US 422 Improvements – Potential Economic Impacts

Report Submitted to:

Select Greater Philadelphia
200 South Broad Street, Suite 700
Philadelphia, PA 19102

Report Submitted by:

Econsult Corporation
Sixth Floor
3600 Market St.
Philadelphia, PA 19104

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Introduction

The 422 corridor stretches between Norristown and Reading, and includes US 422 ("422") itself, the Schuylkill River, the old Reading Railroad rail line from Norristown to Reading, and the communities and land surrounding these routes. Rapid population growth, commercial development, and the lack of transportation alternatives have led to frequent and severe congestion on US 422 with congestion adding 25 additional minutes or more to the average roundtrip commute between Pottstown and King of Prussia during peak hours compared to only a few years ago. To address these transportation issues, PennDOT and Montgomery, Chester and Berks Counties, along with the Delaware Valley Regional Planning Commission (DVRPC) have developed plans to rebuild and upgrade US 422 and reintroduce rail service to the corridor. Because sufficient funding from state or federal sources is not expected to be available in the near future, the upgrades will likely require local funds, such as toll revenue generated by the individuals that use US 422.

This report illustrates some of the costs and benefits of the improvements to help inform stakeholders about how the project might impact their areas of concern. The analysis focuses on selected areas of concern, and is not meant to be a comprehensive review of the project. We evaluate impacts in three areas:

- Benefits and Costs for individuals and society;
- Fiscal impacts on municipalities;
- Property value impacts.

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The 422 corridor is expected to continue to grow, regardless of whether transportation investments are undertaken, and so the baseline against which the value of improvements is measured is not the current traffic conditions – it is the conditions that will prevail in the future if no significant investment is undertaken. Further, because losses from traffic congestion grow much faster than population once the roads reach capacity, future congestion costs will significantly exceed current congestion costs without transportation infrastructure investment.

The US 422 Corridor

The US 422 Corridor between Reading, PA and the intersection with Interstate 76 near Norristown is the most heavily traveled section of US 422 in Pennsylvania with some portions of the road carrying over 100,000 vehicles a day. The corridor is approximately 25 miles long encompassing over 200 square miles, parts of three Counties (Berks, Chester, and Montgomery), and 24 local municipalities. The corridor is already home to approximately 300,000 people and 150,000 jobs and significant growth is expected in all three counties within the Corridor. DVRPC projects that between 2000 and 2035 the population within in the corridor will increase by 20 to 25 percent, with an additional 21,000 new housing units added between

2009 and 2030. In addition, over the same 21-year period a total of approximately 28,000 new jobs will be located within the corridor.[1]

Improvements

Rail Line Improvements

The 2009 "R6 Norristown Line Service Extension Study" report prepared for the Montgomery County Planning Commission and the Delaware Valley Regional Planning Commission proffered several alternatives for providing rail service the Route US 422 Corridor. The rail service assumed in this analysis is based on Alternative 5, "Wyomissing to Philadelphia 30th Street Station – Dual Mode". This alternative would use dual power locomotives to provide service between Wyomissing and Philadelphia 30th Street Station, providing a one-seat ride from stations along the corridor into Center City Philadelphia. Service would run express east of Norristown except for station stops at Conshohocken and Temple University. Opening year operating statistics as contained in US 422 Toll and Revenue Study can be found in Table 1.

Figure 1 – Proposed Transit Alternative

[1] DVRPC. (2009). *US 422 Corridor Master Plan*. Delaware Valley Regional Planning Commission, Publication Number: 09035.

Table 1 - Proposed Transit Alternative Operating Statistics

	Operating Statistics
Round Trips per Day	*7*
Daily Ridership (2015)	*3,270*
Daily Ridership (2035)	*4,350*
Average Annual Ridership (2015)	*817,500*
Average Annual Ridership (2035)	*1,087,500*

Highway Improvements

US 422 opened in the early 1980s and by 2020 many parts will be close to the end of their economic life and will need to be reconstructed simply to keep functioning. The proposed highway improvements are a series of related projects that go beyond replacement in kind, and are designed to upgrade the road and reduce congestion. The major components of the improvements are:

- River Crossing Complex – Reconstruction of the existing expressway bridge and construction of a new expressway bridge across the Schuylkill River, a new pedestrian and bicycle bridge over the Schuylkill River, improvements to the US 422 / PA 363 interchange, and the reconfiguration of and improvement to the US 422 / PA 23 interchange;
- US 422 eastbound and westbound will be widened from US 202 to PA 29 (Phoenixville-Collegeville Road);
- Four (4) US 422 Reconstruction projects;
- Three (3) Resurfacing projects;
- Improvements to Sanatoga Interchange;
- Intelligent Transportation Systems (ITS);
- Acceleration and deceleration lane improvements at four (4) locations; and
- Intersection improvements on routes parallel and perpendicular to US 422.

Benefits and Costs for Individuals and Society

Detailed information needed to prepare a general, corridor-wide, benefit cost assessment is still being prepared.[2] However, it is possible to develop cost-benefit analyses for individual trip makers to illustrate the types and magnitudes of benefits to representative beneficiaries. We examine five individual scenarios, three people and two businesses, to assess how the transportation improvements affect their welfare. We

[2] Traffic volumes and congestion are driven by many factors, including population, employment, the availability of alternative routes or modes, the operating costs of cars, tolls, and a variety of other factors. Further, many of these factors, such as population and employment, are themselves affected by traffic volume and congestion. Detailed traffic engineering, travel time, and cost information for the planned improvements is being prepared as part of the Toll and Revenue study, led by Michael Baker, Inc., and is not complete at this time. Available results from the Baker-led study have been incorporated into this study where appropriate.

also assess society's change in welfare in the aggregate. These analyses are based on straight-forward assumptions about time saved, income, and similar inputs.

General Benefits and Costs

Individual and societal perspectives are different because they account for some costs and benefits differently. A cost, from society's perspective, is a use of resources that could productively be used elsewhere, such as maintenance, construction, and policing activities. Tolls and train fares are not costs from society's perspective because they merely transfer money (which is not a resource) from one party to another. However, from an individual's perspective, tolls and train fare are clearly costs.

Benefits

The transportation improvements bring several types of benefits[3], including:

- Time savings due to traffic reductions – The most significant benefit of a transportation improvement is typically travel time savings.

- Productivity – Train travel allows the traveler to do things that are not possible (or at least not advisable) for drivers, such as reading, writing, or other tasks that require concentration.

- Productivity – Highway improvements will reduce travel times for those individuals who do not take the train, thereby increasing productivity.

- Productivity – Highway improvements will allow goods to move more quickly both within and through the US 422 Corridor.

- Reduction in stress – Train travel or travel on lightly congested roads is less stressful than driving in congestion.

- Reduction in fuel use, pollution and greenhouse gas emissions – Less driving by those who switch to the train leads to less fuel used by cars idling in traffic, which also reduces pollution and greenhouse gas emissions. In addition, driving in congested conditions uses more gas and generates more pollution than driving during free-flow traffic. Emissions are costs borne by society and not individuals.

- Reduction in auto accidents – The net effect of the planned improvements on accidents is not clear. A better engineered road will have fewer accidents than an unimproved road. However, if average travel speed increases as a result of the improvements, the severity of the accidents may increase. Also, to the extent that traffic is diverted from highways to trains, travel on trains is safer.

