SHRP2 EconWorks: Wider Economic Benefits Analysis Tools

Delaware Valley Regional Planning Commission

Draft Final Report 9/25/2017

Contents

Overview of Case Studies and Rationale for W.E.B. Tool Selections

The Delaware Valley Regional Planning Commission (DVRPC) initially hoped to use all four Wider Economic Benefits (W.E.B.) tools for three case studies as a part of its Strategic Highway Research Program 2 (SHRP2) W.E.B. grant, but further research into tool documentation and reflection on the purpose of the facilities proposed in each case study revealed that project purpose was key to selecting one of the WEB tools as most applicable. Correspondence with the Federal Highway Agency (FHWA), United States Department of Transportation John A. Volpe National Transportation Systems Center (Volpe), and their consultants confirmed that most often a single tool is applicable to a given project, based on its purpose, and there are times when two tools should not be used together. For example, DVRPC was directed not to use the Market Access tools and Connectivity tools for the same case study, as double-counting of benefits would likely occur. Table 1 shows guidance from W.E.B. tool documentation as to what tool to use, based on project type.

Table 1: EconWorks W.E.B. Tool Applicability by Project Type

Project Type	Traffic Impact (1)	Reliability Tool (2)	Effective Density Access Tool (3)	Intermodal Connectivity Tool (4)
Capacity Expansion to reduce congestion on existing route	YES	Yes		
New or Upgraded Route to enhance access from residential areas to employment centers	YES		YES	
New or Upgraded Route to enhance truck delivery market area	YES		YES	
New or Upgraded Route to enhance truck movement to/from air, marine or rail terminals	YES			YES
Highway Projects to enhance safety	YES			

What follows is a description of the projects DVRPC used for EconWorks W.E.B. tool application case studies, along with the rationale for the W.E.B. tool chosen. Note that all case studies used travel demand model (TDM) results from DVRPC's Travel Improvement Model (TIM). TIM 2 is the agency's four-step TDM but the version of TIM 2 varied from case study to case study. Version 1 is called TIM 2.1 and version 2 is called TIM 2.2.

The Pennsylvania Turnpike Corridor Reinvestment Project

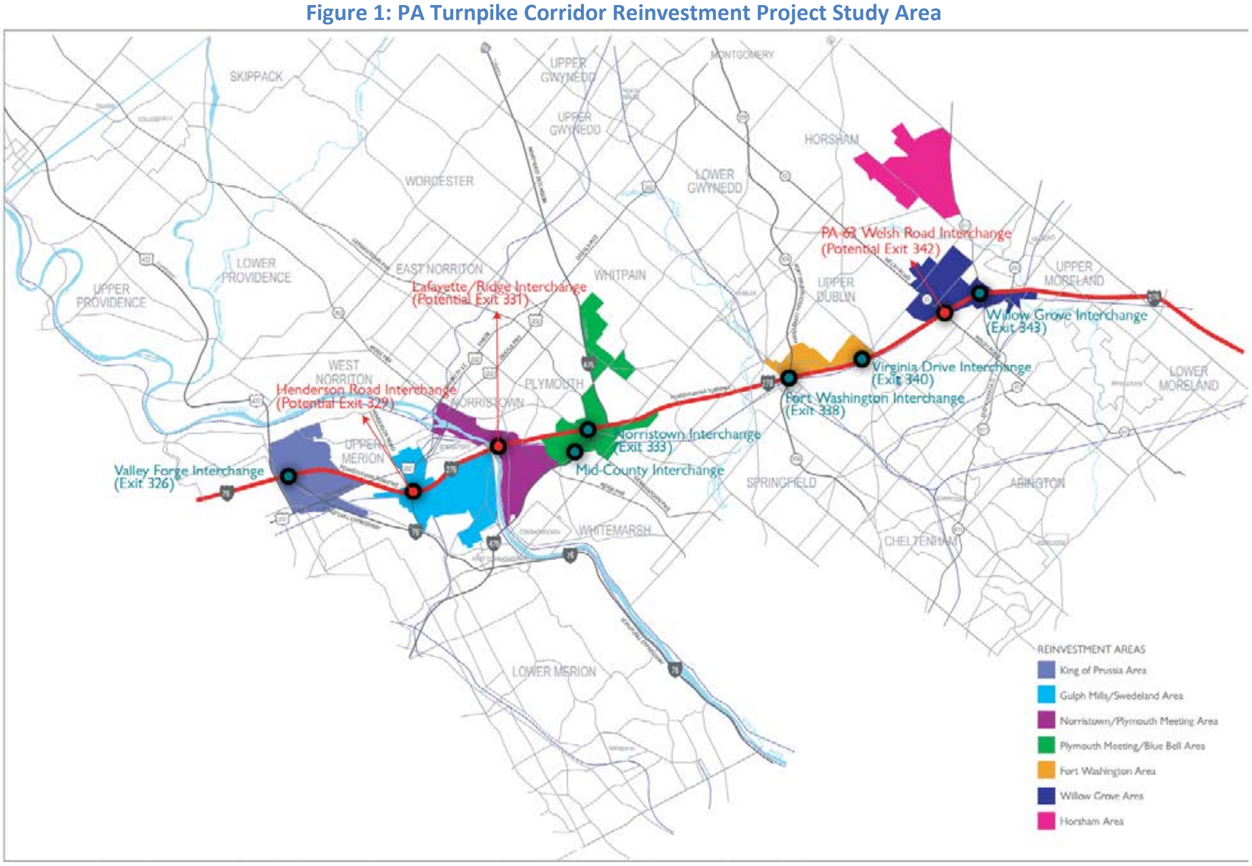
In 2015, the Montgomery Planning Commission published a study called the Pennsylvania (PA) Turnpike Corridor Reinvestment Project[1], making use of TIM 2.1 forecasts . The study examined the length of the PA Turnpike passing through Montgomery County, PA and the business parks along that corridor. It proposed a combination of rezoning some of those business parks and improvements made to the turnpike—either reconfiguring some current interchanges or adding new interchanges for better

[1] http://www.montcopa.org/DocumentCenter/View/7887

accessibility to and from the business parks. The age of the business parks provides an opportunity for revitalization as mixed use centers. New tolling technology that reads license plates on the main line of the turnpike creates an opportunity to reconfigure the circuitous on and off ramps through toll booth facilities into slip ramps that directly feed into the business parks. The smaller footprints of the slip ramps allow for more access points along the turnpike that alleviate congestion along local roads, funneling traffic to and from existing interchanges.

Figure 1 shows the study area of the PA Turnpike Corridor Reinvestment Project. The PA Turnpike mainline is in red with the seven business parks along the corridor in various colors shown in the legend. The blue circles show the location of existing interchanges while the red ones are proposed. Only Mid-County and Norristown interchanges, in the center, are proposed to remain unaltered.

Figure 1: PA Turnpike Corridor Reinvestment Project Study Area



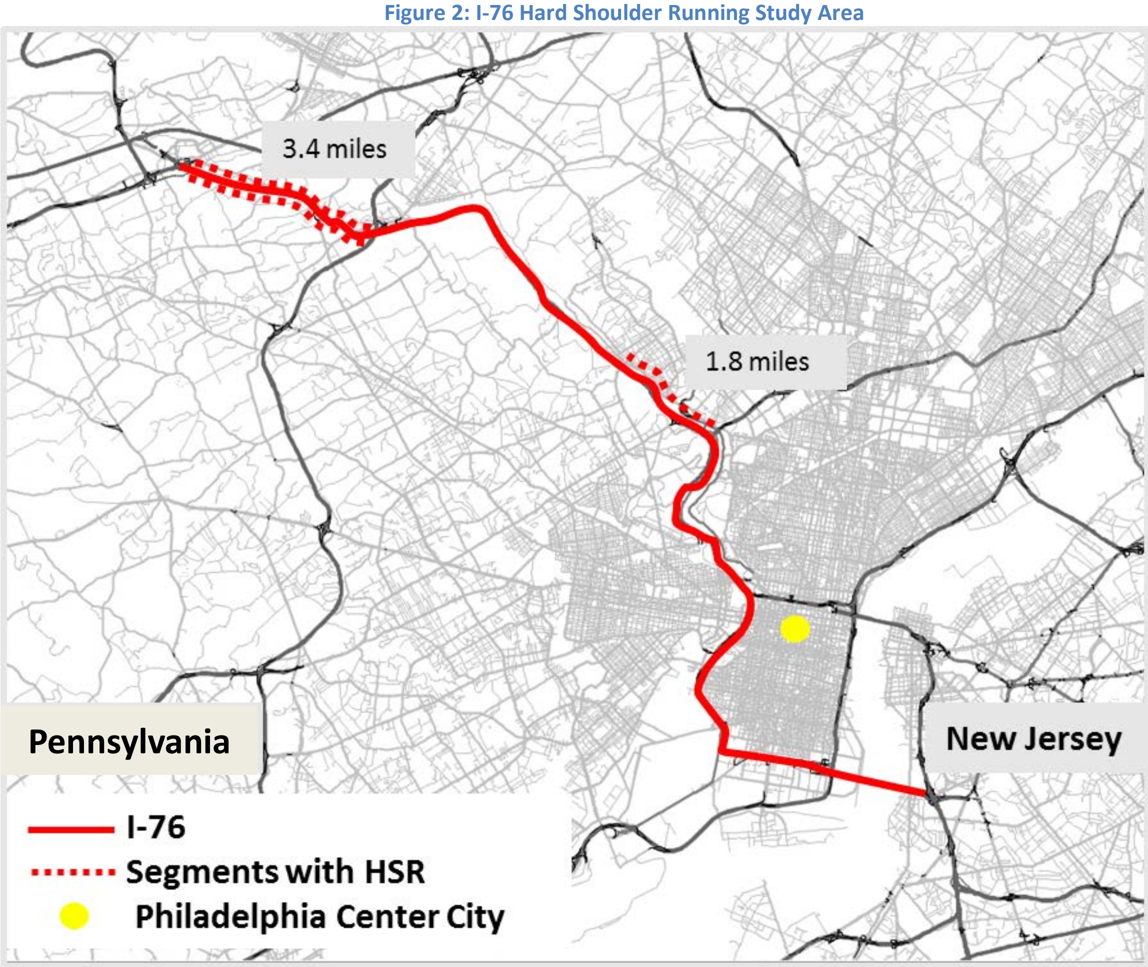
Source: Montgomery County Planning Commission

Accessibility to and from the business parks for workers and goods is the main goal of the project. This goal is addressed in Table 1's "new or upgraded route to enhance access from residential areas to employment centers" project type along with "new or upgraded route to enhance access from residential areas to employment centers." Still, the increased population and employment that come with the new and upgraded interchanges for these business parks in our TDM make the accessibility benefits attributable to the new facilities less discernable. This challenge will be discussed later in the document.

