$12.00	$15.00
		Multiplier of Auto		2.0	3.0	4.0	5.0

4.5 Conceptual Toll Rates

The final assumption needed to charge the customer a correct toll in an AET environment after having established the video surcharge and vehicle classification parameters are conceptual toll rates. As previously discussed, Level 1 traffic and revenue forecasts often consider different conceptual toll rates during phase I and phase II.

4.5.1 Conceptual Phase I Toll Rates

Table 4-3 below illustrates that there are a wide range of toll rates charged on comparable Interstate toll facilities in terms of cents per mile. For forecasting purposes, it is useful to consider rates that span both the low and high end of this spectrum to better understand the range of revenue and traffic diversions that are possible.

4.5.2 Conceptual Phase II Toll Rates

For consistency, revenue results should not vary much from phase I to phase II. The main benefits of the phase II analysis are the identification of tolling locations, refined traffic diversion estimates, and more accurate tolling capital cost and toll processing cost estimates. The phase II analysis kept one toll rate the same from the phase I analysis for comparison purposes (four cents per mile) and also used a new rate to obtain an additional tolling price point (six cents per mile). The phase II tolling plan locations are illustrative in nature and represent one of many potential tolling location concepts. Appendix A, attachments B-1 through B-10 show the phase II tolling locations.

Table 4-3: Toll Rates in Other Jurisdictions*

Toll Facility	Facility Length (miles)	2-Axle Vehicles				Effective Truck Multiplier	
		Full-Length Toll		Toll Per Mile		5-Axle Truck	
		ETC	Cash	ETC	Cash	ETC	Cash
Indiana Toll Road	157	$ 4.65	$ 10.20	**$ 0.03**	**$ 0.06**	**7.7**	**3.5**
Kansas Turnpike	236	$ 10.20	$ 12.00	**$ 0.04**	**$ 0.05**	**2.9**	**2.6**
West Virginia Turnpike	88	$ 3.90	$ 6.00	**$ 0.04**	**$ 0.07**	**4.2**	**3.4**
Ohio Turnpike	241	$ 12.25	$ 17.75	**$ 0.05**	**$ 0.07**	**2.7**	**2.4**
Oklahoma Turnpike				**$ 0.05**	**$ 0.05**	**3.5**	**3.5**
Will Rogers Turnpike	87	$ 3.90	$ 4.00	$ 0.05	$ 0.05	4.0	4.1
Turner Turnpike	86	$ 3.90	$ 4.00	$ 0.05	$ 0.05	4.0	4.1
Cimarron Turnpike	59	$ 2.85	$ 3.00	$ 0.05	$ 0.05	3.8	3.8
Indian Nation Turnpike	105	$ 5.30	$ 5.50	$ 0.05	$ 0.05	3.3	3.3
HE Bailey Turnpike	86	$ 4.45	$ 5.30	$ 0.05	$ 0.06	3.0	3.0
Muskogee Turnpike	53	$ 2.80	$ 3.00	$ 0.05	$ 0.06	3.2	3.1
Illinois Toll Roads				**$ 0.07**	**$ 0.14**	**7.3**	**3.6**
Jane Addams Memorial Tollway (I-90)	76	$ 3.95	$ 7.90	$ 0.05	$ 0.10	8.0	4.0
Reagan Memorial Tollway (I-88)	96	$ 5.10	$ 10.20	$ 0.05	$ 0.11	7.9	4.0
Tri-State Tollway (I-94/I-294/I-80)	78	$ 4.40	$ 8.80	$ 0.06	$ 0.11	8.0	4.0
Veterans Memorial Tollway (I-355)	33	$ 3.80	$ 7.60	$ 0.12	$ 0.23	6.3	3.2
Pennsylvania Turnpike	360	$ 30.02	$ 42.30	**$ 0.08**	**$ 0.12**	**5.6**	**5.6**
Northeast Extension	110	$ 9.58	$ 14.10	**$ 0.09**	**$ 0.13**	**5.6**	**5.6**

**For phase I of the traffic and revenue forecast, rates of four, eight, and twelve cents per mile were assumed.*

It should be noted that the rates in Table 4-3 are for full-length trips, which are normally the lowest possible rate. All toll roads must recover the cost of processing transactions and therefore a minimum toll cost is embedded in the toll charge at each entry point to the system. Thus, shorter distance trips have effectively higher per mile rates since the minimum charge is spread across a shorter distance than a full-length trip.