- Reduction in automobile related expenses – A reduction in car trips leads to auto maintenance savings. In addition, a reduction in automobile usage by individuals who switch from driving to riding the train will

[3] Note that these assumptions hold true if the nature of the auto trips themselves do not change as a result of the transportation improvements. If the transportation improvements lead to greater development in places far removed from destinations, and thus lead to an increase in miles traveled, then additional travel miles may result in a net increase in fuel use, greenhouse gas emissions, and maintenance, for example.

also lead to a reduction other vehicle related expenses, such as depreciation and insurance. In addition, the train option may allow some families to give-up their second and or third cars.[4]

- Parking Savings – Train riders will have minimal parking fees at the station, and can avoid larger parking fees at their destination.

Costs

The improvements impose costs on individuals and society as well, including:

- Construction costs – Construction requires the irrevocable commitment of resources.

- Construction / disruption impacts – The construction of upgrades to the rail line and roadway can cause impacts to the surrounding community, such as traffic delays, visual clutter, dust, and other externalities.

- Operating costs – These costs include added maintenance, maintaining a tolling system, and operating a train line.

- Visual impacts and noise impacts – Unsightly structures and added noise can harm property values. However, for this project the roadway already exists, as does the train line, which is currently an active freight line. Accordingly, incremental visual and noise impacts are expected to be minimal.

Scenarios

We have prepared illustrative scenarios to demonstrate how the project might affect individuals and businesses in the corridor. For each of the scenarios and for society, we examine the qualitative benefits and costs. In addition, for individual scenarios, we also quantify specific costs and benefits. The individual scenarios are:

1 – A person who lives in Limerick, works in Chesterbrook, and drives to work on US 422, either with or without the planned improvements. This scenario shows the effect of roadway improvements for drivers who commute on US 422 every day.

2 – A person who lives in Royersford and works in Philadelphia – This person drives all the way to work without the improvements, but would take the train from Royersford if that option were available. This scenario shows the effect of rail improvements on US 422 and the Expressway.

3 – A person who lives in Phoenixville and works in Norristown – This person drives to work without the improvements, but would take the train once the capital improvements are complete. This scenario shows the effect of rail improvements on US 422, and shows the benefit of the new train service itself, not linked to existing SEPTA service.

[4] However, at least initially, due to the limited nature of the transit option, it is likely that most families will not be able to completely give up their second car.

4 – A business located near the intersection of US 422 and PA 29. With the improvements, existing workers can get to work more quickly, boosting the amount of time they have to devote to leisure activities, or to work. Also, the area within reasonable commuting distance increases, so the labor pool of potential workers expands to include workers who in the past would not have considered the location because of the difficulty getting there.

5 – A manufacturer located near the intersection of US 422 and Firestone Road in Pottstown. The benefits in scenario 4 still apply, but there are additional positive considerations. Access to markets is improved by reduced drive time. Further, because delivery time is reduced and reliability increased, the manufacturing process can be more oriented to just-in-time manufacturing and inventory levels can be reduced.

Table 2- Assessment of Impacts[5]

Category	Person 1	Person 2	Person 3	Business 1	Business 2	Society
Origin	Limerick	Royersford	Phoenixville	Various	Various	Various
Destination	Chesterbrook	Philadelphia	Norristown	Various	Various	Various
Distance	19	32	24	Various	Various	Various
Mode Without Improvements	Auto	Auto	Auto	Mostly Auto	Mostly Auto	Mostly Auto
Mode With Improvements	Auto	Train	Train	Mostly Auto	Mostly Auto	Mixed
Individual Benefits						
Travel Time Savings (mins/day)	23	28	7	Large	Large	Large
Travel Time Savings ($/year)	$1056	$1,283	$321	Large	Large	Large
Fuel Savings	*90 gals $321*	*808 gals $2,883*	*420 gals $,1499*	Moderate	Moderate	Moderate
Maintenance Reductions	*de minimis*	$725	$560	Unknown	Unknown	Unknown
Parking Savings	N/A	Large	Moderate			
Total Individual Benefits	$1,377	$4,891	$2,380			
Societal Benefits						
Greenhouse Gas Reduction	$70	$810	$410	Moderate	Moderate	Moderate
Costs						
Toll	$2.10 per trip	No	No	Yes	Yes	No
Train Fare	No	$6.25 per trip	$4.50 per trip	Yes	Yes	No

Source: Econsult Calculations (2010)

Fiscal Impacts on Municipalities

Transportation improvements bring fiscal impacts to communities in two primary ways – through induced new development and through impacts on existing development. New residential, commercial or retail development induced by the transportation investments generates new municipal revenue via property, transfer, income, employment, and other taxes, and brings new costs because of the need to add services,

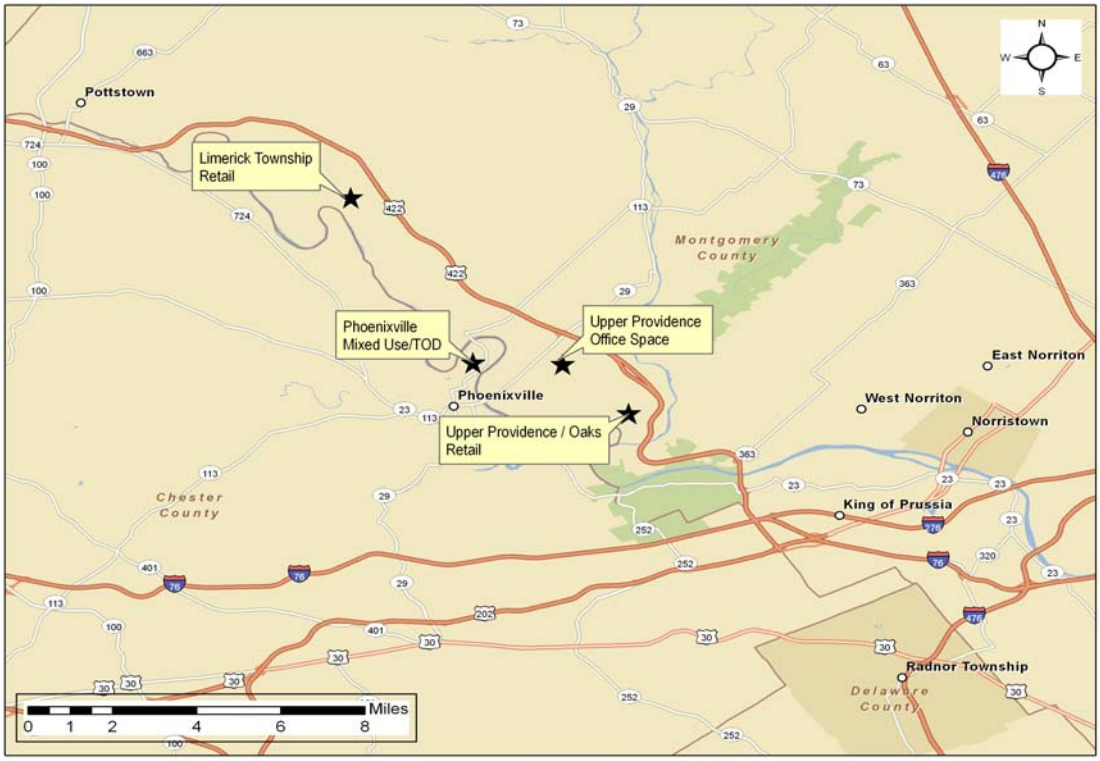
[5] Please see Appendix 3 for the detailed calculations.

such as additional police, fire, or school personnel. In addition, property values on existing development increase because of the transportation improvements, as discussed in the Property Value Impacts section[6].