Hard Shoulder Running on the Schuylkill Expressway (I-76)

In a region where many congested corridors run through built-out communities or through environmentally sensitive areas it is difficult to obtain support for capacity expansion projects. The engineering involved with compensating for the physical constraints and make these projects very costly. Hard shoulder running (HSR) treatments are increasingly considered as potential relief measures for Greater Philadelphia's most congested, unreliable corridors and come at a fraction of the cost of roadway widening. Seen in Figure 2, the I-76 Schuylkill Expressway, running from southwestern Montgomery County, PA to the City of Philadelphia, is the most congested, unreliable corridor in the region. Our long-range plan calls for hard shoulder running treatments to help alleviate some of the adverse effects of the corridor's volume at peak periods. Since congestion and reliability are the chief concerns, the Reliability EconWorks W.E.B. tool appeared best suited for the analysis.

Figure 2: I-76 Hard Shoulder Running Study Area



Two sections of I-76 were modeled with TIM 2.2 for our long-range plan. The first is the 3.4-mile section of I-76 between the I-476 interchange and US 202 interchanges, where hard shoulder running is being considered as a capacity improvement option along eastbound (EB) and westbound (WB) I-76. This section of the study area is shown in Figure 3.

The second section of the study area includes the 1.8-mile section of I-76 between the US 1 interchange and Manayunk, where hard shoulder running is being considered as a capacity improvement option along WB I-76. This section of the study area is shown in Figure 4.

Figure 3: I-76 EB and WB between I-476 and US 202

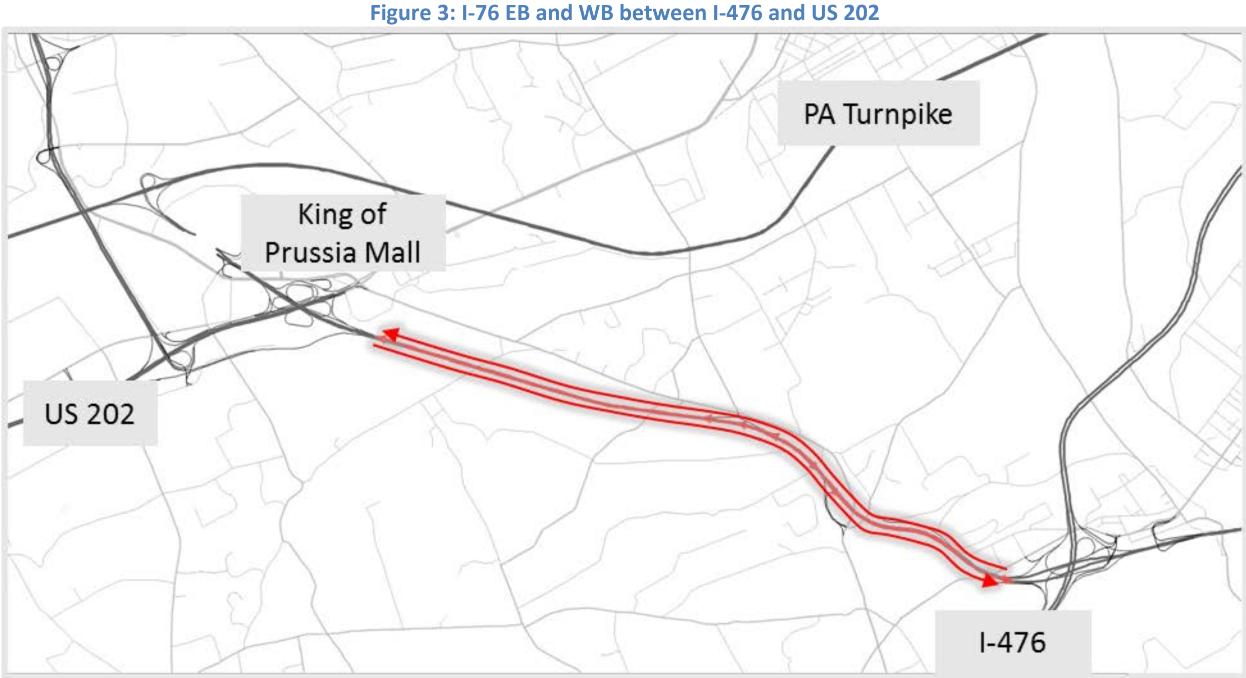
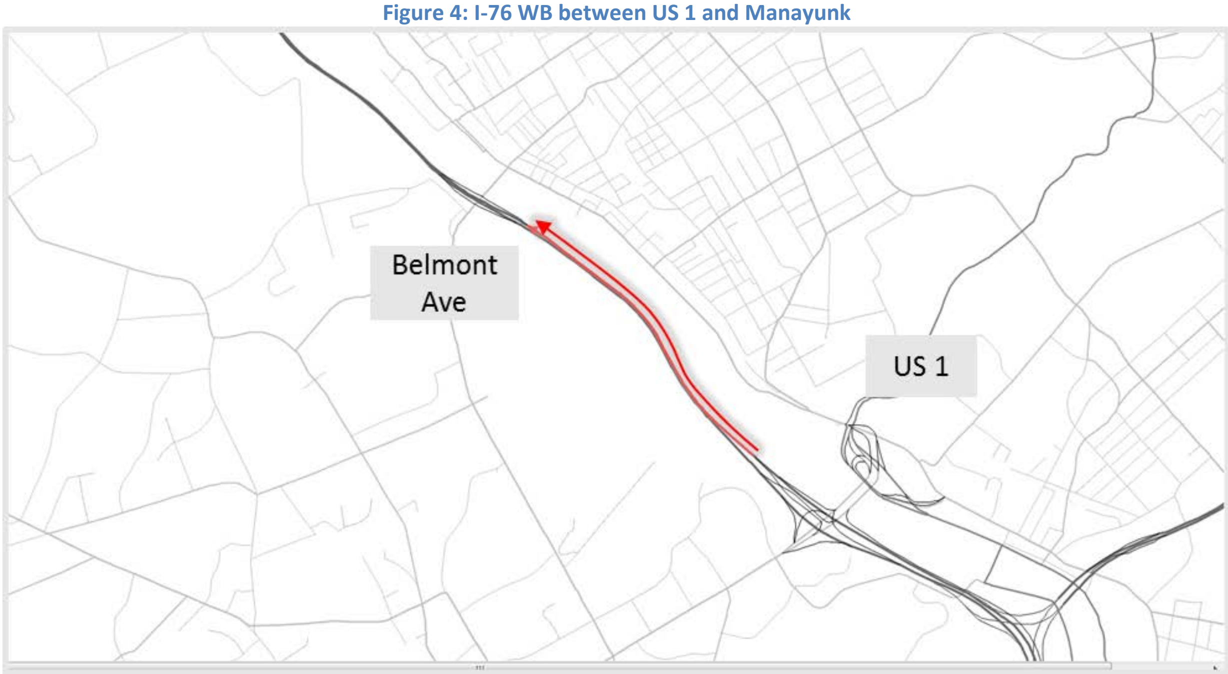