4.6 Toll Rate Inflation

Having established an assumption about base conceptual toll rates, an assumption is required as to whether and how those toll rates will be inflated or indexed over time to protect against erosion of the purchasing power of the revenue stream. One advantage of AET is that toll increases are simpler to administer annually than in a cash collection environment. With cash collection, rates typically remain stagnant until an increase of 25 cents is justified, because charging toll rates that are not multiples of 25 cents makes paying the toll more difficult with cash. Freed from this restriction, AET facilities are increasingly implementing small annual toll increases to keep pace with inflation.

Customers of AET facilities typically manage toll expenses like cellular phone or utility bills which are tied to usage of the system. This can make them less sensitive to small annual adjustments than would otherwise be observed if they were paying at the roadside in cash every day. While no toll rate increase is politically popular, more and more toll authorities are taking advantage of indexing toll rates to avoid having to take an affirmative action every year to increase toll rates as may be necessary to meet with bond covenants. This can be viewed favorably by rating agencies and other capital market participants as they evaluate the overall creditworthiness of toll projects.

This study's traffic and revenue forecast assumes no indexing or inflating of toll rates in the future.

4.7 Openness of the Toll System

Another major assumption required to perform a traffic and revenue forecast is the openness of the toll system. Tolling systems can be classified as either "open" or "closed". A closed system tolls all traffic movements and every customer pays for the exact mileage they travel. To accomplish this, closed toll systems require vehicle identification at every entry and exit point. Alternatively, an open toll system allows for some un-tolled movements along the roadway. By permitting un-tolled movements, an open system relaxes the requirement that vehicles be identified at every single entry and exit point.

Closed toll systems maximize revenue collection by eliminating un-tolled movements. However, the need to intercept and identify vehicles using any section of the roadway closed systems have higher capital costs. Hybrid systems can be implemented where low traffic volume entry and exit points are left un-tolled, or strategic traffic movements are left un-tolled to minimize diversion. These hybrid systems offer a somewhat reduced capital cost for tolling equipment and create less transactions to process in the back-office.

Phase I of the traffic and revenue forecast models a closed toll system. Phase II also models a closed system, but a partially open system is modeled as a sensitivity.

4.8 System Limits

The final assumption of the traffic and revenue forecast is when to begin tolling on the Interstate system. Specifically, tolling may commence immediately upon entering Wisconsin, or alternatively a single un-tolled traffic movement may be allowed until the first interchange to allow a customer to take an alternate route. For phase I, a single free movement was allowed when entering the state. For phase II, there were three tolling systems examined. This assumption was not relevant to tolling Metro Milwaukee. For tolling on the South Milwaukee corridor, a toll is charged at the exit ramp of the first interchange but the location of the first mainline toll gantry is north of the first interchange. For tolling on the I-90 phase II corridor, a toll is collected immediately upon entering Wisconsin with a mainline gantry.

5. CAPITAL, OPERATIONS, AND MAINTENANCE COSTS

5.1 Toll System Capital Costs

HNTB developed a high-level capital cost forecast to design, purchase, and implement the tolling system for the phase I and II corridors. Capital cost estimates for AET systems include costs for the following major items related to the design, development, and installation of the toll system equipment:

- Central & Project Host Servers (Hardware & Software)
- Lane/Gantry Equipment & Software
    - Lane /Zone Controllers/Servers
    - AVI Antennae & Readers (multi-protocol)
    - License Plate Image Capture Cameras & Lighting (Front and Rear Cameras with Optical Character Recognition)
    - Vehicle Detection &Classification Subsystem (Loops & Scanners)
    - Digital Video Audit Subsystem (Cameras, Lighting, Serves & Software)
- Equipment Enclosures/Cabinets and Pads
- Back-up Generators and Uninterruptible Power Supplies (UPSs)
- Overhead Gantries (one pair at each toll location) with foundations & guardrail
- Static Toll Signing
- Lightning Protection
- Maintenance Access Areas

When developing a project's toll system capital cost estimate, the primary cost drivers include the project's quantity of toll locations (toll zones), the quantity and type of tolled lanes at each toll location (shoulder vs. mainline), and lane type (such as AET with axle-based classification).