This analysis investigates the fiscal impact of new projects that are potentially enabled by highway and rail improvements. In other words, it assumes that these example developments occur only because the transportation upgrades are made. These are examples only, and it is not certain that these projects are in fact contingent on transportation improvements. The assumptions underlying each development scenario are detailed in the Appendix.

The uses in a development make a significant difference to the fiscal impact of the development, particularly residential uses. A residential development that attracts families with school-age children will have a greater impact on municipal and school district costs than a pure retail development, which requires few additional municipal services in comparison.

Figure 2 – Example Development Scenarios



Phoenixville

Mixed Use Transit Oriented Development

Phoenixville has a recently completed a master plan for 130 acres of developable land along French Creek near the proposed train station, which calls for the construction of approximately 500 residential units,

[6]The property tax implications manifest themselves annually if reassessment occurs, but if it does not, then increased property valuation does not have a property tax impact. However, the increased valuation does matter when a property is sold, because the transfer tax is based on the value of the transaction.

115,000 square feet of retail space, and 875,000 square feet of office space. The first phase to be developed will likely be a mixed-use development that includes 125 townhouse and lofts, 40,000 square feet of retail, and 35,000 square feet of office space. The addition of commuter rail service to Norristown and then onto Philadelphia will make this site in particular, and the 130 acres in general, more attractive for a mixed-use transit oriented development.

Source: Delta Development (2010)

Limerick Township

Retail Development

A number of retail centers, including the 550,000 square foot Philadelphia Premium Outlets have already opened near the Sanatoga Exit of Route 422 in Limerick Township and a sizeable number of additional commercial developments have been proposed, including the development of approximately 250 acres surrounding the Philadelphia Premium Outlets into a mix of entertainment, commercial, office and light industrial uses as well as the development of a high-end corporate office park on eighty acres surrounding the Limerick Airport. If US 422 is not improved, these projects might not happen at all or could be significantly scaled back or delayed. This scenario analyzes a retail development in Limerick with 125,000 square feet of gross leasable retail space.

Upper Providence

Retail Development

In Upper Providence Township, the Greater Philadelphia Expo Center has already opened and an additional 250,000 square feet of retail uses are scheduled to be completed over the next couple of years. This scenario analyzes a retail development in Upper Providence with an additional 125,000 square feet of gross leasable retail space.

Source: Philadelphia Premium Outlets (2010) and Vornado Real Estate (2010)

Commercial Development

Additionally, Upper Providence Township is projected to gain 3,500 jobs by 2035 under current trend projections from the Delaware Valley Regional Planning Authority (DVRPC). US 422 is the main commuting artery for office complexes located in Upper Providence Township and surrounding areas, and if this artery is improved, it offers the potential for the development of more office space in the Township. This scenario analyzes the impact of an additional 1,000 jobs and 400,000 square feet of office space above the 3,500 jobs projected under current trends.

Summary

As indicated in Table 3, the mixed-use development in Phoenixville has a neutral to negative annual net fiscal impact, while the developments in Limerick and Upper Providence, with no residential component, have substantial positive fiscal impacts.

Table 3: Net-Fiscal Impacts of Illustrative Projects[7]

Annual Net Fiscal Impacts	Phoenixville	Limerick	Upper Providence 1	Upper Providence 2
Development Location	Mixed Uses	Entertainment/ Retail	Retail	Office
Residential	125 units	N/A	N/A	N/A
Commercial (s.f.)	35,000	N/A	N/A	400,000
Retail (s.f.)	40,000	125,000	125,000	N/A
Other (s.f.)	N/A	N/A	N/A	N/A
Increased Revenue	$874,000	$408,000	$338,000	$950,000
Increased Costs	$766,000	$54,000	$37,000	$285,000
Net Impact	$108,000	$354,000	$301,000	$665,000

Source: Econsult Calculations (2010)

[7] Please see Appendix 2 for a description of the methodology employed as well as detailed results. Also, please note that the results for Phoenixville are sensitive to assumptions made about the number of school-aged children that move into the new development. Please see Appendix 2 for more details.

Property Value Impacts

Many variables influence the impact of rail or highway service on property values, including quality of service, noise and visual impacts, additional traffic, and air quality changes, so the project does not affect each property owner the same. Further, any change in property value is caused by the reduction in travel time and other quality of life improvements quantified elsewhere in the report, and is not additive to them.

Rail

The presence of rail transit increases property values. Specifically, houses located near a transit station have greater market values compared to what they would be without the transit station. In addition, evidence indicates that commuter railway stations have a consistently higher positive impact on property values compared to light and heavy railway/Metro stations.

Property value impacts vary widely based on location, socio-economic factors, the quality of the individual transit systems, and other influences. Stations with a higher level and quality of facilities, such as adequate and convenient parking, are expected to have greater impact on the surrounding properties. However, the houses located immediately adjacent to stations with large parking areas may suffer a negative impact due to the disamenity of being near a large parking area and the associated traffic of people traveling to and from the station. But this disamenity quickly dissipates as one moves away from the parking area and amenity value of being near the transit station leads to increases in property values.

Estimates of the impact of rail service on property values vary from almost 4 percent to well in excess of 20 percent, depending on the location and characteristics of the service. For a $300,000 house, this range implies an increase in value of between $12,000 and $60,000. The most comparable study, for a line with five AM peak trains a day, found an increase in property value near the stations of approximately 10 percent.[8] In this situation, a $300,000 house located near the station could appreciate in value by $30,000.

Benefit to Norristown:
The rail line will offer another kind of benefit to Norristown. Norristown is a *destination* of the train service, and the train will improve Norristown's attractiveness as an employment center because it will become easier to access the city. Thus, the catchment area for workers will increase, and some existing workers will find it easier to get to Norristown. While the impact has not been quantified, property values in downtown Norristown should also increase as a result of the transit improvements.

Highway

Improved access to highways and decreased congestion reduce commuting times and provide firms with lower transportation costs for shipping inputs and outputs. Theory predicts, and the literature largely confirms, that highway improvements lead to greater land prices near the highway[9]. Being near an

[8] Armstrong, R. J. et al. (2006). "An evaluation of the accessibility benefits of commuter rail in Eastern Massachusetts using spatial hedonic price functions." *Transportation*, Vol. 3, No. 3: 21-43.

[9] Investment that expands capacity and decreases delays, especially without tolls, will increase the relative attractiveness of the 422 corridor compared to nearby areas. This increase in attractiveness will likely lead to more residential, commercial, and retail development in the corridor than would occur without the improvements. Increased development will have two indirect impacts on property values, which work in opposite directions. First, greater population will result in more traffic, which may roll back some of the travel time savings brought by the capacity increase, and thus undercutting some of its value. Second, additional

improved highway adds value to nearby properties, but the nuisance generated by the increased traffic can offset the positive effect. For example, a study of a toll-road extension in Dallas found that for residential properties located within a quarter mile of the new toll-road there was a 10 percent discount in property values due to the increased noise and traffic, while properties located between one quarter and two miles from the interchange had a price premium between 13 and 19 percent[10]. A similar study from California also found increased home prices as a result of improved highway access. The magnitude of the change in value also depends on the type of project; projects that include construction of new highways tend to have greater impacts than projects that focus solely on improvements to existing roads[11].

