

Benefit-Cost Analysis Methodology

The Cost Benefit Analysis for the public infrastructure improvements at the site in the Lower Hill District was based on a comparison of build-out of the proposed multi-use development at the Project Site with three prototypical suburban communities in three distinct areas: McCandless Township, the Municipality of Monroeville, and the Municipality of Bethel Park. The analysis is based on the underlying assumption that economic expansion will occur in Allegheny County. The analysis reviews the differences between the Lower Hill urban redevelopment and three suburban locations. The density of development and resulting employment in the retail and commercial office (services), and the residential build-out was assumed to be the same for each scenario.

Development Type	Projected Employment						Total
	2015	2020	2025	2030	2035	2040	
Manufacturing	0	0	0	0	0	0	0
Retail	0	250	250	250	0	0	750
Services	0	750	750	750	0	0	2,250
Other	0	0	0	0	0	0	0
Total Employment	0	1,000	1,000	1,000	0	0	3,000
Total Housing	0	400	400	400	0	0	1,200

The key difference between development in the proposed Lower Hill District versus the alternative suburban locations is changes in transportation behavior. To support this analysis, the Southwest Pennsylvania Commission (SPC) conducted a detailed analysis simulating travel patterns for the above described development scenario for the Lower Hill District redevelopment area and each of the suburban locations. Travel simulations for the SPC’s proprietary travel model are produced with a standard four-step chain of transportation models developed by SPC for TP+ processing. The four steps include 1) trip generation, 2) trip distribution, 3) modal split, and 4) travel assignment models. A detailed description of the model is included as a separate attachment (see Section IV. Travel Estimation Process, an excerpt from the Southwestern Pennsylvania Commission Air Quality Conformity Determination, 2013 – 2016 Transportation Improvement Program and 2040 Long Range Transportation Plan, July 2012). The



key outputs from the travel simulation utilized as a basis for the benefit-cost analysis include: auto, person, and transit work and non-work trips; average auto and transit work and non-work travel times for; average auto and transit work and non-work distance traveled.

Generally, the trip generation and mode use behavior shows for each suburban location a significantly higher volume of auto trips with longer distances and longer drive times when compared to the same change in development at the urban location. The difference between the Lower Hill District and each alternative suburban location in trip generation, distance, and time was used as the basis for calculating the benefits to the project. The analysis looks at changes in travel time, fuel consumption, emissions production, vehicle operating costs, and safety.

Summary of Significant Assumptions

Project Costs and Schedule

The project construction scope is divided into six (6) elements. The details of each element, including its orientation to the site, were reviewed in preparation of this analysis and presented in the narrative portion of the FY2014 TIGER application submission. The elements and their respective costs and timing are summarized as follows:

Element	Description	Project Cost	Start	Complete	Duration
I	New Street 2, 3, 4 and Eastern Portion of Street 5	\$ 10,848,697	Aug-14	Oct-15	15
II	New Street 1 and Middle and Western Portions of Street 5	\$ 6,187,482	Jun-15	Aug-16	15
III-a	Improvements to Centre Avenue	\$ 9,168,755	Jun-15	Aug-16	15
III-b	Improvements to Centre Avenue – storm separation	\$ 1,896,697	Jun-14	Oct-14	5
IV	Improvements to Washington Place, Crawford Street, and Bedford Avenue North of Centre Ave	\$ 2,951,498	Jun-15	Aug-16	15
V-a	Preliminary Design for I-579 Crosstown Boulevard “Cap”	\$ 1,148,368	May-14	Feb-15	10
V-b	Final Design for I-579 Crosstown Boulevard “Cap”	\$ 1,551,632	Mar-15	Nov-15	9
VI	Improvements to Washington Place, Fifth Avenue, and Crawford/Pride Street South of Centre Ave	\$ 5,757,949	Jun-15	Aug-16	15
TOTAL		\$ 39,511,078			



Travel Time Savings

Travel time savings are based on total person trips (broken down by work trips and other (non-work trips) both from the region to the area and from the area to the region over the next twenty years for the Lower Hill District project site as well as for the comparative communities. Total trips by year, as well as average trip time (in hours) are based on May 2013 data provided by the Southwestern Pennsylvania Commission. The difference between the total trip time for the Project Site and each of the chosen analysis districts represents the total time savings.