Toll system capital cost estimates are produced with varying degrees of detail and typically become more precise as the project advances through the stages of development. For phase I of the WisDOT's Tolling Feasibility Study, the study provides a high-level determination for each analyzed roadway regarding the quantity of toll zones and the quantity and type of toll lanes at each zone. Table 5-1 illustrates the number of tolling locations for each phase I corridor and a cost estimate to design and implement the tolling system for each corridor based on the type of gantries on the corridors.

Table 5-1: Phase I Estimated Tolling Locations and Tolling Capital Costs

	Description		Number of Mainline & Ramp Gantries				
Corridor	Length and 2014 AVMT*	I-changes/ Miles per Interchange	2-Lane Mainline Gantries	3-Lane Mainline Gantries	4-Lane Mainline Gantries	Ramp Gantries	RTS** Capital Cost Estimate ($M)
Northwest 1	208 miles - 2,228M AVMT	39/5.3	16	4	0	40	$52.2
Northwest 2	45 miles - 342M AVMT	10/4.5	4	0	0	12	$14.8
North Central	111 miles - 775M AVMT	34/3.3	12	0	0	48	$49.8
Northeast 1	119 miles - 2,078M AVMT	53/2.2	10	4	2	32	$42.6
Northeast 2	105 miles - 1,077M AVMT	31/3.4	8	2	0	20	$27.0
Central	34 miles - 725M AVMT	10/3.4	0	2	2	8	$12.4
South Central	45 miles - 760M AVMT	10/4.5	0	6	0	6	$12.9
Southeast 1	38 miles - 505M AVMT	6/6.3	2	2	0	4	$9.0
Southeast 2	57 miles - 489M AVMT	14/4.1	4	2	0	18	$21.5
Metro Milwaukee	93 miles - 3,544M AVMT	75/1.2	2	10	6	108	$103
South Milwaukee	24 miles - 757M AVMT	12/2	0	0	4	20	$21.6
Total			**58**	**32**	**14**	**316**	**$366.8**

*AVMT = Annual Vehicle Miles Travelled
**RTS = Roadside Tolling System

Table 5-1 Notes:

- Includes the system implementation costs of an Integrator/Provider (project management, design, testing, labor, and host computer).
- Includes the cost of equipment at the lane (cameras, readers, etc.), the gantries, and roadwork.
- For phase I, exact tolling locations were not identified; the estimates above are only intended to give a high-level estimate of the potential tolling capital costs for each corridor.
- For a more refined tolling capital cost estimate, a tolling plan would need to be identified for each corridor; phase II identifies a tolling plan for select corridors.
- Cost estimates are preliminary and subject to change; actual costs and number of tolling locations will vary based on the final tolling plan and policy decisions.
- Dynamic Toll Rates/Pricing does NOT apply to this project.
- Design/Installation/Implementation/Construction duration for the Toll System is 18 months.

- Capital costs do not include costs for Toll System maintenance, Toll System operations (e.g., electricity, gas, communications, etc.) and communications network (e.g., fiber-based, leased-line-based, etc.).
- Capital costs do not include Back-office/CSC System.
- Costs are in 2016 dollars.

For phase II, a more detailed determination of tolling zones was developed, as shown in Table 5-2. As is typical for AET projects, it was assumed that no additional Right-of-Way (ROW) would be needed for the WisDOT toll systems due to the nature of AET systems and the flexibility of where toll gantries can be located between the roadway's ingress and egress points.

Table 5-2: Tolling Zone Types used in Phase II

Tolling Zone Types
Per 1-lane/0-Shldr Zone
Per 1-lane/1-Shldr Zone
Per 1-lane/2-Shldr Zone
Per 2-lane/0-Shldr Zone
Per 2-lane/1-Shldr Zone
Per 2-lane/2-Shldr Zone
Per 3-lane/0-Shldr Zone
Per 3-lane/1-Shldr Zone
Per 3-lane/2-Shldr Zone
Per 4-lane/0-Shldr Zone
Per 4-lane/1-Shldr Zone
Per 4-lane/2-Shldr Zone
Per 5-lane/0-Shldr Zone
Per 5-lane/2-Shldr Zone

Phase II identified the exact tolling locations and utilized a more detailed approach to developing the cost for the toll system. HNTB estimated the upfront toll system capital costs, the annual toll system O&M costs, and the life cycle toll system costs. Table 5-3 presents a summary of the tolling capital costs for each of the corridors. In all presentations of net revenue, the upfront toll system capital costs are not included in the annual net revenue calculation since the costs are incurred before revenue is collected.