A more direct way to examine the benefits of improving 422 is to value the time saved due to reduced congestion net of tolls. For a household with one individual wcommutes daily on US 422 driving from the Collegeville Road (Route 29) Interchange to the intersection of Route 202, the permanent value of the benefit is as great as $6,433, which is equivalent to 2.5 percent of median house price.[12] Please see Table 4.

Table 4: Value of Savings and Tolls Related to Housing Prices

Maximum Impact to House Value	
Minutes saved per day (2010)	0.0
Minutes saved per day (2035)	25.6
Total hours saved per year (2010)	0.0
Total hours saved per year (2035)	106.7
Perpetual value of net benefit	$6,433
Median house price	$255,000
Percent of house price	2.5%

Source: Econsult Calculations (2010) ESRI Business Analyst Online (2010), US Census Bureau (2010)

development itself is helpful for property values because it means that in many cases, the need to travel is reduced because more daily needs can be satisfied by short trips. Tolling will also limit demand somewhat from existing residents compared to demand without tolls, reducing travel time for those who do use the road.

[10] Vadali, S. 2008. "Toll roads and economic development: Exploring effects on property values." *Annuals of Regional Science*, Vol. 42: 591-620.

[11] Boarnet, M.G. & Chalermpong, S. (2001). "New highways, house prices, and urban development: A case study of toll roads in Orange County, CA." Housing Policy Debate, Vol. 12, No. 3: 575-605.

[12] The value of the benefit depends on the amount of time saved.

Appendix 1

Benefit Calculations

The improvements to Route 422 and implementation of transit service to the area will generate travel time savings to individuals by either reducing congestion on US 422 or by providing transit riders with a one-seat ride into center-city Philadelphia. Using traffic model data and estimated transit travel times obtained from Michael Baker, Jr., Inc. we are able to estimate the travel time savings that will accrue to three illustrative individuals. The first individual commutes from Limerick to Chesterbrook on a daily basis for work. They currently commute by car and will continue to commute by car after the improvements to US 422. The second individual currently commutes from Royersford to Philadelphia by car and will switch to taking the train once the transit alternative is implemented. The final individual commutes by car from Phoenixville to Norristown on a daily basis via US 422 and once the transit alternative opens, they will switch to taking the train everyday.

Table 1 presents the current travel times for all three individuals in 2010 as well as the projected travel times after the improvements are made. We valued the travel time savings for each individual using $11 per hour which is equal to 40% of the average hourly wage of individuals living in the study area.

Table 1
Travel Times and Savings

	Person 1	Person 2	Person 3
AM Travel Time Current	28	69	17
PM Travel Time Current	23	59	18
AM Travel Time After Improvements	13	50	14
PM Travel Time After Improvements	15	50	14
AM Travel Time Savings	15	19	3
PM Travel Times Savings	8	9	4
Total Savings (mins/day)	23	28	7
Total Annual Savings (hours)	96	117	29
Value of Time (per hour)	$11	$11	$11
Total Value of Travel Time Savings	$1,056	$1,283	$321

*Source: Econsult Calculations (*2010)

When people switch from commuting by car to train, they reduce the amount of vehicle miles that they travel per day and as a result they reduce the amount of air pollution they generate and the gas they consume. For example, an individual who commutes by car from Royersford to Philadelphia 5 days a

week, 50 weeks per year drives an average of 32 miles one-way each day and approximately 15,750 miles per year. The individual that commutes from Phoenixville to Norristown drives on average 15 miles one way and over 7,500 miles per year (See Table 2).

Table 2
Estimated Annual Commuting Miles

Commuter	Miles Driven One Way	Miles Driven Per Week	Miles Driven Per Year
Royersford to Philadelphia	31.5	315	15,750
Phoenixville to Norristown	15	150	7,500

Source: Econsult Calculations (2010)

When these commuters switch from commuting by car to commuting on the new rail line, rather than being vehicle miles traveled by these commuters, they will be vehicle miles "not" traveled. Since these commuters are driving less each day, they will also be generating less pollution. The pollution generated by automobile travel includes carbon dioxide, sulfur dioxide, carbon monoxide, nitrous oxide, volatile organic chemicals and particulate pollutants. Using per vehicle mile traveled pollution estimates developed by the University of California at Berkeley Center for Future Urban Transport[13]; we are able to estimate the pollution reduction from the daily vehicle miles that are no longer driven by these example individuals (See Table 3). We only calculate the pollution reduction benefits for the individuals in Scenarios 2 and 3 because they are the only individuals that switch from commuting by car to commuting by rail.

[13] "Environmental Life-cycle Assessment of Passenger Transportation: A Detailed Methodology for Energy, Greenhouse Gas and Criteria Pollutant Inventories of Automobiles, Buses, Light Rail, Heavy Rail and Air v.2," University of California at Berkeley Center for Future Urban Transport (2008).

Table 3
Estimated Air Pollution Reductions

		Pounds	
Emissions	g(VMT)	Scenario 2 Pollution Reduction	Scenario 3 Pollution Reduction
Operational Emissions			
CO2	365.000	12,674	6,035
SO2	0.020	1	0
CO	9.500	330	157
NOX	0.800	28	13
VOC	0.280	10	5
PM10	0.11 0	4	2
Non-operational Emissions			
Startup - CO	2.400	83	40
Startup - Nox	0.150	5	2
Startup - VOC	0.220	8	4
Brake Wear - PM10	0.010	0.35	0.17
Tire Wear - PM10	0.010	0.35	0.17
Evaporative Losses - VOC	0.810	28	13

Source: Econsult Corporation (2010), University of California at Berkeley (2008)

Additionally, this reduction in pollution can then be valued using the externality costs of the different pollutants. We estimate that the driver in Scenario 2 will generate approximately $725 in air pollution benefits and the driver in Scenario 3 will generate over $345 in pollution reduction benefits (See Table 4). The air pollution reduction benefits were calculated by multiplying the per-ton externality costs for each pollutant by the pollution reduction amounts from Table 3.[14] The externality costs can be considered the estimated costs of pollution to society that is not accounted for in the market price of the goods or services that produced the pollution. It is important to note that these pollution reduction benefits do not just accrue to the individual driver, but are benefits to society as whole.

[14] Nowak, David J.; Crane, Daniel E.; and Stevens, Jack C. (2006). "Air Pollution Removal by Urban Trees and Shrubs in the United States." Urban Forestry and Greening Vol. 4: 115-123.
Murry, F. J.; Marsh L.; and Bradford, P.A. (1994). New York State Energy Plan Vol. II: Issue Reports. New York State Energy Office, Albany.