The value of total time savings was subsequently derived based on total time savings as reported in the TIGER Benefit-Cost Analysis (BCA) Resource Guide. Hourly savings for work trips and all other purposes were based on the local travel category – either work or other trips at rates of \$25.23 per hour and \$12.98 per hour, respectively.

Fuel Savings

Fuel savings were derived by first calculating the total distance saved in miles, which reflects the difference between the total distance traveled resulting from development at the Lower Hill site versus each of the comparative communities. In order to calculate the total fuel savings, average car fuel use of 23.5 miles per gallon (most recently available average from Department of Transportation figure for light duty cars) was applied to the total distance saved and an average per gallon cost of \$3.58 (US Energy Information Administration 2013 annual average) was applied to the estimated total gallons.

Reduced Emissions

Reduced emissions were quantified by using the total fuel savings calculated to estimate the reduction in carbon dioxide (CO₂), Volatile Organic Compounds (VOCs), and Nitrogen Oxide (NOX) realized by developing in the proposed Lower Hill urban area when compared to suburban development. The following factors of grams per gallon were applied to the reduction in fuel consumption. These factors were developed using data in the EPA publication entitled “Greenhouse Gas Emissions from a Typical Passenger Vehicle” (EPA-420-F-11-041, December 2011):

CO ₂	8,887.00	grams CO ₂ / gallon
VOC	24.62	grams VOC / gallon
NOX	16.50	grams NOX / gallon



The resulting reductions in emissions were converted to metric tons and the value per metric ton from the TIGER Benefit-Cost Analysis (BCA) Resource Guide was then applied to monetize the savings. VOC and NOX emission reductions were valued at \$1,999 and \$7,877 per metric ton, respectively. The CO2 emission reduction was valued using the variable annual discounted factors provided in the TIGER Benefit-Cost Analysis (BCA) Resource Guide.

Reduced Operating Costs

Reduced operating costs reflect maintenance savings for automobiles as a result of reduced driving. In order to quantify reduced operating costs, an operating cost per mile of \$0.06 (AAA 2012 Study, "Your Driving Costs", reflects maintenance and tire costs per mile for an average sedan) was applied to the total miles saved derived in the fuel savings task.

Changes in Safety

The reduction in fatalities, injuries, and property damage was calculated based on the total distance savings used in the fuel, emissions, and operating calculations. A factor of \$0.15 per vehicle mile was developed based on the Pennsylvania Department of Transportation 2012 Pennsylvania Crash Facts and Statistics report. The estimated statewide total value of all fatalities, injuries, and property damage was divided by the total vehicle miles for the same period. The Pennsylvania values per fatality, type of injury, and property damage only were selected since these are more conservative than the USDOT TIGER Benefit-Cost Analysis (BCA) Resource Guide recommended values.

Discounting

Each benefit was discounted at both three and seven percent discount rates; however, only the three percent discount was used in the summary since the portion of the project reviewed by the benefit-cost analysis is a publicly funded infrastructure development. The construction cost was also discounted at a rate of three percent in accordance with TIGER recommendations.

A summary of the results showing total value of time, fuel, emissions, operating cost, and safety savings for each alternative when compared to the Lower Hill District is provided on the following page. The results indicate a positive benefit-to-cost ratio for the Lower Hill District redevelopment project when compared to each alternative. The Monroeville Area alternative resulted in a benefit-to-cost ratio of 2.09,

representing the high range. Both the McCandless Township and Bethel Park Area alternatives show similar ratio results in the middle range, 1.51 and 1.46, respectively. Based on the more conservative of the middle range results, Bethel Park versus Lower Hill District indicates a positive discounted benefit of \$55.8 million over the 20 year period of the analysis, which is significantly greater than the discounted cost of \$38.2 million for the project. The detailed tables supporting these results are included as a separate attachment. Additionally, the electronic Excel file containing further detail and the calculations and assumptions used in the benefit-cost analysis are included as an addendum to the TIGER grant submission.



Benefit Cost Analysis Results Summary Lower Hill District Area versus...