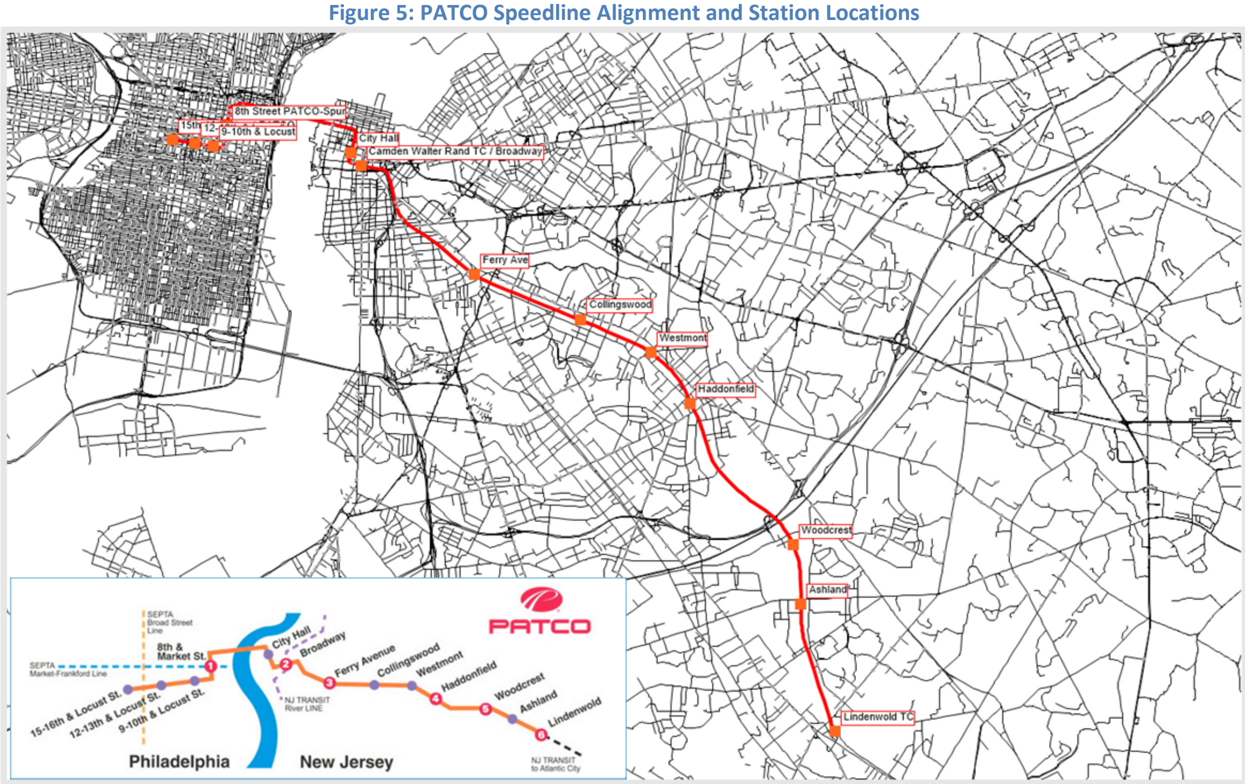
Figure 4: I-76 WB between US 1 and Manayunk



PATCO Speedline

In 2013 DVRPC experimented with modeling the traffic effects of a region with and without the Port Authority Transit Corporation (PATCO) Speedline. This commuter rail line connects suburban and urban New Jersey communities with Center City Philadelphia. Figure 5 show the alignment and station locations for PATCO. By taking cars off the road, PATCO alleviates congestion and traffic incidents on many corridors and bridge crossings with a similar traffic flow. PATCO connects labor markets, as well, but PATCO serves many choice riders who might be able to drive into Center City with similar and sometimes better travel times than taking the train. Many riders see it as a reliable service that is less costly than parking in Center City and paying tolls at river crossings.

Figure 5: PATCO Speedline Alignment and Station Locations



The Reliability tool was determined to be the best tool estimating benefits because of the congestion relief PATCO provides, along with the fact that W.E.B. tool documentation indicated the Reliability tool could be used for transit analysis. The tool was recommended for examining parallel highway corridors or other segments most impacted by increased volume when PATCO is eliminated from the model network.

Accessibility Tool Applications

The Pennsylvania Turnpike Corridor Reinvestment Study

Buyer Supplier Tool

Inputs

Constant Decay Factor: a range of decay factors from 1 to 3 was used to test potential impacts. This range was broken into intervals of 0.5, yielding a total of 5 sets of values for each of the model time periods.

Productivity Elasticity: a range of elasticities were used to test results of tool. The Accounting-Framework-Tool appears to indicate a preferred elasticity of 0.02 for the service industries which comprise the vast majority of employment in the business parks.

Activity (Total Employment): taken from the travel model's transportation analysis zone employment data derived from DVRPC's National Establishments Time Series (NETS) data.

Impedance (TTC): No Build and Build impedances were taken from the Total Highway Travel Time (TTC) Matrices in the respective scenarios and time periods. TTC was used instead of In-Vehicle Time (IVT) as it was felt that at the regional level the time associated with activities like accessing one's vehicle and parking search, as well as the time values of any tolls, would give a more thorough representation of the change in perceived cost on the part of drivers. It should be noted that the absolute change in TTC is equal to the absolute change in IVT.

Estimating GRP: Using per capita GDP data for the Philadelphia-Camden-Wilmington MSA from the Bureau of Economic Analysis (BEA) a total GDP for the DVRPC 9-county modeling area was estimated based on the total 9-county population in the model. Census Transportation Planning Products (CTPP) earnings data were then used to estimate the share of total earnings by geography of interest—in this case, the seven business park districts in the study. These district-level earnings shares were then multiplied by the regional GDP to estimate GRP by district for use in the Buyer-Supplier-Market-Access-Tool.

Results

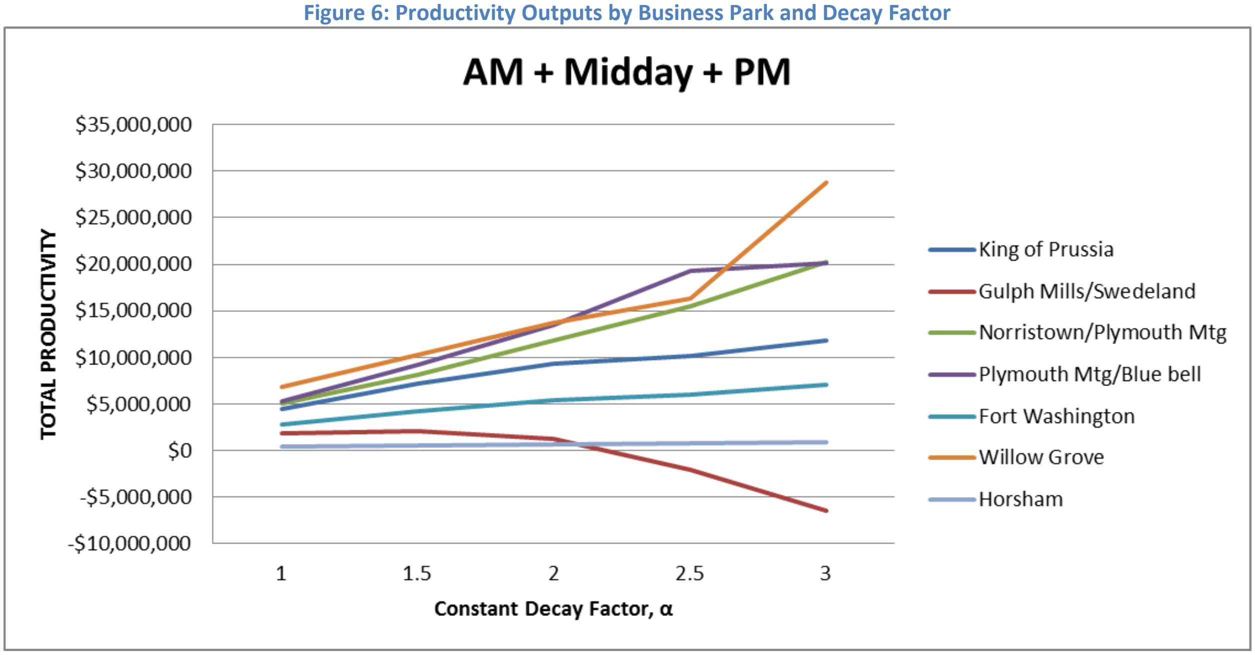
Due to the low demand for night time travel to the business parks of interest, this time period was excluded from the aggregate benefit results for this tool. This was done on the basis of the tool lacking an input for demand and the belief that the midday off-peak values would be the best representation of the benefits that accrue for off-peak travelers and movements.

The results of the tool varied by decay and productivity inputs. Table 2 and Figure 6 show that using an input value of 0.02 for service type jobs the total productivity benefits of increased access to the business parks generally trends upward as the decay factor increases. This is likely a result of the proximity of these parks to one another. There is a clear outlier to this trend at the Gulph Mills/Swedeland business park. Under the build scenario the skim values for Gulph Mills/Swedeland to the majority of Philadelphia actually increase, in the case of the AM time period generally between one and two minutes. Given the high density of employment in these districts, and their proximity to the Montgomery County business park corridor, it would make sense that as the value of destinations further away decreases there will be fewer other areas to diffuse the negative impact of increased times to or from locations closer in.

Table 2: Productivity Outputs by Business Park and Decay Factor

AM + Midday + PM	TOTAL PRODUCTIVITY($)				
Constant Decay Factor, α	**1**	**1.5**	**2**	**2.5**	**3**
King of Prussia	$4,494,529	$7,189,501	$9,353,195	$10,162,384	$11,812,249
Gulph Mills/Swedeland	$1,797,040	$2,104,675	$1,210,587	-$2,056,118	-$6,487,390
Norristown/Plymouth Mtg	$5,071,496	$8,200,233	$11,817,804	$15,444,346	$20,240,930
Plymouth Mtg/Blue Bell	$5,347,531	$9,209,592	$13,509,603	$19,311,895	$20,073,672
Fort Washington	$2,814,221	$4,194,010	$5,396,672	$6,028,166	$7,106,396
Willow Grove	$6,781,750	$10,324,053	$13,698,062	$16,278,045	$28,766,415
Horsham	$396,874	$589,275	$678,026	$828,271	$905,338
Total	**$26,703,441**	**$41,811,339**	**$55,663,949**	**$65,996,989**	**$82,417,610**

Figure 6: Productivity Outputs by Business Park and Decay Factor



Labor Market Access Tool

Inputs

The industry sector of interest for the business parks access study was selected to be Professional, Scientific, and Technical Services (NAICS 54). This industry represents approximately twenty percent (19.5%) of total employment for all of the parks of interest, and has the largest share in four of the seven parks.

Wages per hour of $39.92 were taken from BLS.gov industry specific data and represent the average wage for workers in this industry for May 2016.

Results

Across all business parks, zones and employment accessible within threshold increase under the build scenario. The change in concentration index by Business Park is more variable, with increase or decrease depending on time period analyzed. In all time periods analyzed except for midday, the total change in concentration index, for all business parks, is negative. See tables 3, 4, 5, and 6 for results by time period.