Table 4
Air Pollution Reduction Benefits

Pollutant	Costs per ton ($)	Scenario 2 Pollution Reduction Benefits	Scenario 3 Pollution Reduction Benefits
CO2	$21	$133	$63
SO2	$2,370	$1	$0
CO	$1,280	$211	$101
NOX	$9,685	$160	$76
VOC	$9,040	$206	$98
PM10	$6,460	$15	$7
		$725	$345

Source: Econsult Calculations (2010), Nowak et al., (2006), Murray et al., (1994)

Furthermore, since these individuals are no longer using their cars to commute to work everyday, they are purchasing less gas each year. If we assume that the cars used by each driver gets an average fuel efficiency of 22.5 miles to gallon[15], the driver in Scenario 2 will save almost 700 gallons of gas, while the driver in Scenario 3 will save over 333 gallons of gas each year. This reduction in gas purchases also translates into a dollar savings for the individual and unlike the air pollution benefits; this benefit accrues solely to the individual. Assuming a per gallon cost of $3.568[16] the gallons of gas not purchased each year amounts to over $2,498 in costs savings for the driver in Scenario 2 and over $1,188 dollars in Scenario 3. Additionally, driving in congested conditions also causes more gas to be burned than during free-flow conditions. Using techniques developed by Texas Transportation Institute[17], we were able to estimate the additional gas burned by each individual during peak time due to driving in congested conditions (See Tables 5 and 6), This reduction in gas consumption translates into further dollar savings for each individual. We estimate that the driver in Scenario 1 burns 90 additional gallons of fuel per year by driving in congested conditions, the driver in Scenario 2 burns 108 additional gallons, and the driver in Scenario 3 consumes 87 less gallons per year. This translates into $321, $385, and $310 in reduced fuel costs per year respectively (See Table 7). In addition, the reduced fuel consumption leads to air pollution benefits of $68, $83, and $67 per year respectively. For the individuals in Scenarios 1 and 2 these are fuel savings and pollution benefits over and above those generated when they switch from commuting by automobile to commuting by train.

[15]"Table 4-23 Average Fuel Efficiency of U.S. Passenger Cars and Light Trucks," National Transportation Statistics 2009 (2009).
[16] Energy Information Agency. http://www.eia.gov/dnav/pet/pet_pri_gnd_a_epm0_pte_dpgal_w.htm as of March 11, 2011.(2011)
[17] Texas Transportation Institute. 2009. 2009 Urban Mobility Report Methodology. Texas Transportation Institute. http://mobility.tamu.edu/ums/congestion_data/

Table 5
Increased Fuel Consumption Due to Congestion
AM Peak Travel Period

	Person 1	Person 2	Person 3
Distance (miles)	9.58	12.09	8.58
Free Flow Travel Time (mins)	11	10	7
Congested Travel Time (mins)(2010)	25.7	22.8	17
Congested Travel Speed (mph)	22.37	31.82	30.28
Uncongested Travel Speed (mph)	52.25	72.54	73.54
Average Fuel Economy in Congested Conditions (mpg)	14.39	16.75	16.37
Average Fuel Economy in Free-Flow Conditions (mpg)	21.86	26.94	27.19
Fuel that would be consumed Free-Flow Conditions (gals)	0.44	0.45	0.32
Fuel Consumed in Congested Conditions (gals)	0.67	0.72	0.52
Additional Fuel Consumed per Day Due to Congestion (gals)	0.23	0.27	0.21
Travel Days per Year	250	250	250
Total Additional Fuel Consumed During the AM Peak (gals)	56.9	68.2	52.1

Source: Econsult Calculations (2010), Texas Transportation Institute (2009)

Table 6
Increased Fuel Consumption Due to Congestion
PM Peak Travel Period

	Person 1	Person 2	Person 3
Distance (miles)	9.58	12.09	8.58
Free Flow Travel Time (mins)	13	12	9
Congested Travel Time (mins)(2010)	21.1	19.4	16.1
Congested Travel Speed (mph)	27.24	37.39	31.98
Uncongested Travel Speed (mph)	44.22	60.45	57.20
Average Fuel Economy in Congested Conditions (mpg)	15.61	18.15	16.79
Average Fuel Economy in Free-Flow Conditions (mpg)	19.85	23.91	23.10
Fuel that would be consumed Free-Flow Conditions (gals)	0.48	0.51	0.37
Fuel Consumed in Congested Conditions (gals)	0.61	0.67	0.51
Additional Fuel Consumed per Day Due to Congestion (gals)	0.13	0.16	0.14
Travel Days per Year	250	250	250
Total Additional Fuel Consumed During the PM Peak (gals)	32.8	40.1	34.9

Source: Econsult Calculations (2010), Texas Transportation Institute (2009)

Table 7
Cost Savings Due to Decreased Fuel Consumption

	Person 1	Person 2	Person 3
Reduced Fuel Consumption due to Decreased Congestion (gals)	90	108	87
Reduced Fuel Consumption Due to Mode Switching (gals)	N/A	700	333
Total Reduced Fuel Consumption (gals)	90	808	420
Average Price of Gasoline as of December 2, 2010	$3.568	$3.568	$3.568
Total Fuel Cost Savings	$321	$2,883	$1,499

In addition to spending less money on gas, the individuals that switch from commuting by car to commuting by train also spend less each year on vehicle maintenance. It is estimated that vehicle maintenance costs

amount to $0.0533 per mile on average; [18] this translates into over $830 in maintenance cost[19] savings for the driver in Scenario 2 and over $400 in maintenance cost savings in Scenario 3 (See Table 8).

Table 8
Maintenance Cost Savings

Description	Scenario 2	Scenario 3
Annual Vehicles Miles Not Driven	15,750	7,500
Maintenance Costs Savings per Mile	$0.0533	$0.0533
Total Maintenance Cost Savings	$839	$400

Source: Econsult Corporation (2010), Bureau of Transportation Statistics (2009), Energy Information Agency (2010), American Automobile Association (2009)

[18] "Your Driving Costs: 2009 Edition," American Automobile Association (2009).

[19] These costs only include vehicle maintenance costs due to wear and tear, and do not include costs related to purchase/leasing of the car, depreciation, or insurance.

Appendix 2

Fiscal Scenario Methods

Revenue Methods

We calculated the assessed value of the retail portion of the projects by estimating the per-square foot assessments of similar recent retail projects located in the study area. We found that similar recent projects in the study area have a per-square foot assessed value of approximately $100 per square foot. The assessed values of the office space component of the projects were calculated by estimating the per-square foot assessments of similar recent office projects located in the study area. We found that similar recent projects have a per-square foot assessed value of approximately $85 per-square foot. The assessed value for the residential portions of the projects was estimated based on an assumed selling price of the unit as well as the appropriate equalization factor. The estimate of real estate transfer taxes for the residential units also utilized the same assumed selling price.

Earned Income Tax (EIT) revenue was estimated based on the square footage of the retail and office space components of the projects using employee per square foot ratios developed by United States Department of Energy[20] of 950 square feet per retail employee and 400 square feet per office employee. We estimated the total wages for both the retail and office space portion of the potential project using wage estimates from the United States Bureau of Labor Statistics.[21] We assumed that the retail employees were paid an average wage equal to mean wage for retail employees in the Philadelphia, PA Metropolitan area ($26,920) and we also assumed that office employees were paid an average wage equal to the mean wage for all occupations ($48,340) in the Philadelphia, PA Metropolitan area. However, since most of the communities in Montgomery and Chester Counties already levy an EIT on their residents, it is unlikely that the commercial and retail properties will result in much EIT tax revenue for host municipalities. In order to be conservative, we assumed that 10% of the employees come from non-EIT jurisdictions. It is likely that the residential component will generate significant EIT tax revenue for the host.