Total Annual Savings (Time, Fuel, Emissions, Operating Costs, and Safety) at 3.0% Discount

	Lower Hill District Area			Lower Hill TIGER Project Costs	
	McCandless Township	Monroeville Area	Bethel Park Area	Nominal	3.0% Discount
2014	\$4,023,627	\$6,982,536	\$2,988,788	\$6,431,624	\$6,431,624
2015	\$3,881,844	\$6,734,225	\$2,883,183	\$20,244,423	\$19,654,779
2016	\$3,769,495	\$6,539,389	\$2,799,746	\$12,835,031	\$12,098,248
2017	\$3,660,398	\$6,350,190	\$2,718,724		
2018	\$3,554,458	\$6,166,464	\$2,640,046		
2019	\$3,451,584	\$5,988,053	\$2,563,645		
2020	\$3,098,709	\$4,518,619	\$2,845,041		
2021	\$3,009,581	\$4,388,466	\$2,763,137		
2022	\$2,922,705	\$4,261,840	\$2,683,367		
2023	\$2,838,228	\$4,138,702	\$2,605,802		
2024	\$2,756,298	\$4,019,282	\$2,530,574		
2025	\$2,456,910	\$2,778,337	\$2,770,943		
2026	\$2,386,467	\$2,698,675	\$2,691,316		
2027	\$2,317,494	\$2,620,707	\$2,613,511		
2028	\$2,250,601	\$2,545,093	\$2,538,050		
2029	\$2,185,554	\$2,471,561	\$2,464,676		
2030	\$1,931,544	\$1,424,062	\$2,669,740		
2031	\$1,876,205	\$1,383,415	\$2,592,974		
2032	\$1,821,983	\$1,343,455	\$2,518,005		
2033	\$1,769,396	\$1,304,702	\$2,445,293		
2034	\$1,769,808	\$1,305,025	\$2,445,831		
Total	\$57,732,890	\$79,962,796	\$55,772,392	\$39,511,078	\$38,215,479
Benefit-to-Cost Ratio	1.51	2.09	1.46		



Benefit-Cost Analysis Long-Term Outcomes

Savings from 2014-2034 broken down by long-term outcome category at 3.0% discount

Long-Term Outcome:	Lower Hill versus...		
	McCandless Township	Monroeville Area	Bethel Park Area
Economic Competitiveness			
	<i>Time</i> \$ 35,908,712	\$ 48,279,021	\$ 35,034,608
	<i>Fuel</i> 8,894,475	12,920,414	8,447,666
	<i>Operating Costs</i> 3,193,688	4,639,259	3,033,255
Economic Competitiveness Total	\$ 47,996,875	\$ 65,838,693	\$ 46,515,529
Sustainability - Emissions	1,078,841	1,548,400	1,034,577
Safety	8,657,174	12,575,703	8,222,286
Long-Term Outcome Total	\$ 57,732,890	\$ 79,962,796	\$ 55,772,392
Benefit-to-Cost Ratio	1.51	2.09	1.46



Construction Impacts

One time construction impacts attributable to the construction of infrastructure at the Project Site were estimated based on total construction costs of \$39.5 million. Total one-time construction employment is based on US Department of Transportation (USDOT) estimates of 13,000 short-term job years created per one billion dollars of government investment. The total value of employment is based on a multiplier of 1.148 recommended by the Federal Highway Administration (<http://www.fhwa.dot.gov/policy/otps/pubs/impacts/index.htm>).

Element	Cost	Employment Value		Estimated Total Employment 2/
		Employment Factor 1/	Total Value	
I	\$ 10,848,697	1.148079	12,455,161.20	162
II	\$ 6,187,482	1.148079	7,103,718.15	92
III-a	\$ 9,168,755	1.148079	10,526,455.07	137
III-b	\$ 1,896,697	1.148079	2,177,558.00	28
IV	\$ 2,951,498	1.148079	3,388,552.87	44
V-a	\$ 1,148,368	1.148079	1,318,417.19	17
V-b	\$ 1,551,632	1.148079	1,781,396.11	23
VI	\$ 5,757,949	1.148079	6,610,580.21	86
TOTAL	\$ 39,511,078		\$ 45,361,839	590

1/ If a project does not include a substantial ROW purchase in the cost, FHWA recommends a multiplier of 1.148079.

2/ Based USDOT estimate of 13,000 short-term job years created per one billion dollars of government investment, or \$76,900 per job-year.