Table 5-3: Toll Capital, O&M, and Lifecycle Cost Estimates for Phase II Corridors

		Toll System & Corridor Signage Capital Costs	Toll System O&M	Toll System Lifecycle
		Upfront	Annual	Every 7 Years
Closed System				
	I-94 N-S South Milwaukee Corridor	23,625,000	1,520,000	14,525,000
	I-90 Corridor	56,925,000	3,855,000	35,500,000
	Metro Milwaukee Corridor	80,905,000	4,355,000	41,675,000
	Total	161,455,000	9,730,000	91,700,000
Partial System				
	I-94 N-S South Milwaukee Corridor	21,150,000	1,325,000	12,950,000
	I-90 Corridor	40,100,000	2,600,000	24,675,000
	Metro Milwaukee Corridor	80,905,000	4,355,000	41,675,000
	Total	142,155,000	8,280,000	79,300,000
Difference				
	I-94 N-S South Milwaukee Corridor	2,475,000	195,000	1,575,000
	I-90 Corridor	16,825,000	1,255,000	10,825,000
	Metro Milwaukee Corridor	-	-	-
	Total	19,300,000	1,450,000	12,400,000

5.2 Toll System Operations and Maintenance Costs

Toll System Operations & Maintenance (O&M) costs include both costs associated with the ongoing operations and maintenance of equipment, infrastructure, and systems and costs associated with their lifecycle-based period renewal and replacement (R&R).

Toll System O&M expenditures are divided between the Roadside Toll Collection System (RTCS) and the Back-office System (BOS) since they are distinct systems and services.

It is common for these estimates to be constructed separately for the roadside and back-office components of the tolling system. Roadside cost estimates are driven by the number of lanes, and the number and types of equipment needed to achieve tolling classification specifications such as loops, lasers, fiber optic treadles, antennae, etc. Back-office cost estimates are both a function of resources needed to review license plate images and respond to customer calls/requests and a function of maintaining and licensing computer hardware and software.

The RTCS O&M expenditures are primarily maintenance-related services, including preventative, predictive and emergency repairs to roadside toll equipment, and periodic renewal and replacement of the system, including hardware and software. The maintenance-related services are estimated on an annual basis based on the quantity of toll lanes being operated and maintained and the quantity and type of equipment needed to meet the tolling specifications such as loops, lasers, fiber optic treadles (axle counters), antennae, etc. These costs also include active spare parts inventory management.

The RTCS R&R costs are based on replacing the toll system equipment (excluding the civil infrastructure) every seven years.

The operations and maintenance of the BOS is more labor intensive than the RTCS. It includes customer service representatives to answer telephone calls and communicate with customers, fulfill transponder orders, review license plate images, generate invoices, and process payments. These ongoing costs are estimated based on the quantity and type (i.e., transponder based or video based) of toll transactions processed through the BOS.

The BOS O&M cost estimates include costs for the following operational items:

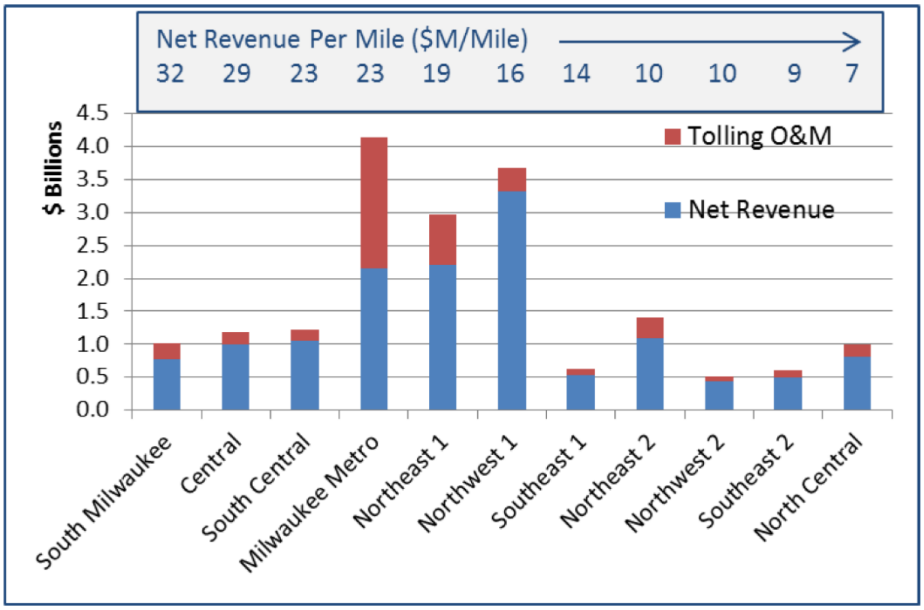
- Transaction and Image Processing
- Call Center
- Account Management
- Payment Processing
- Inventory Management & Fulfillment
- Storefront Operations
- Printing & Mailing
- Reconciliation & Reporting
- System Maintenance