Cost Methods

In addition to the fiscal benefits provided by the possible new developments through EIT and property tax revenues, local governments incur additional costs from the necessary increase in the provision of services.

The fiscal costs of office and retail components of the four development scenarios were calculated by first multiplying the estimate of new employees generated from the project by a cost multiplier from *The New Practitioner's Guide to Fiscal Analysis*.[22] There are cost multipliers for seven categories of expenditures: government, public safety, public works, health and welfare recreation, other and debt service. The product of each cost multiplier and the number of new employees is the percent change in municipal expenditures for each category. This percent change was then multiplied by current expenditures in order to obtain the

[20] http://www.eia.doe.gov/emeu/consumptionbriefs/cbecs/pbawebsite/retailserv/retserv_howmanyempl.htm
[21] http://www.bls.gov/oes/current/oes_37964.htm
[22] Burchell, R., et al. (1985). *The New Practitioner's Guide to Fiscal Impact Analysis.*

increase in municipal expenditures as a result of the development. Current expenditures were obtained from the Governors' Center for Local Government Services "Municipal Statistics Report".[23]

For the residential component of the Phoenixville development, the important fiscal cost to the municipality is the additional cost of new students into the school system. We estimated the number of new school-age children by multiplying the number of units of each type by the number of public school age children per unit, taken from "Residential Demographic Multipliers" published by Rutgers University's Center for Urban Policy Research.[24] After determining the number of new students, current expenditures on a local level were calculated by deducting debt service expenditures, federal and state revenue to the school district and other revenue from the Phoenixville School District budget obtained from the Pennsylvania Department of Education.[25] The total budget from local funds was then divided by the current enrollment in the district to get the value of local spending per student. Multiplying the total local spending per student by the projected number of new students resulted in the projected total new local spending by the school district due to the addition of new students.

Fiscal Scenario Results

Phoenixville

We assumed that the potential mixed-use transit oriented development in Phoenixville Borough would consist of 125 for-sale townhouses, 40,000 square feet of retail, and 35,000 square feet of office space. Based on similar recent projects in Phoenixville, we assumed that each townhouse will sell for approximately $250,000, resulting in a combined market value for the residential portion of $31.25 million. After applying Chester County's equalization ratio of .53, we arrived at an assessed value of approximately $16.56 million. We further estimate that the retail portion of the project will have an assessed value of approximately $4 million and the office component will have an assessed value of $3 million (See Table 9)

We calculated the potential property tax collections for the combined project by multiplying the estimated assessed values by the Borough, School District, and County property tax rates (See Table 9).

We estimate that the 125 townhouses will generate $66,000 in Borough property taxes, $437,000 in School District property taxes, and almost $66,000 in Chester County taxes. Together the retail and office space component of the potential project will generate $28,000 in Borough, $185,000 in School District, and $28,000 in County property taxes (See Table 9). Additionally, the initial sale of each townhouse will generate $156,000 in one-time realty transfer taxes for both Phoenixville and Chester County (See Table 10)

The project will also generate significant EIT revenue for Phoenixville. Using employee per square foot ratios developed by United States Department of Energy[26] and wage estimates from the United States Bureau of Labor Statistics[27] we estimated the total wages for both the retail and office space portion of the potential project. We then estimated the EIT revenue collections for Phoenixville using a 1% EIT rate and

[23] http://munstatspa.dced.state.pa.us/Registers.aspx
[24] Burchell, R. et al "Residential Demographic Multipliers – Estimates of the Occupants of New Housing" (2006)
[25] http://www.education.state.pa.us/portal/server.pt/community/finances/7671
[26] http://www.eia.doe.gov/emeu/consumptionbriefs/cbecs/pbawebsite/retailserv/retserv_howmanyempl.htm
[27] http://www.bls.gov/oes/current/oes_37964.htm

assuming that 10% of the employees come from non-EIT jurisdictions and as such are subject to the EIT tax levied by Phoenixville (See Table 11) In order to calculate the EIT revenue from the residential portion, we assumed that each unit was home to 1.5 working-age adults, on average, and that 85% of these individuals were employed with an average wage of $74,000 (See Table 12).

Table 9
Estimated Assessed Value and Property Tax Collections
Potential Phoenixville Project

		Tax Rates (mills)	4.01	26.39	3.965	34.365
Type	Size	Assessed Value	City Property Taxes	School District Property Taxes	County Property Taxes	Total
Residential	125 units	$16,562,500	$66,416	$437,084	$65,670	$569,170
Retail	40,000sf	$4,000,000	$16,040	$105,560	$15,860	$137,460
Office	35,000sf	$3,000,000	$12,030	$79,170	$11,895	$103,095
Total		$23,562,500	$94,486	$621,814	$93,425	$809,725

Source: Econsult Calculations (2010), Chester County (2010)

Table 10
Estimated Transfer Tax Revenue
Potential Phoenixville Project

Category	Amount
Number of Units	125
Price per Unit	$ 250,000
Aggregate Value	$ 31,250,000
Local Transfer Tax Rate	0.5%
Local Transfer Tax Collections	$ 156,250
County Transfer Tax Rate	0.5%
County Transfer Tax Collections	$ 156,250
Total Transfer Tax Collections	$ 312,500

Source: Econsult Calculations (2010), Chester County (2010)

Table 11
Estimated Earned Income Collections
Potential Phoenixville Project – Commercial Portion

Type	Size	S.F. per Employee	Total Employees	Employees from non-EIT Jurisdictions	Average Wage	Total EIT Wages	EIT Rate	EIT Collections
Retail	40,000sf	950	42	4	$26,920	$107,700	1.0%	$1,100
Office	35,000sf	400	88	9	$48,340	$435,000	1.0%	$4,350
					Total	$542,700		$5,450

Source: Econsult Calculation (2010), US Bureau of Labor Statistic (2010), US Department of Energy (2010), Phoenixville Borough (2010)

Table 12
Estimated Earned Income Collections
Potential Phoenixville Project – Residential Portion

Type	# Units	Working-age Individuals per Unit	Percent Employed	Average Wage	Total Wages	Wage Tax Rate	Wage Tax Collections
Residential	125	1.5	1	$74,000	$11,795,000	0.5%	$59,000

Source: Econsult Calculation (2010), US Bureau of Labor Statistic (2010), Phoenixville Borough (2010)

Table 13 presents the estimated fiscal costs of the potential mixed use development. We estimate that the project will generate approximately $252,300 in annual revenue for the Phoenixville Borough and Chester County, and $228,000 in additional costs for a total net-fiscal benefit of approximately $24,300. We estimated the number of new school age children residing in the residential portion of proposed development based on residential demographic multipliers developed by Rutgers University's Center for Urban Policy Research[28] (See Table 14). Due to the type, location, and mix of uses included in the development, we expect that this development will be less family-oriented than other similar developments and as such we reduce the number of expected school children by 25 percent. Based on a development of 31 2-bedroom units, 63 3-bedroom units, and 31 4-bedroom units, we estimate that 58 school age children will reside in the new development and of those, 43 will move in from outside of the Phoenixville School District. Based on Phoenixville School District budget information obtained from the Pennsylvania Department of Education,[29] we estimated that the Phoenixville School District spends approximately $12,500 of local revenue per student. This will amount to total costs of the new development to the School District of $537,500. Based on projected property tax revenue of $534,000, the new development will have a total net-fiscal benefit of $84,300 on the Phoenixville School District (See Table 15). However, if we were to assume that this development generated the same number of school children as other similar developments (58 school children versus 43), the new development would impose a fiscal cost on the School District of $101,000 per year. Due to the large residential component of the project and the increase in school-children and their associated costs, the potential mixed-use project will have a total fiscal benefit of $108,600 for the municipality, school district, and county.