Overall, the increases in zonal access and employment access point to a positive impact associated with this project. The accounting framework asks for Effective Density values from the Labor Market tool, but the guidance appears to indicate that Employment Accessible (EA) should be used (which makes sense given that the Labor Market tool does not calculate effective density).

Table 3: Labor Market Access Outputs (AM)

AM — **OUTPUTS**

	ZA = Zones Accessible within Threshold			*EA = Employment Accessible (sectoral) within Threshold*			*CI= Concentration Index*		
EMPLOYMENT CENTERS	**ZA (No-Build)**	**ZA (Build)**	**Difference in ZA**	**EA (No-Build)**	**EA (Build)**	**Difference in EA**	**Base Year CI (No-Build)**	**Reference Year CI (Build)**	**Difference in CI**
King of Prussia	27	27	0	121,658	123,614	1,956	1.1000	1.1166	0.0167
Gulph Mills/Swedeland	51	55	4	116,937	127,488	10,551	1.1683	1.1130	-0.0552
Norristown/Plymouth Mtg	73	83	10	98,345	121,043	22,699	1.1678	1.0675	-0.1003
Plymouth Mtg/Blue bell	97	111	14	90,594	113,360	22,766	0.9735	1.0486	0.0751
Fort Washington	126	142	16	91,610	98,117	6,507	0.8753	0.8729	-0.0024
Willow Grove	155	172	17	82,601	88,324	5,723	0.8103	0.8507	0.0404
Horsham	171	190	19	48,567	54,684	6,116	0.8712	0.8590	-0.0122
TOTAL	***700***	***780***	***80***	***650,312***	***726,630***	***76,318***	***6.9664***	***6.9283***	***-0.0380***

Table 4: Labor Market Access Outputs (MD)

MD — **OUTPUTS**

	ZA = Zones Accessible within Threshold			*EA = Employment Accessible (sectoral) within Threshold*			*CI= Concentration Index*		
EMPLOYMENT CENTERS	**ZA (No-Build)**	**ZA (Build)**	**Difference in ZA**	**EA (No-Build)**	**EA (Build)**	**Difference in EA**	**Base Year CI (No-Build)**	**Reference Year CI (Build)**	**Difference in CI**
King of Prussia	35	37	2	142,616	147,441	4,825	1.1193	1.1142	-0.0050
Gulph Mills/Swedeland	71	74	3	136,447	143,509	7,062	1.0506	1.0645	0.0139
Norristown/Plymouth Mtg	108	116	8	145,228	153,808	8,580	1.0493	1.0190	-0.0303
Plymouth Mtg/Blue bell	148	159	11	147,592	155,816	8,224	0.9970	0.9976	0.0006
Fort Washington	191	204	13	140,582	145,493	4,912	0.9523	0.9356	-0.0167
Willow Grove	231	246	15	123,920	135,755	11,835	0.8887	0.9103	0.0216
Horsham	264	279	15	99,993	101,949	1,956	0.9472	0.9723	0.0251
TOTAL	***1048***	***1115***	***67***	***936,378***	***983,771***	***47,394***	***7.0043***	***7.0135***	***0.0092***

Table 5: Labor Market Access Outputs (PM)

PM	OUTPUTS								
	ZA = Zones Accessible within Threshold			*EA = Employment Accessible (sectoral) within Threshold*			*CI= Concentration Index*		
EMPLOYMENT CENTERS	ZA (No-Build)	ZA (Build)	Difference in ZA	EA (No-Build)	EA (Build)	Difference in EA	Base Year CI (No-Build)	Reference Year CI (Build)	Difference in CI
King of Prussia	15	18	3	87,410	100,206	12,796	1.2367	1.2142	-0.0225
Gulph Mills/Swedeland	28	33	5	66,282	72,432	6,150	1.1798	1.1727	-0.0071
Norristown/Plymouth Mtg	44	52	8	74,202	84,977	10,775	1.1344	1.0733	-0.0610
Plymouth Mtg/Blue bell	65	73	8	91,377	93,333	1,956	0.9944	1.0282	0.0338
Fort Washington	88	100	12	86,152	96,434	10,282	0.9209	0.8650	-0.0559
Willow Grove	111	124	13	70,592	76,322	5,730	0.7946	0.8325	0.0378
Horsham	129	146	17	63,005	74,686	11,681	0.8694	0.9222	0.0528
TOTAL	***480***	***546***	***66***	***539,020***	***598,390***	***59,370***	***7.1302***	***7.1081***	***-0.0221***

Table 6: Labor Market Access Outputs (NT)

NT	OUTPUTS								
	ZA = Zones Accessible within Threshold			*EA = Employment Accessible (sectoral) within Threshold*			*CI= Concentration Index*		
EMPLOYMENT CENTERS	ZA (No-Build)	ZA (Build)	Difference in ZA	EA (No-Build)	EA (Build)	Difference in EA	Base Year CI (No-Build)	Reference Year CI (Build)	Difference in CI
King of Prussia	45	47	2	155,313	159,843	4,531	1.0978	1.0770	-0.0208
Gulph Mills/Swedeland	96	101	5	166,322	171,562	5,240	0.9874	0.9664	-0.0211
Norristown/Plymouth Mtg	150	155	5	172,971	174,927	1,956	0.9688	0.9753	0.0065
Plymouth Mtg/Blue bell	205	210	5	174,842	176,798	1,956	0.9693	0.9757	0.0064
Fort Washington	258	264	6	168,399	176,238	7,839	0.9882	0.9983	0.0101
Willow Grove	307	313	6	155,485	157,440	1,956	1.0153	1.0226	0.0073
Horsham	348	355	7	125,288	128,693	3,404	0.9925	1.0014	0.0089
TOTAL	***1409***	***1445***	***36***	***1,118,620***	***1,145,501***	***26,882***	***7.0194***	***7.0168***	***-0.0026***

Reliability Tool Applications

Hard Shoulder Running on the Schuylkill Expressway (I-76)

Traffic Analysis and Inputs

The following is a summary of the TIM 2.2 model traffic analysis with and without the hard shoulder running treatments on the two stretches of the Schuylkill Expressway. See Table 7 for a summary of inputs.

- Segments
  - Section 1: 3.4 miles between I-476 merge ramp and US 202 exit ramp (EB and WB)
  - Section 2: 1.8 miles between US 1 entrance ramp and Manayunk interchanges, Green Lane Bridge exit (WB only)
- Build Year: 2035
- Analysis Periods
  - 6:00 AM – 7:00 PM for I-76 between US 202 and I-476
  - 3:00 PM – 7:00 PM for I-76 between US 1 and Manayunk
- Free Flow Speed – posted speed limit
  - Segment 1: 55 mph

- Segment 2: 50 mph

Table 7: Schuylkill Expressway Reliability Tool Input Summary

Segment	Existing Hourly Capacity in each Direction	Hourly Capacity in Peak Direction with HSR (vph)	Truck Percentage	2015 AADT	2035 AADT (with HSR)	Traffic Annual Growth Rate
1. I-76 between I-476 and US 202	4,200	5,249	24%	104,566	111,987	0.34%
2. I-76 between US 1 and Manayunk	4,200	5,118	16%	118,487	122,133	0.15%

DVRPC's TIM 2.2 model uses Average Weekday Daily Traffic (AWDT). The Reliability tool calls for annual average daily traffic (AADT). For consistency with the model results, DVRPC's most recent (2014) AADT to AWDT conversion factor was (1.043) was applied to the 2015 AADT traffic count data.

Tool Analysis and Results

The inputs above were entered into the Reliability tool to determine the existing and future total annual weekday delay and congestion costs. The tables below show the outputs of the Reliability tool for existing (Table 8) and future (Table 9) conditions along both sections of the study area with and without the hard shoulder running treatments.

Table 8: Schuylkill Expressway Reliability Tool Results – Current Year Conditions with and without HSR Improvements

Year 2015	**I-76 : US 202 to I-476**		**I-76 North of Philadelphia between US 1 and Manayunk**	
	without HSR	with HSR	without HSR	with HSR
Congestion Metrics				
Overall mean TTI	1.19	1.07	2.04	1.18
TTI_{95}	1.60	1.24	3.51	1.59
TTI_{80}	1.28	1.09	2.61	1.25
TTI_{50}	1.13	1.04	1.91	1.11
Pct. trips less than 45 mph	22.53%	9.28%	73.33%	22.80%
Pct. trips less than 30 mph	3.56%	1.12%	42.41%	2.20%
Total Annual Weekday Delay (veh-hrs)				
Total Equivalent Delay	187119	71642	275900	42059
Recurring Equivalent Delay	168051	68542	211180	38099
Passenger Delay	123726	49957	175919	31279
Commercial Delay	44326	18585	35261	6820
Incident Equivalent Delay	19068	3100	64721	3959
Passenger Delay	12775	2051	50737	3046
Commercial Delay	6293	1049	13983	913
Total Annual Weekday Congestion Costs ($)				
Total Equivalent Delay	$4,651,245	$1,786,787	$6,261,394	$959,825
Recurring Equivalent Delay	$3,896,114	$1,594,084	$4,678,767	$848,481
Passenger Delay	$2,162,952	$871,310	$3,217,825	$568,428
Commercial Delay	$1,733,162	$722,774	$1,460,942	$280,053
Incident Equivalent Delay	$755,131	$192,703	$1,582,626	$111,344
Passenger Delay	$362,313	$90,842	$975,309	$66,581
Commercial Delay	$392,818	$101,861	$607,318	$44,762

Table 9: Schuylkill Expressway Reliability Tool Results – Future Year Conditions with and without HSR Improvements