The BOS O&M costs are estimated by multiplying the annual amount of transponder and video transactions by the assumed cost of each respective collection method. The BOS cost estimates are based on eight cents per transponder transaction and 35 cents per video transaction. The BOS R&R costs are based on replacing the hardware and software every seven years. A summary of the gross revenues, tolling lifecycle costs, and the net revenue for years 2020 through 2050, in 2016 dollars, are presented below in Table 5-4. Net revenue per mile for each corridor is shown in Figure 5-1.

Table 5-4: Net Revenues for Phase I Corridors (4 Cents per Mile)

$M	Gross Rev	Tolling O&M	Net Rev
Northwest 1	3,670	346	3,324
Northwest 2	505	71	434
North Central	1,005	193	812
Central	1,178	188	991
Northeast 1	2,971	766	2,205
Northeast 2	1,402	319	1,083
Southeast 1	624	88	537
South Central	1,217	164	1,054
Southeast 2	601	101	500
Milwaukee Metro	4,132	1,986	2,146
South Milwaukee	1,021	248	772
Total	18,326	4,469	13,857

Figure 5-1: Years 2020 – 2050 Phase I Corridors Net Rev Per Mile - 4 cents per mile



The phase II traffic and revenue modeling was able to determine a precise amount of transactions for each scenario since the analysis identified exact tolling points. Figure 5-2 below shows gross revenue components for the phase II six cents per mile analysis for both the closed and partially open systems. The graphs below in Figure 5-3 illustrate the tolling cost components that establish the net revenue forecast in 2016 dollars for the phase II closed system (all corridors combined). In all presentations of net revenue, the upfront toll system capital costs are not included in the annual net revenue calculation since the costs are incurred before revenue is collected.

Figure 5-2: Years 2020 – 2050 Phase II Gross Revenue Components - 6 cents per mile