[28] Burchell, R. et al "Residential Demographic Multipliers – Estimates of the Occupants of New Housing" (2006)
[29] http://www.education.state.pa.us/portal/server.pt/community/finances/7671

Table 13
Estimated Net Fiscal Impacts
Potential Phoenixville Project

	Municipal and County	School District	Total
Revenue	$252,300	$621,800	$874,100
Costs	($228,000)	($537,500)	($765,500)
Net Fiscal Impacts	$24,300	$84,300	$108,600

Sources: Econsult Calculations (2010), Governor's Center for Local Government Services (2010), PA Department of Education (2010)

Table 14
Estimated Number of New Public School Children
Potential Phoenixville Project

	Percent of All Units	Total Units	Public School Age Children per Unit	Total School Age Children
2 BR Units	25%	31	0.15	5
3 BR Units	50%	63	0.36	23
4 BR Units	25%	31	0.97	30
Total		125		58
Percent of Students that are Net-new				75%
Total New Students that Move into the District				43

Sources: Econsult Calculations (2010), Burchell, R. et al., (2006)

Table 15
Estimated Fiscal Impact to the Phoenixville School District
Potential Phoenixville Project

	Amount
Total Phoenixville School District 2008-2009 Budget	$ 70,760,805
Total Debt Service Expenditures	$ 10,412,390
Total State Revenue	$ 12,173,041
Total Federal Revenue	$ 601,641
Total Other Revenue	$ 45,710
Total Budget from Local Funds (excluding Debt Service)	$ 47,528,023
Average Daily Attendance	3,813
Total Local Spending per Student	$ 12,500
Projected Number of New Students	43
Total New Local Spending	$ 537,500
Projected New Property Tax Revenue	$ 621,814
Net School District Fiscal Impact	$ $84,300

Sources: Econsult Calculations (2010), PA Department of Education (2010)

Limerick

We assumed that the potential retail oriented development in Limerick will consist of 125,000 square feet of gross leasable area. We estimate the assessed value of the new development to be approximately $15 million. We estimated the property tax revenues for Limerick, the Spring Ford Area School District, and Montgomery County by using the appropriate property tax rates. We estimate that the retail project will generate approximately $18,000 for the township, $40,000 for the county, and $346,000 for the school district in annual property tax revenue (See Table 16).

We estimated the number of employees by using the same square feet per employee estimates as we used for the retail portion of the Phoenixville project. We estimate that there will be approximately 158 employees who each earn an average wage of $26,920 per year for a total annual payroll of approximately $4.25 million. We then estimated the annual wage tax revenue for Limerick by using a 1% earned income tax rate (See Table 17).

Table 16
Estimated Assessed Value and Property Tax Collections
Potential Limerick Retail Project

		Tax Rates (mills)	1.213	23.07	2.695	26.978
Type	Size	Assessed Value	City Property Taxes	School District Property Taxes	County Property Taxes	Total
Retail	150,000sf	$15,000,000	$18,195	$346,050	$40,425	$404,670

Sources: Econsult Calculations (2010), Montgomery County (2010)

Table 17
Estimated Earned Income Tax Collections
Potential Limerick Retail Project

Type	Size	S.F. per Employee	Total Employees	Employees from non-EIT Jurisdictions	Average Wage	Total EIT Wages	EIT Rate	EIT Collections
Retail	150,000sf	950	158	16	$26,920	$430,720	1.0%	$4,300

Source: Econsult Calculations (2010), US Bureau of Labor Statistics (2010), US Department of Energy (2010), Limerick Township (2010)

Table 18 presents the estimated fiscal costs of the potential retail development in Limerick Township. We estimate that the project will generate approximately $63,000 in annual revenue for the Township and Montgomery County and $54,000 in additional costs for a total net-fiscal benefit of $9,000. Since there is not a residential component associated with this potential project the costs to the Spring Ford Area School District is likely to be minimal. We estimate that the potential retail development will generate approximately $345,000 in increased revenue for the School District.

Table 18
Estimated Net Fiscal Impacts
Potential Limerick Retail Project

	Municipal and County	School District	Total
Revenue	$63,000	$345,000	$408,000
Costs	($54,000)	*de minimis*	($54,000)
Net Fiscal Impacts	$9,000	$345,000	$354,000

Sources: Econsult Calculations (2010), Governor's Center for Local Government Services (2010)

Upper Providence Township

Retail Project

We assumed that the potential retail-oriented development in the Oaks section of Upper Providence Township will consist of an additional 125,000 square feet of gross leasable area. We calculated the

assessed value of the retail portion of the project by estimating the per-square foot assessments of similar recent retail projects located in the study area. We found that similar recent projects in the study area have a per-square foot assessed value of approximately $100 per square foot, multiplying by the project size of 125,000 square feet, gives us a potential assessed value of $13 million. We estimated the property tax revenues for the School District and Montgomery County by using the appropriate property tax rates (See Table 19). Please note that Upper Providence Township does not currently levy a property tax.

We estimated the number of employees using the same square feet per employee estimates as we used for the retail portion of the Phoenixville project. We estimate that there will be approximately 132 employees who each earn an average wage of $26,920 per year for a total annual payroll of approximately $3.5 million. We then estimated the annual EIT revenue for Oaks by using a 1% EIT rate (See Table 20).

Table 19
Estimated Assessed Value and Property Tax Collections
Potential Upper Providence Retail Project

		Tax Rates (mills)	0	23.07	2.695	25.765
Type	Size	Assessed Value	Township Property Taxes	School District Property Taxes	County Property Taxes	Total
Retail	125,000sf	$13,000,000	$0	$299,910	$35,035	$334,945

Sources: Econsult Calculations (2010), Montgomery County (2010)

Table 20
Estimated Earned Income Tax Collections
Potential Upper Providence Retail Project

Type	Size	S.F. per Employee	Total Employees	Employees from non-EIT Jurisdictions	Average Wage	Total EIT Wages	EIT Rate	EIT Collections
Retail	125,000sf	950	132	13	$26,920	$349,960	1.0%	$3,500

Source: Econsult Calculations (2010), US Bureau of Labor Statistics (2010), US Department of Energy (2010), Upper Providence Township (2010)

Office Space

The DVRPC estimates that by 2035 Upper Providence is projected to gain 3,500 additional jobs. US 422 is the main commuting artery for office complexes located in Upper Providence Township and surrounding areas, if this artery is improved it offers the potential for the development of additional office space in Upper Providence Township beyond the DVRPC projections. If the improvements allow for an additional 1,000 jobs, we estimate that this will require an additional 400,000 square feet of office space. We calculated the assessed value of the office space component of the project by estimating the per-square foot assessments of similar recent office projects located in the study area. We found that similar recent projects have a per-square foot assessed value of approximately $85 per-square foot, multiplying by the project size of 400,000 square feet, gives us a potential assessed value of $35.0 million. We estimated the

property tax revenues for the School District and Montgomery County by using the appropriate property tax rates (See Table 21). Please note that Upper Providence Township does not currently levy a property tax.