Year 2015	I-76 : US 202 to I-476		I-76 North of Philadelphia between US 1	
	without HSR	with HSR	without HSR	with HSR
Congestion Metrics				
Future year - 2036	1.45	1.12	2.29	1.30
TTI_{95}	2.17	1.37	4.00	1.93
TTI_{80}	1.69	1.16	3.00	1.44
TTI_{50}	1.38	1.07	2.16	1.22
Pct. trips less than 45 mph	36.83%	13.91%	83.41%	34.05%
Pct. trips less than 30 mph	17.12%	2.18%	54.53%	5.67%
Total Annual Weekday Delay (veh-hrs)				
Total Equivalent Delay	515387	139104	356407	80728
Recurring Equivalent Delay	462937	133090	272811	73133
Passenger Delay	342836	97367	227376	60187
Commercial Delay	120101	35723	45435	12946
Incident Equivalent Delay	52450	6014	83596	7595
Passenger Delay	35399	3998	65578	5861
Commercial Delay	17051	2017	18018	1734
Total Annual Weekday Congestion Costs ($)				
Total Equivalent Delay	$12,757,721	$3,460,309	$8,084,662	$1,838,438
Recurring Equivalent Delay	$9,662,837	$2,916,882	$5,980,477	$1,525,255
Passenger Delay	$5,478,954	$1,614,944	$4,120,822	$1,032,243
Commercial Delay	$4,183,883	$1,301,938	$1,859,655	$493,011
Incident Equivalent Delay	$3,094,884	$543,427	$2,104,185	$313,183
Passenger Delay	$1,518,390	$260,308	$1,298,824	$189,646
Commercial Delay	$1,576,493	$283,119	$805,361	$123,537

The total annual weekday delay and congestion cost savings were determined based on the results obtained from the reliability tool and are shown in Table 10.

Table 10: Schuylkill Expressway Reliability Tool Results – Future Year Total Savings with HSR Improvements

	I-76 US 202 to I-476			*I-76 North of Philadelphia between US 1 and Manayunk*		
Year 2035	Without HSR	With HSR	Difference	Without HSR	With HSR	Difference
Total Annual Weekday Delay (veh-hrs)						
Total Equivalent Delay	**515,387**	**139,104**	**376,282**	**356,407**	**80,728**	**275,679**
Recurring Equivalent Delay	462,937	133,090	329,847	272,811	73,133	199,678
Passenger Delay	342,836	97,367	245,469	227,376	60,187	167,189
Commercial Delay	120,101	35,723	84,378	45,435	12,946	32,489
Incident Equivalent Delay	52,450	6,014	46,435	83,596	7,595	76,001
Passenger Delay	35,399	3,998	31,401	65,578	5,861	59,717
Commercial Delay	17,051	2,017	15,034	18,018	1,734	16,284
Total Annual Weekday Congestion Costs ($)						
Total Equivalent Delay	**12,757,721**	**3,460,309**	**9,297,412**	**8,084,662**	**1,838,438**	**6,246,225**
Recurring Equivalent Delay	9,662,837	2,916,882	6,745,955	5,980,477	1,525,255	4,455,223
Passenger Delay	5,478,954	1,614,944	3,864,010	4,120,822	1,032,243	3,088,579
Commercial Delay	4,183,883	1,301,938	2,881,945	1,859,655	493,011	1,366,644
Incident Equivalent Delay	3,094,884	543,427	2,551,456	2,104,185	313,183	1,791,002
Passenger Delay	1,518,390	260,308	1,258,082	1,298,824	189,646	1,109,178
Commercial Delay	1,576,493	283,119	1,293,374	805,361	123,537	681,824

Reliability Tool Observations and Recommendations

Customized Hourly Traffic Distribution

The DVRPC research team suggests considering the peak hour information since the peak hour percent and time changes from location to location for more information, see the PATCO section below. Additionally, the team suggests including the directional peak information for the tool to closely resemble specific project areas.

Asymmetric Infrastructure Improvement

In the case of Hard Shoulder Running on I-76 (North of Philadelphia between US 1 and Manayunk), westbound (WB) direction with HSR would have 3 travel lanes, while EB traffic would only have 2 travel lanes. However, the spreadsheet model does not have a provision for a roadway with an odd number of lanes.

In addition, tables 3 and 4 in the Reliability Tool User Guide (pages 11-12) shows that calculation of the delays and congestion cost is done for each direction individually for multilane highways. This has been confirmed by viewing results in debugging mode. When a future project only improves traffic condition in one direction, a user needs to choose either 6am-9am or 3pm-7pm as analysis period to be consistent with the peak period of the affected direction. In reality when a corridor is congested throughout the day, the project may improve traffic during "peak" and "off-peak" periods.

Formatting

The research team also recommends some smaller formatting and display changes that will help users understand outputs better. First, the Future year shown in the results tab is 2022 (6 years after the current year). The year should be 2035 based on the time horizon of 20 years. Second, there is no provision to reorder the results. Adding this functionality can allow users more freedom to reorganize results in order to better understand outputs.

AWDT as potential input

The research team recommends providing an option to input Annual Weekday Daily Traffic (AWDT) to more accurately depict the Annual Weekday delays and congestion costs.

PATCO Speedline

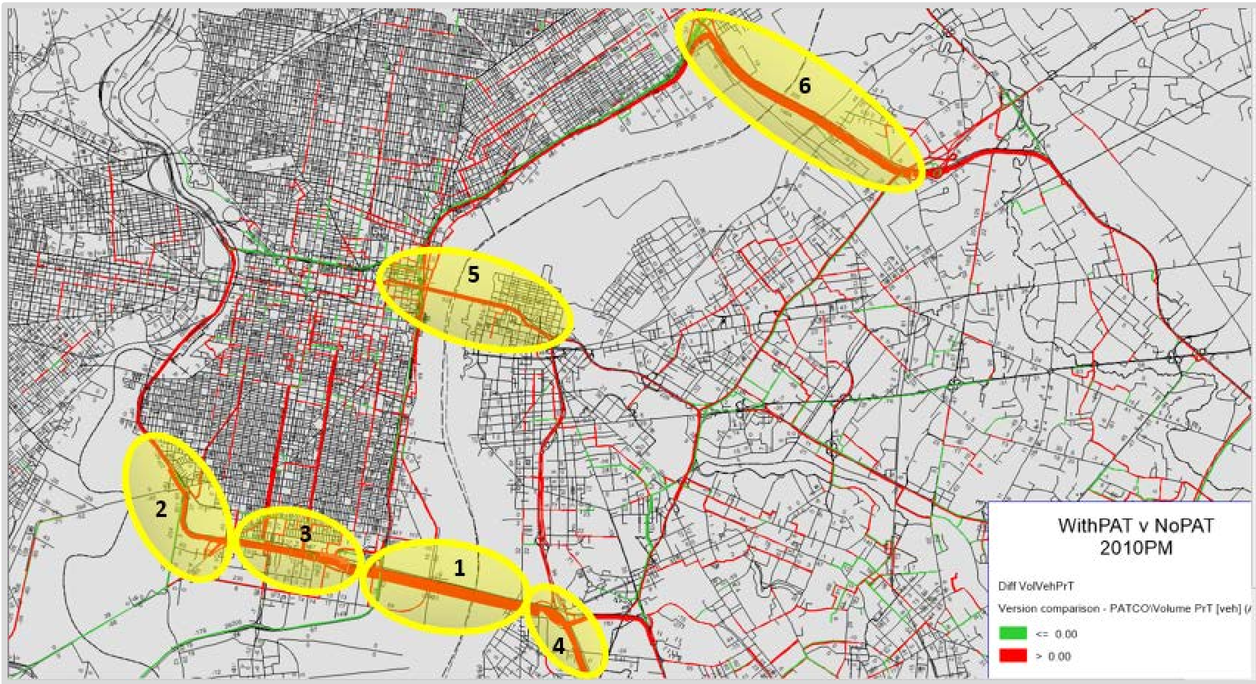
The travel modeling exercise examining the region with and without PATCO was modeled for 2010 as the only analysis year using TIM 2.1. Traffic counts and truck volumes were taken from DVRPC's traffic count database. Transportation Economic Development Impact System (TREDIS) v5 software was used to compare outputs with Reliability tool outputs as well as to calculate value of time (VOT) for auto commuters for Reliability tool inputs.

Selecting Analysis Areas

Knowing it would be unreasonable to account for the change in volume on all highway links in a world without PATCO, a set of the six areas with the largest increases in volume were selected for the analysis. Figure 7 displays the TIM 2.1 traffic assignment results of the with PATCO and without PATCO model runs, displaying by varying thickness, the red lines where volume increases most in the highway network. Circled and numbered are the six most significant impact areas for the PM peak period:

1. Walt Whitman Bridge
2. I-76 with 2 lanes in each direction East of Passyunk Ave.
3. I-76 Approaching Walt Whitman Bridge on the west side of the river (3 lanes in each direction)
4. Walt Whitman Bridge Exit on the east side of the river (3 lanes in each direction)
5. Ben Franklin Bridge
6. Betsy Ross Bridge

Figure 7: 2010 PM Peak Period Volume Difference and Impact Area (with and without PATCO)



Value of Time Calculation

In general, the VOT for passenger car depends on trip purpose (business, commute, personal) and VOT for commercial vehicle is affected by size of the vehicle and commodity type.

Based on purpose-specific VOT information from TREDIS, and the regional passenger traffic statistics by purpose by time of day from TIM 2.1, weighted average passenger car VOT can be calculated using the following formula (Truck VOT calculation is based on available truck counts at the three river crossings using the same method):

- Weighted Average Passenger Car VOT=
  - Business purpose%* $33.58+ Commute purpose%*$23.06+ Personal purpose%*$11.53
- Weighted Average Truck VOT=
  - Light-medium truck%* $32.21+ Tractor Trailer Truck%*$74.84

The results of applying these formulas are seen in Table 11 and Table 12.