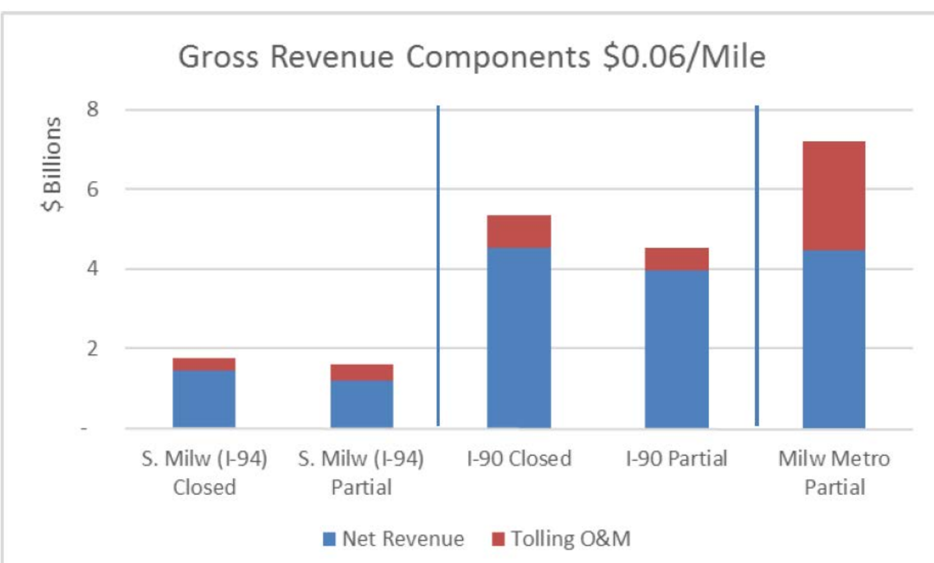
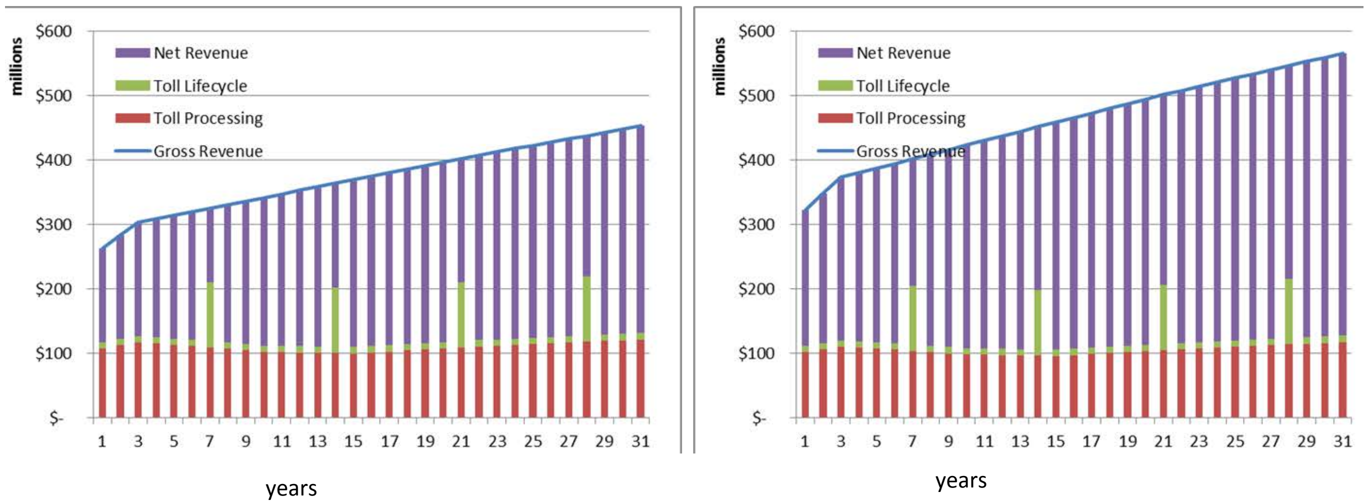


Figure 5-3: Net Revenue Graphs for Phase II Corridors (Closed System)

4 cents per mile | 6 cents per mile



6. TRAFFIC DIVERSION

6.1 Phase I Modeling Diversion Estimates

Charging tolls for Interstate motorists will create diversion of trips from the Interstate to other non-tolled routes. This study's phase I modeling of the entire Interstate system included toll rates of four cents per mile, eight cents per mile, and twelve cents per mile. The model results show diversion increases for higher tolls but decrease over time as shown below in Table 6-1. Diversion estimates decrease over time due to projected traffic growth and increased personal incomes[2]. The traffic and revenue model includes annual growth in statewide traffic demand, which over time, decreases alternate route capacities to handle diversion. The model also holds tolls constant while taking into account projected increases in personal incomes and thus, tolls over time decrease in relative costs to travelers.

Table 6-1: Phase I Modeling Traffic Diversion Estimates

	4 cents per mile	8 cents per mile	12 cents per mile
2020 Auto	15.1%	25.7%	37.9%
2020 Truck	23.1%	41.6%	64.6%
2020 Total	16.1%	27.7%	41.2%
2040 Auto	9.9%	14.7%	19.6%
2040 Truck	21.2%	23.8%	33.3%
2040 Total	11.3%	15.8%	21.3%

[2] Personal income growth is a factor added into the statewide travel diversion model by Stantec. In the forecast years, personal income is assumed to increase in a trend that follows anticipated increases in the Consumer Price Index. This increased income effectively increases the value of time, thus reducing the actual value of the tolls that are being held constant.