We estimate that 1,000 additional office employees will earn an average of $48,340 per year for a total annual payroll of approximately $48.3 million. We then estimated the annual Earned Income Tax revenue for Upper Providence Township by using a 1% EIT rate assuming that 10% of the employees come from non-EIT jurisdictions (See Table 22).

Table 21
Estimated Assessed Value and Property Tax Collections
Potential Upper Providence Office Project

		Tax Rates (mills)	0	23.07	2.695	25.765
Type	Size	Assessed Value	Township Property Taxes	School District Property Taxes	County Property Taxes	Total
Office	400,000sf	$35,000,000	$0	$807,450	$94,325	$901,775

Sources: Econsult Calculations (2010), Montgomery County (2010)

Table 22
Estimated Earned Income Tax Collections
Potential Upper Providence Office Project

Type	Size	S.F. per Employee	Total Employees	Employees from non-EIT Jurisdictions	Average Wage	Total EIT Wages	EIT Rate	EIT Collections
Office	400,000	400	1000	100	$48,340	$4,834,000	1.0%	$48,340

Source: Econsult Calculations (2010), US Bureau of Labor Statistics (2010), US Department of Energy (2010), Upper Providence Township (2010)

Table 23 presents the estimated fiscal costs of the potential retail and office space projects in Upper Providence Township. We estimate that the projects will generate approximately $181,200 in annual revenue for the township and Montgomery County, and $320,000 in additional costs for a total net-fiscal cost of $138,800.[30] Since there is not a residential component associated with this potential project the costs to the Spring Ford Area School District is likely to be minimal. We estimate that the potential retail and office projects will generate approximately $1.1 million in increased revenue for the School District.

[30] The fiscal cost is mainly due from the fact that Upper Providence Township does not currently levy a property tax and as such, the only new revenue that the Township receives from the project is from EIT collections. However, since the vast majority of individuals who will work in the new commercial development come from other areas of Montgomery or Chester County, they already pay the EIT to their home jurisdiction and, as such do not pay any taxes to Upper Providence Township.

Table 23
Estimated Net Fiscal Impacts
Potential Upper Providence Development Projects

	Municipal and County	School District	Total
Revenue	$181,200	$1,100,000	$1,281,200
Costs	($320,000)	*de minimis*	($320,000)
Net Fiscal Impacts	($138,800)	$1,100,000	$960,000

Sources: Econsult Calculations (2010),
Governor's Center for Local Government Services (2010)

Appendix 3

Property Value Impacts – Literature Analysis

A San Francisco Bay Area study found that for every meter a single-family home was closer to a BART station in 1990, its sales price increased by $2.29, all else being equal.[31] A 1993 study (Voith) of residential properties near the 14.5-mile Lindenwold Line in Philadelphia, using hedonic price models, concluded that access to rail created an average housing value premium of 6.4%.[32] Voith also found that in suburban New Jersey the median home price for census tracts immediately served by PATCO was generally 10% higher that the median home price in census tracts located away from the rail line. This differential was evident in the same direction for the Philadelphia suburbs within Pennsylvania. The average median home price for census tracts served by SEPTA commuter rail enjoys a 3.8% premium over the average median home price for census tracts not directly served by commuter rail.[33] Furthermore, the fifteen studies reviewed by Debrezion et al. of the impact of commuter rail stations on property values found an average price premium of 18.7% for houses located in proximity to commuter rail stations.[34]

A study with service levels most similar to the proposed "Wyomissing to Philadelphia 30th Street Station – Dual Mode" alternative is Armstrong and Rodriguez where all four communities with commuter rail stations examined received comparable train frequencies consisting of five AM peak period trains per day. Their results suggest a premium of more than $29,532 for properties located in the municipalities with one or more commuter rail stations. Evaluated at the mean selling price of the houses included in the study, this translates into a 10.1% market value premium. They also found that distance from the commuter rail station had an impact on the results. Properties located within a one-half mile buffer of a commuter rail station exhibit values that are 10.1% higher than properties located outside of this buffer area and that for every additional minute of drive time from the station, property values decrease by 1.6%, all else held equal.[35]

While the proximity to station convey a positive impact on property value impacts, proximity to the actual rail corridor and outside of the impact area of the actual transit station could have a negative impact on property values due to noise and vibration generated by the rail line. Landis et al.[36] find that properties within 300 m of the CalTrain right-of-way experience a discount of about $51,000, which represents 15.3% of the mean sales price at the time, while Armstrong[37] finds that homes located within 400 feet of Boston's Fitchburg commuter rail line experience a discount of 18.9%. Armstrong and Rodriguez[38] found that for

[31] Landis, J. et al. (1995). Rail transit investments, real estate values and land use change: A comparative analysis of five California rail transit systems. University of California Institute of Urban and Regional Development. Berkley, CA.
[32] Voith, R. (1993). "Changing capitalization of CBD-oriented transportation systems: Evidence from Philadelphia 1970-1988." Journal of Urban Economics, Vol. 19, No. 2: 117-137.
[33] Voith, R. (1991). "Transportation sorting and house values." *AREUEA Journal*, Vol. 19, No. 2: 117:137
[34] Debrezion, G., et al. (2007). "The impact of railway stations on residential and commercial property values: A meta-analysis." *Journal of Real Estate Finance Economics*, Vol. 35: 161-180.
[35] Armstrong, R. J. & Rodrigues, D. A. (2006). "An evaluation of the accessibility benefits of commuter rail in Eastern Massachusetts using spatial hedonic price functions." *Transportation*, Vol. 33: 21-43.
[36] Landis, J. et al. (1995). Rail transit investments, real estate values and land use change: A comparative analysis of five California rail transit systems. University of California Institute of Urban and Regional Development. Berkley, CA.
[37] Armstrong, R. J. (1995). "Impacts of commuter rail service as reflected in single-family residential property values." *Transportation Research Record*, Vol. 1466: 88-98.
[38] Armstrong, R. J. & Rodrigues, D. A. (2006). "An evaluation of the accessibility benefits of commuter rail in Eastern Massachusetts using spatial hedonic price functions." *Transportation*, Vol. 33: 21-43.

every 1,000 ft. in distance from the commuter rail right-of-way, property values are $732 higher, all else held equal. However, they also found that that these coefficients likely overestimate the true effect of proximity, partly because freight rail service also operated to varying degrees over most of the rights-of-way analyzed (similar to the rail-line being used by Wyomissing to Philadelphia 30th Street Station – Dual Mode" alternative. They also found that, although the service frequency of freight trains is considerably lower than commuter rail trains, it is reasonable to expect that their length and their possible operation during nighttime hours affects the relative nuisance effect from their noise and result in steeper price discounts for freight rail than for a similar commuter rail train operation.