Table 11: Passenger Trip Value of Time by Purpose and Regional Trip Statistics

Mode	Purpose	Buffer Time Cost Factor ($/hr per veh-trip)	Regional Annual Trips (PATCO)			
			AM	MD	PM	NT
Passenger Car	Business	33.58	93,202,813	176,909,783	146,706,658	17,275,524
Passenger Car	Commute	23.06	511,519,127	137,564,468	431,296,804	168,724,622
Passenger Car	Personal	11.53	490,224,325	766,061,378	666,920,996	399,690,984
Passenger Car	**Total**		**1,094,946,264**	**1,080,535,630**	**1,244,924,458**	**585,691,130**

Note: AM weighted average VOT is $18.71 and PM weighted average VOT is $18.11. Daily weighted average VOT is $17.5. A value of $18.5 is used for this project.

Table 12: Truck Value of Time Calculation

Vehicle Type	Location/ Direction	Light/ Medium Truck Daily Volumes[1]	Light/ Medium Truck Buffer Time Cost Factor ($/hr per veh-trip)	Tractor Trailer Truck Daily Volumes[2]	Tractor Trailer Truck Buffer Time Cost Factor ($/hr per veh-trip)	Weighted Average VOT ($/hr)
Commercial Vehicle	Walt Whitman WB	1261	32.21	2326	74.84	***59.3***
	Walt Whitman EB	2404		3384		***57.1***
	Ben Franklin WB	1509		815		***47.2***
	Ben Franklin EB	996		761		***50.7***
	Betsy Ross WB	599		988		***58.7***
	Betsy Ross EB	1050		888		***51.7***

Note:

1. *Data source: http://www.dvrpc.org/webmaps/TrafficCounts/*
2. *Based on traffic counts, ratio of light medium truck over tractor trailer truck is 1:2 throughout the day at above locations. As a result, daily volumes were used for weighted average VOT estimation.*

Pre-processing of AADT to Account for Walt Whitman Bridge Traffic Profile

The W.E.B. reliability tool uses a built-in lookup table[2] (Table 3.4-Hourly Traffic Distributions) based on a 1994 study that applies pre-defined hourly traffic distribution factors to AADT to derive peak direction hourly traffic volumes. Performance metrics are first calculated on an hourly basis and then summarized. Table 13 shows that the peak hour factors in the lookup table in general match observed data. However, Walt Whitman Bridge has much higher peak hour factors between 7am and 9am compared with the lookup table.

Further analysis of Walt Whitman Bridge traffic (refer to Figure 8) reveals that WB traffic is highly congested during AM peak with a V/C ratio around 0.92 between 7am and 9am. As a result, adjustment factor 1.34 (which is equal to 6.13/4.59) and 1.64 (which is equal to 6.24/3.8) were applied to AADT to calculate 7-8am and 8-9am statistics separately. Three sub-scenarios were created for each of Walt Whitman Bridge "No PATCO" and "PATCO" scenarios:

1. *2010 AADT *1.34*- used to derive 7am-8am hourly statistics
2. *2010 AADT*1.64*- used to derive 8am-9am hourly statistics
3. *Original AADT*-used to derive 3pm-7pm statistics.

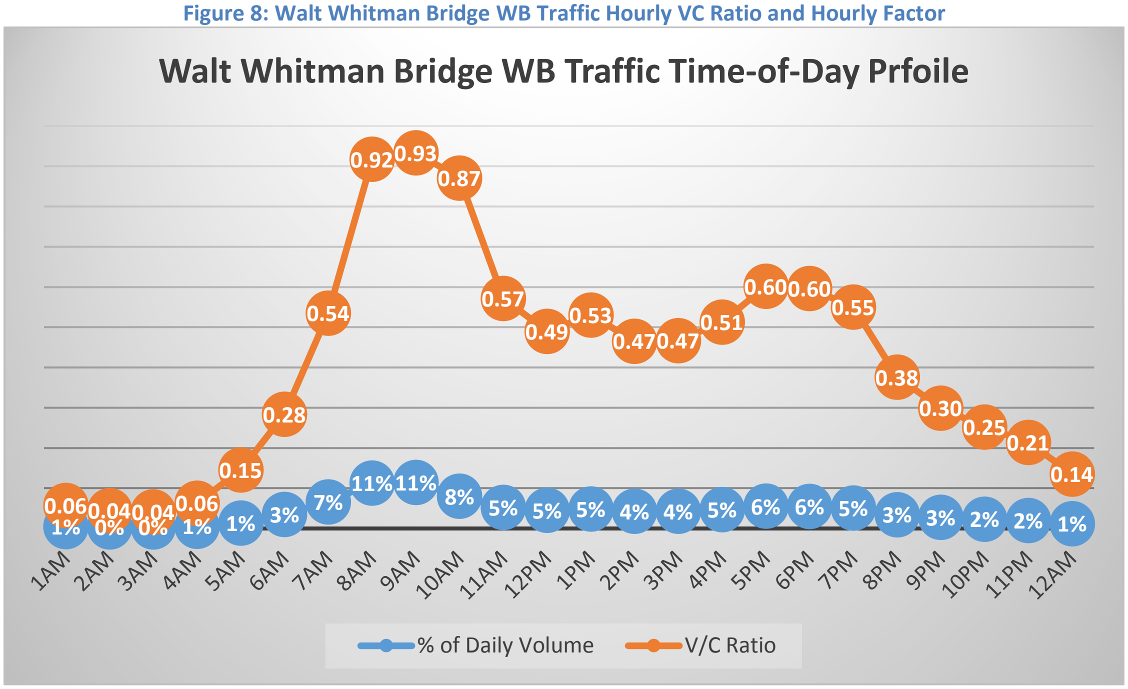
[2] *SHRP2 Project W.E.B.: Reliability Analysis Tool: Technical Documentation and User's Guide, July 2013*

Table 13 Comparison of Peak Hour Factor between Count Data and W.E.B. Lookup Table

	1. Walt Whitman Bridge	2. I-76 East of Passyunk (2 lanes in each direction)	3. I-76 West of Walt Whitman Bridge (3 lanes in each direction)	5. Ben Franklin Bridge	6. Betsy Ross Bridge	W.E.B. Tool
Time Period	**AM Peak Direction**					
5-6AM	1.90%	2.29%	2.36%	1.76%	2.17%	1.12%
6-7AM	3.58%	4.24%	4.59%	2.92%	2.40%	3.16%
7-8AM	**6.13%**	4.02%	3.71%	3.21%	2.82%	4.59%
8-9AM	**6.24%**	3.90%	4.59%	3.32%	2.78%	3.80%
	PM Peak Direction					
3-4PM	4.22%	4.30%	4.60%	3.85%	4.08%	4.01%
4-5PM	4.65%	4.61%	4.82%	3.89%	3.89%	4.81%
5-6PM	4.80%	4.81%	5.26%	3.44%	3.73%	4.85%
6-7PM	3.06%	3.40%	3.85%	3.14%	4.33%	3.23%

Note: hourly count data is not available at location 4- Walt Whitman Bridge Exit on the east side of the river.

Figure 8: Walt Whitman Bridge WB Traffic Hourly VC Ratio and Hourly Factor



Reliability Tool Input Summary

Table 14 summarizes the input data used for reliability tool testing purpose. It is worth noting that both Walt Whitman Bridge and Ben Franklin Bridge have 7 lanes with a reversible median lane to serve peak direction traffic. 6am-7pm is defined as the analysis period for all locations except for Walt Whitman Bridge, which considers 6-9am and 3-7pm separately.

Table 14: Input Data for PATCO Analysis

ID	Location	Dir.	Length (mile)	No. of Lanes	Peak Dir. Hourly Capacity	2010 noPAT Daily Volume	2010 No PATCO AADT	2010 PAT Daily Volume	2010 PATCO AADT	Daily Truck%	Passenger VOT ($/hr)	Truck VOT ($/hr)
1	Walt Whitman Bridge	WB	2.02	Peak 4/off peak 3	8000	48411	167829/ 137128	46366	159533/ 130350	6%	18.5	59.3
		EB				53924		50910		11%		57.1
2	I-76 2 lane West near Passyunk	WB	1.48	2	4000	23955	51704	23478	50032	6%		59.3
		EB				27750		26554		11%		57.1
3	Walt Whitman 3 Lane Approach	WB	0.91	3	6000	28194	68103	27050	64630	6%		59.3
		EB				39908		37580		11%		57.1
4	Walt Whitman 3 Lane Exit Segment	WB	0.67	3	6000	37325	78414	35971	75250	6%		59.3
		EB				41089		39278		11%		57.1
5	Ben Franklin Bridge	WB	1.56	Peak 4/off peak 3	8000	48074	91411	46812	88757	6%		47.2
		EB				43337		41945		4%		50.7
6	Betsy Ross Bridge	WB	1.75	3	6000	18051	39593	17013	36894	12%		58.7
		EB				21541		19881		10%		51.7

Note:

*1.Walt Whitman Bridge AADT values shown in the table include original AADT*1.64 and original AADT*1.34.*

2.Walt Whitman Bridge Truck VOT is also applied to I-76 due to lack of the information at those locations.

3.Average of Truck VOT in two directions is used as input.

Results

Seen in Table 15, benefits gained from PATCO service include a reduction of 7,000 annual weekday vehicle hours of delay on the segments analyzed, as well as a decrease of $166,057 in total annual weekday congestion costs. The most significant impact occurs at Walt Whitman Bridge during AM peak period. It was found that PATCO service change will have minimal impact on both the Ben Franklin Bridge and the Betsy Ross Bridge due to low congestion, and thus the statistics were not included in the final presentation.