Appendix D, Attachments D-1 through D-6, includes diversion maps under the three different phase I modeling toll rates. The maps show which non-Interstate routes would have increased traffic volumes due to diversion and which routes would experience increased congestion due to diverted traffic. Overall, the modeling indicates traffic diversion spreads widely to many routes and on most diversion routes resulting volumes are within the roadway capacity. Diversion occurs on all eleven corridors but impacts to diversion route capacities are more prevalent in the southern portion of Wisconsin. Traffic volumes in general are higher in the more densely populated southern part of the State, especially in the Madison and Milwaukee areas. Diversion routes in these areas have less available capacity to handle diverted traffic. Furthermore, Interstates in the Madison and Milwaukee area have high traffic volumes compared to other parts of the State and therefore, the magnitude of diversion is comparatively higher.

6.2 Phase II Diversion Estimates

The phase II modeling is more refined as compared to the phase I modeling due to actual pay point locations inserted into the model. The phase II modeling included corridors with high traffic volumes, closely spaced interchanges, and multiple adjacent diversion routes. The corridors included in phase II were:

- I-90 from the Illinois state line north to just south of the I-90/I-94 split south of Tomah
- I-94 North-South from the Illinois state line north to just north of Seven Mile Road
- The Metro Milwaukee area which included urban/suburban Interstate segments in all of Milwaukee County, most of Waukesha, and a portion of I-43 in southern Ozaukee County

Toll rates for the phase I model were uniform on a per mile basis whereas the phase II modeling had per mile costs that varied depending upon the trip origin and destination. Because of these differences, diversion estimates were also different.

The four cent per mile and six cents per mile scenarios for the phase II modeling include mainline gantry tolls set at a rate so a vehicle traversing the entire corridor would be charged tolls that result in an approximate overall four cents per mile or six cents per mile rate. However, not all trips on a corridor are through trips with most trips either beginning and/or ending within the corridor. These shorter trips on the tolled corridor usually have actual per-mile toll costs higher than the through trips. The reason for this is toll gantry locations, both mainline and ramps, have fixed prices. A vehicle pays the same toll price whether it is a shorter trip or longer trip.

Because shorter trips, in most cases, end up paying tolls that result in higher per-mile rates, the actual per-mile toll rate for all trips using the I-90 corridor as a whole under the four cents per mile scenario is nine cents per mile. This example illustrates why as a result, diversion estimates are generally higher in the phase II model outputs when comparing the phase I and phase II tolling scenarios. Table 6-2 below displays the estimated percent reductions in vehicle miles traveled on the tolled corridors for the phase II modeling.

Table 6-2: Phase II Diversion Estimates

	4 cents per mile	6 cents per mile
2020 Auto	27.1%	30.3%
2020 Truck	32.2%	40.8%
2020 Total	27.5%	31.4%
2040 Auto	20.1%	22.4%
2040 Truck	29.3%	36.7%
2040 Total	21.0%	23.9%

6.3 Potential Diversion Impacts

Diversion of traffic away from the Interstate increases traffic on other State and local roads. The increased traffic decreases those roads' available capacity and increases their wear and tear. If WisDOT were to toll the Interstate system, or a portion of it, local and State routes may need improvements for safe and efficient handling of diverted traffic. Furthermore, WisDOT would need to provide outreach and information to communities who will see diverted traffic on their local and State routes.

If WisDOT were to toll Wisconsin's Interstates, or a portion of them, ongoing environmental studies may need updates if projected diverted traffic affects traffic volumes within the study area. As an example, when evaluating the phase II diversion results for the I-90 closed system 4 cents per mile tolling option (Appendix D Attachment D-7), diversion in the Madison area increases traffic on the US 51 corridor and decreases traffic along I-39/90/94. Both of these corridors have ongoing environmental studies that would likely require updates with new projected traffic volumes. Updating the studies would affect their cost and schedule. The new set of traffic volume estimates on those studies could also affect the preferred alternative for the roadway reconstruction.

US 14 in southern Dane County and northern Rock County represents a good example of how diversion could potentially affect a roadway. If I-39/90 from the State line to Madison were tolled, the two-lane US 14 section between Janesville and Madison would see increased traffic and based upon the modeling results, would be over capacity on several segments as shown in Appendix D Attachment D-8. Prior to tolling I-90, WisDOT would need to closely study whether to make improvements on the US 14 corridor to maintain safe and efficient operations.