Table 15 Model Results

Year 2010 No PAT Scenario					
Total Annual Weekday Delay (veh-hrs)	1. Walt Whitman Bridge	2. I-76 2 lanes in each direction	3. I-76 3 lanes in each direction	4. Walt Whitman Exit (east side)	**Total**
Total Equivalent Delay	**13,534**	**2,216**	**320**	**1,082**	17,152
Recurring Equivalent Delay	12,769	2,195	320	1,074	16,357
Passenger Delay	11,115	1,885	273	918	14,191
Commercial Delay	1,654	310	46	156	2,166
Incident Equivalent Delay	765	21	1	8	794
Passenger Delay	635	17	0	6	659
Commercial Delay	129	4	0	2	135
Total Annual Weekday Congestion Costs ($)					
Total Equivalent Delay	**$319,229**	**$53,119**	**$7,717**	**$26,075**	**$406,140**
Recurring Equivalent Delay	$300,055	$51,113	$7,646	$25,171	$383,984
Passenger Delay	$205,608	$33,999	$5,020	$16,576	$261,203
Commercial Delay	$94,447	$17,114	$2,625	$8,595	$122,781
Incident Equivalent Delay	$19,174	$2,006	$71	$905	$22,155
Passenger Delay	$11,771	$1,188	$41	$528	$13,529
Commercial Delay	$7,403	$818	$30	$376	$8,627
Year 2010 With PATCO Scenario					
Total Annual Weekday Delay (veh-hrs)	1. Walt Whitman Bridge	2. I-76 2 lanes in each direction	3. I-76 3 lanes in each direction	4. Walt Whitman Exit (east side)	**Total**
Total Equivalent Delay	**7,574**	**1,828**	**59**	**603**	**10,064**
Recurring Equivalent Delay	7,256	1,812	59	601	9,727
Passenger Delay	6,276	1,551	50	513	8,391
Commercial Delay	979	261	9	87	1,337
Incident Equivalent Delay	318	16	0	3	337
Passenger Delay	262	13	0	2	277
Commercial Delay	56	3	0	0	60
Total Annual Weekday Congestion Costs ($)					
Total Equivalent Delay	**$180,090**	**$44,031**	**$1,421**	**$14,540**	**$240,083**
Recurring Equivalent Delay	$172,024	$42,514	$1,419	$14,246	$230,204
Passenger Delay	$116,104	$28,041	$931	$9,366	$154,442
Commercial Delay	$55,920	$14,474	$488	$4,880	$75,762
Incident Equivalent Delay	$8,066	$1,517	$3	$294	$9,879
Passenger Delay	$4,859	$888	$1	$171	$5,919
Commercial Delay	$3,207	$629	$1	$123	$3,960
Difference					
Total Equivalent Delay	***5960***	***388***	***261***	***479***	***7,087***
Total Annual Weekday Conges	***$139,138***	***$9,088***	***$6,295***	***$11,536***	***$166,057***

Feedback on Reliability Tool for PATCO W.E.B. Analysis

The following commentary is feedback, based on DVRPC's experience in applying Reliability tool to the PATCO modeling exercise.

Only Part of the Benefits due to Introduction of Transit Services can be captured

Based on our experience with PATCO analysis, the reliability tool is not suitable for analyzing the economic benefits of a new or improved transit service. The impact of PATCO service on travel time reliability is twofold: a) When people choose to shift from auto to the fixed-guideway system PATCO, their some travel times are likely to be reduced and reliability of a PATCO trip is likely to be more reliable than an auto trip; b) When PATCO ridership is part of the total trips crossing the Delaware River, traffic on major roads—especially on three bridges—are significantly reduced and so the remaining vehicle trips on the roadways experience faster travel speeds and higher travel time reliability.

Since the current version of the Reliability tool is focused on the roadways of the regional transportation infrastructure, only Part B of the reliability improvement can be captured. In the future, we suggest that reliability calculation formula consider the reliability of transit services.

Hourly Traffic Distributions cannot be modified to Match Local Conditions

The Reliability tool uses a built-in lookup table (refer to the User Guide Table 3.4-Hourly Traffic Distributions) based on a 1994 study that applies pre-defined hourly traffic distribution factors to AADT to derive peak direction hourly traffic volumes. Our analysis shows that the hourly factors during 6-9 am and 3-7 pm in the lookup table are like the observed traffic pattern. However, when analyzing a heavily congested bridge (Walt Whitman Bridge in this case) which exhibits very different time of day traffic profile during AM peak period, estimation delays and congestion cost form the W.E.B. reliability tool will not be accurate. During PATCO analysis the team had to apply different hourly adjustment factors and went through several post-processing steps to improve the accuracy of the final results.

In the future, we suggest the tool provide an interface for user to modify hourly factors in the lookup table to match local traffic characteristics. Displaying the two curves will help to visualize the comparison.

Scenario Editing GUI Needs to be Improved When Multiple Scenarios Are Created

It is understood that most Reliability tool applications only involve two scenarios "Build" and "No-Build" for highway improvement. However, when the impact area is in an Urban Area the corridor often needs to be disaggregated into multiple segments (e.g., changes in number of lanes, roadway type and free flow speed). When multiple scenarios are created, modifying and checking data entry becomes difficult. In the future, we suggest the spreadsheet model provide a scenario input summary sheet for QA/QC purpose.

TREDIS Results for Comparison

This section compares the outputs of tools for estimating travel reliability benefit analysis: the TREDIS and the EconWorks W.E.B. tools. Omitted from the section is a discussion of the Pennsylvania Turnpike Corridor Reinvestment Project. This was due to the fact that the "equivalent" TREDIS result in its Market Access outputs was not functioning properly while DVRPC had access to a TREDIS subscription.

Purpose of Tools

The EconWorks W.E.B. tools are considered planning tools with a focus on the highway mode. They allow users to quickly assess the wider economic benefits of highway investments in terms of travel time reliability, market access, and freight connectivity. The tool is available to users for free and does not require highly detailed information, making them ideal for preliminary evaluation of long-range plans and corridor studies. TREDIS is a more sophisticated tool for either economic impact analysis (EIA) or more holistic benefit cost analysis (BCA) including the benefits of travel time efficiencies. It is multi-modal and includes the W.E.B. analysis types that the EconWorks W.E.B. tools provide, as well as financial analysis, and freight and trade impact analysis. However, TREDIS requires a usage license and subscription service.

The Reliability tool involves minimal data development and model calibration. It uses the results of other previous studies in its methodology to estimate recurring and non-recurring congestion and to determine the ratio of Value of Reliability over VOT (Reliability Ratio). Predictive equations are used to develop reliability metrics. Input data includes Average Annual Daily Traffic (AADT), length of the study corridor, truck percentage, free flow speed, capacity per lane, VOT and Reliability Ratio for passenger trip or commercial trip.

When using the Reliability tool, most traffic-related input data can be collected on existing corridors, including base year AADT and the annual traffic growth rate which can be used to derive future year AADT. Since the W.E.B. Module assumes that traffic volumes stay the same when project is built (induced traffic is not considered), a comprehensive regional traffic model often is not necessary for the users to understand the traffic redistribution in the network caused by road network changes. When analyzing the wider economic benefits of I-76 HSR project, DVRPC's TIM 2 has been used to estimate the 2035 (design year) corridor AADT.

Inputs to TREDIS can be generated by sketch planning methods, spreadsheets, capacity databases such as the Highway Performance Monitoring System (HPMS), surveys, or travel demand models. In this case, TIM 2 has been used to provide TREDIS with input data such as the regional total number of trips, vehicle miles traveled (VMT), vehicle hours traveled (VHT), congestion, etc.

Areas of Application

TREDIS considers all users and operators of infrastructure, including: auto and transit passengers, auto drivers, and the crew of freight or transit systems. Therefore, the tool can be used to analyze a wide variety of highway or transit-related infrastructure projects.

The Reliability tool focuses on highway improvement projects. The most common application of the Reliability tool is evaluating corridor segment(s) with lane widening. Traffic diversion and redistribution across the network or elsewhere in the network due to the project cannot be fully captured. According to its scenario input interface, highway segments are the basic unit of analysis, and input data pertains to them. Segments can be of any length but it is recommended that they not be so long that the characteristics change dramatically along the segment, or too short that input is burdensome. According to the User Documentation, reasonable segment lengths would be:

1. Freeways: between interchanges
2. Signalized highways: between signals
3. Rural highways (non-freeways): 2-5 miles

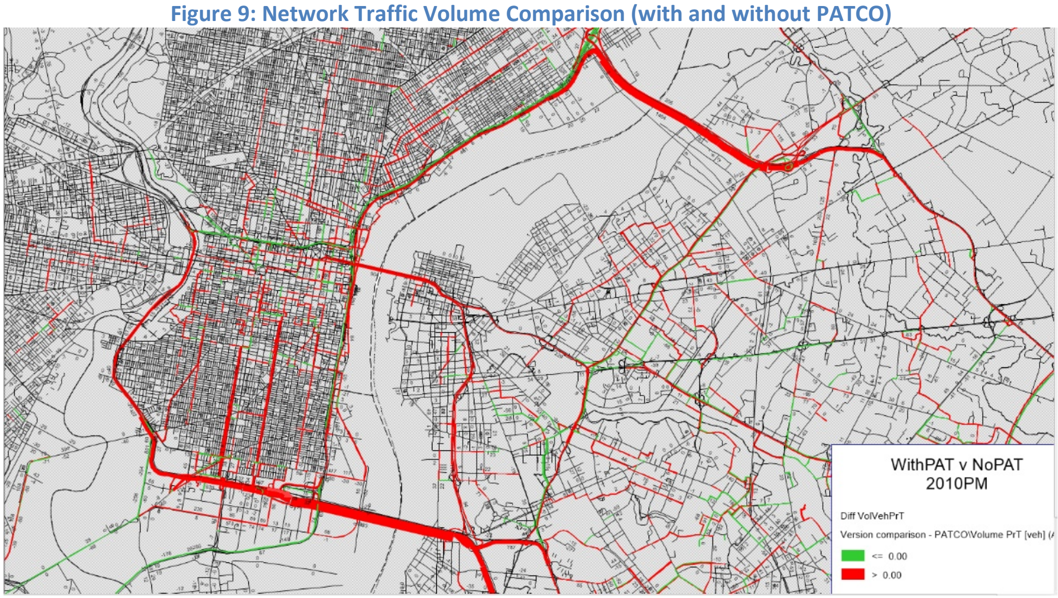
Hard Shoulder Running on the Schuylkill Expressway (I-76)

For a project with corridor length 20-50 miles long, the reliability tool can reasonably estimate the travel time reliability benefits as traffic flows affected by the roadway improvement will be largely taken into consideration. When working on the Schuylkill Expressway hard shoulder running analysis, it was found that only several short project segments are included and actual impact on the whole corridor has not been fully considered (e.g., upstream traffic will be experiencing less congestion and improved travel time reliability). Many “scenarios” would need to be defined to include all the impacted links, and the efforts would be far beyond what a typical sketch planning process would require.

PATCO Speedline

As stated above, the reliability tool is not suitable for analyzing the economic benefits of a new or improved transit service. Ideally both auto and transit reliability benefits should be considered. Currently only the highway side of the reliability benefits can be captured by the reliability tool. In addition, transit stations of fixed guideway mass transit provide all modes of access including auto access (park and ride), transit access or pedestrian access. Therefore, the origins and destinations of the transit riders can be miles away from the stations. People who work or live in the Philadelphia Center City may require additional transfers between the commuter rail and bus/subway to reach their final destination. Figure 9, from the PATCO analysis shows, that new or improved transit service may have significant traffic impact on the regional road network because of the unique origin/destination pattern of the transit riders. The EconWorks W.E.B. tools will not be able to fully capture system-wide congestion and reliability cost of trips on all the links impacted by the project (with traffic volume differences). As a result, the calculated benefits have been significantly underestimated.

Figure 9: Network Traffic Volume Comparison (with and without PATCO)



Study Area

TREDIS has the capability to analyze the regional impact of a specific project, and all outputs including total trips, VMT, VHT, passenger trips, passenger miles, and freight US Ton trips/miles/hours are regional statistics. The study area considered for this analysis coincides with TIM 2 modeling area.

The reliability tool is suitable for considering one roadway segment with uniform traffic and roadway characteristics. Benefits are calculated only for the project site(s) or segments close to the project area. Therefore, to capture the actual impact of a project on regional reliability, each individual link in the network with traffic volume change will be defined as a “scenario” and outputs from all these scenarios have to be combined to obtain the overall impact.

Final Result Comparison

Both TREDIS and the W.E.B. tools calculate VOT savings and value of travel time reliability using different terms (refer to Table 16 below).

Table 16: Definition of Reliability Analysis Results

Item	TREDIS	W.E.B.
Value of Time Savings	Changes in Value of In-Vehicle Travel Time (IVTT)	Changes in Recurring Congestion Delays
Value of Travel Time Reliability Improvement	Changes in Value of Improved Travel Time Reliability	Changes in Non-Recurring (Incident) Congestion Delays

As seen in Table 17, for PATCO analysis, TREDIS has a much higher value of travel time savings (referred to as recurring congested travel time savings in the reliability tool) as well the value of improved travel time reliability (referred to as incident or non-recurring congestion delay savings in the reliability tool). For I-76 HSR analysis, TREDIS has a lower value of travel time savings but significantly higher value of improved travel time reliability.

Table 17 Comparison of TREDIS and W.E.B. Reliability Results

Category	Tool	Present Value ($M)	
		PATCO	I-76 HSR
Value of Travel Time Savings	TREDIS	137.940	4.710
	W.E.B.	0.154	11.000
Value of Improved Travel Time Reliability	TREDIS	3.91	95.760
	W.E.B.	0.012	4.300

PATCO

As previously mentioned, a comparison of "no PATCO" and "with PATCO" shows that links with volume differences are wide spread in the roadway network (refer to Figure 7). In theory, all these links should be included in the calculation. Many streets which are already near or at capacity currently during peak periods within the Philadelphia Center City will likely experience drastic changes in travel delays and queuing at closely spaced signalized intersections even if the absolute volume increase is moderate. However, only several river crossings and the major roads where significant volume changes are expected were included in the reliability tool calculation. In addition, the reliability tool does not consider the benefit gained by current motorists who switch to the PATCO Speedline.

I-76 HSR

As previously mentioned, only the segments with future HSR were included in the calculation. Traffic runs through the whole corridor as a continuous flow between US 202 and Philadelphia Center City. A traffic bottleneck at one location caused by congestion or incident will impact the whole corridor within its impact area, and vice versa, considering hard shoulder running will not only benefit the project location but also the segments along the corridor.

Accounting Framework Spreadsheet

Introduction

The W.E.B. accounting framework spreadsheet lays out the categories of direct economic benefits that a given roadway improvement may have on travelers using it, and on the operation of businesses that depend on it (for workers, customers, or deliveries).

The spreadsheet shows how these wider effects (i.e., reliability benefit, market access benefit, and intermodal connectivity benefit) can be incorporated into benefit-cost analysis. Many of the wider benefit metrics that are generated here can also be applicable for multi-criteria ratings and as input to macroeconomic impact models.

Input and Output Data

Table 18 and Table 19 show the input and output data for PATCO and I-76 HSR analysis, respectively. In the table, *Incident delay hours by trip type* (passenger trips or commercial trips) for No Build and Build scenario are directly from the W.E.B. Reliability module results. The difference between these two values is defined as "Diff" in the table. The *Value of Total Benefit* is equal to Diff * Multiplier Value[3].

Table 18 Accounting Framework Input/Output Data (PATCO)

Benefit Category	Benefit Element	No Build Scenario	Build Scenario	Diff	Multiplier Value	% Diff	Elasticity Value	% Change in GRP (% Diff x	GRP Value (Tab 4b) (in $M's)	Value of Total Benefit
Passenger										
Reliability	Incident Delay hours (in veh-hrs)	659	277	-382	$17.76	--	--	--	--	**$6,784**
									Total ----->	**$6,784**
Commercial										
Reliability	Incident Delay hours (in veh-hrs)	135	60	-75	$69.09	--	--	--	--	**$5,182**
									Total ----->	**$5,182**

Table 19 Accounting Framework Input/Output Data (I-76 HSR)

Benefit Category	Benefit Element	No Build Scenario	Build Scenario	Diff	Multiplier Value	% Diff	Elasticity Value	% Change in GRP (% Diff x	GRP Value (Tab 4b) (in $M's)	Value of Total Benefit
Passenger										
Reliability	Incident Delay hours (in veh-hrs)	100,977	9,859	-91,118	$17.76	--	--	--	--	**$1,618,256**
									Total ----->	**$1,618,256**
Commercial										
Reliability	Incident Delay hours (in veh-hrs)	35,069	3,750	-31,319	$50.82	--	--	--	--	**$1,591,632**
									Total ----->	**$1,591,632**

Feedback on EconWorks Accounting Framework

Based on our experience in applying W.E.B. accounting framework tool to both PATCO and I-76 HSR, it has been found that the *Value of Total Benefit (reliability benefit in this case)* calculated from this tool is different from the output of the W.E.B. reliability module (See Table 20), but we do not know why this is

[3] The multiplier value is equal to *VOT * Vehicle Occupancy Rate * Reliability Ratio*. The VOT for different vehicle trips is shown in Table 11. Note that Vehicle occupancy rate is 1.2 for passenger trips and is 1.1 for commercial trips. In addition, Reliability Ratio is 0.8 for passenger trips and is 1.2 for commercial trips.

the case. Refer to sections above for details of W.E.B. reliability Module results for I-76 HSR and PATCO analysis.

Table 20 W.E.B. Reliability Module vs. Accounting Framework Spreadsheet

Reliability Benefit	W.E.B. Reliability Module (1)	Accounting Framework Spreadsheet (2)	Difference (1-2)
HSR			
Passenger trips	$2,367,261	$1,618,256	$749,005
Commercial trips	$1,975,198	$1,591,632	$383,566
PATCO			
Passenger trips	$7,609	$6,784	$825
Commercial trips	$4,667	$5,182	($515)

Informing Decision Making & Changing Programming Processes

DVRPC staff had hoped to find a low- to no-cost tool that we could create standard inputs for from our travel model outputs. The ideal tool would be one we could run without regard to the project type, mode, or purpose—a one-size-fits-all tool that would give standard outputs we could use to score one project against the next (perhaps for Long Range Plan projects). We learned that such a tool may not be available, or perhaps appropriate. Wider economic benefits are by nature contextual and may have double counts if all W.E.B. tools could be used simultaneously. Standard travel time benefit tools may be more applicable across mode and project types but would ignore the wider economic benefits that one project may have over another—showing only an portion of a project's economic potential.

The result is our staff is more knowledgeable about the tools available and their limits. The W.E.B. tools allowed staff to take better stock of what data we collect and generate from our travel demand modeling studies. We are more empowered to use these tools if the context of the study is right for that kind of analysis. Having collected the data for these tools in the case studies allows us to more readily know what we would need if we chose to use the tools for a future study.