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EXECUTIVE SUMMARY

This technical memorandum serves as a supplement to the Benefit-Cost Analysis (BCA) Spreadsheet submitted as part of the TIGER Discretionary Grant application. The grant application has been prepared by the City of Hoboken, NJ, to demonstrate the need for funds in support of a “Complete Streets” redesign and revitalization of Washington Street and the reconstruction of two antiquated water mains. Hoboken has analyzed the costs and benefits of the project in context with regional transportation goals to demonstrate the net benefits of the project that will be shared amongst motorists, pedestrians, transit riders, residents, through commuters, and beyond.

This technical memorandum has been prepared in response to the requirements of the Notice of Funding Availability for the United States Department of Transportation’s (DOT) National Infrastructure Investments Under the Consolidated and Further Continuing Appropriations Act, 2015 (Pub. L. 113-235 December 16, 2014).

The BCA has been documented in a spreadsheet format consistent with the requirements of the TIGER program. This technical memorandum is a companion piece to the calculations and assumptions that are presented in the BCA Spreadsheet. It details the format and layout of the BCA Spreadsheet, the methodology used to calculate costs and benefits, and the assumptions, limitations, and application of the results. There are two purposes of the BCA Spreadsheet—to describe in a thorough, complete, and accurate manner the total costs and benefits that will occur each year during the project’s life cycle and to derive a benefit-cost ratio. The benefit-cost ratio is one measure of the societal change that can occur as a result of the revitalization of Washington Street. The benefit-cost ratio is the sum total of project benefits divided by the sum total of project costs. BCA ratios greater than one are indicative of a return on a capital investment as measured through benefits spread region wide.

The two projects analyzed in the BCA are the Complete Streets reconstruction of Washington Street, as well as the replacement of two (2) outdated waterlines, which are between 100 and 120 years old, running the length of the roadway project. The reconstruction of Washington Street will include all 16 blocks of Washington Street, from Observer Highway to 15th Street. Improvements to the Complete Streets Corridor include the following:

- ADA accessible sidewalks, curb ramps, and crosswalks
- Dedicated, protected bicycle facilities and bicycle parking areas
- Upgraded and modernized traffic signals
- Pedestrian countdown signal heads
- Green elements and infrastructure
- Curb extensions (bulb-outs) to facilitate pedestrian crossings
- Skid Resistant, retroreflective crosswalks
- New and refurbished street furniture, lighting, and wayfinding
- Commercial parking and loading zones

- Enhanced bus shelters

The total cost of the project is estimated to be approximately $21.1 million dollars.

Project benefits are categorized under the five primary selection criteria of the TIGER program: quality of life, economic competitiveness, safety, state of good repair, and environmental sustainability. This technical memorandum describes the monetization of project benefits under each category. Where appropriate, this technical memorandum also describes additional benefits that are not easily monetized in a qualitative manner. It is recognized that while not all project benefits may be documented, the benefits presented herein and monetized in the BCA spreadsheet are illustrative of the positive impacts that the City of Hoboken's investment will have on the community and region.

The results of the BCA are presented in a project summary matrix using a discount of 3 percent. The BCA ratio at a 3 percent discount is 2.54. Undiscounted results (BCA of 4.06) and results at a 7 percent discount (BCA of 1.67) also are included in the BCA Spreadsheet.

BENEFIT COST ANALYSIS PROJECT SUMMARY MATRIX

Current Transportation Network	Improvements due Complete Street Redesign	Category and Type of Impact		Economic Benefit	Net Benefits Discounted at 3%
Aging pavement, Non ADA compliant pedestrian facilities, aging infrastructure.	Relieves (VMT) related to stresses on existing infrastructure. Refurbishes or reconstructs critical infrastructure elements	State of Good Repair	Pavement Savings	Pavement repair savings	$ 1,679,405.75
			Emergency Repair Savings	Savings in emergency response and repair	$ 351,108.41
			Residual Value	Remaining infrastructure value after analysis period	$ 4,038,654.07
Travel time delays due to existing pretimed cycle length, inefficient parking maneuvers, and inefficient pedestrian crossing operation.	Signal timing improvements, reduced crossing distances, more efficient parking, loading and unloading operations, and less corridor delay	Economic Competitiveness	Personal vehicle operating cost savings	Reduction in personal travel expense	$ 84,746.31
			Travel Time Savings	Reduction in delay and lost productivity	$ 910,859.58
			Parking Revenue	Increased parking space turnover and revenue	$ 32,740,341.17
Recognized desire to reduce personal auto use. Auto-centric focus and existing infrastructure that challenges historic charm and character.	Improves accessibility to multimodal travel, jobs, and activity areas for all community members	Quality of Life	Noise Mitigation Savings	Reduction in road noise and noise mitigation costs	$ 1,073,499.08
					$ 874,606.27
Heavy mobile source emissions from personal autos affecting air and water. Significant draw down on fossil fuels by personal autos.	Promotes modes shift that reduces mobile source emissions, water runoff. Encourages alternative energy technologies and waste and recycling efficiencies. More efficient and less wasteful lighting technology	Environmental Sustainability	Air quality impacts	Reduction in mobile source emissions	$ 174,162.18
			Indirect energy consumption	Reduction in VMT-dependent manufacturing	$ 83,646.51
			Water quality impacts	Reduction in mobile source run-off	$ 124,261.38
			Energy efficient trash receptacles	Reduction in trash collection pick-up frequency and maintenance	$ 482,744.30
			LED Traffic Lights	Reduction energy consumption and maintenance	$ 1,958,649.32
High-crash risk associated with personal vehicle use relative to alternate travel modes. Parking operations that create additional safety hazards. Crossing distances that extend pedestrian exposure. No dedicated bicycle facilities.	Promotes mode shift to a safer travel mode. Design elements that specifically reduce likelihood of certain types of crashes. Reduces crossing distances and provides exclusive space for peds, bikes, and autos.	Safety	Reductions in injuries and property damage only crashes	Reduction in crashes and associated societal costs	$ 5,049,126.63
				Total Benefits (without residual Value)	**$ 45,275,269.47**
				Total Costs (with Residual Value)	**$ (17,790,552.67)**
				Benefit-Cost Ratio	**2.54**

1.0 INTRODUCTION

The purpose of this grant application is to request financial assistance through DOT's TIGER program to secure funding for the City of Hoboken, New Jersey's "Complete Streets" redesign and revitalization of Washington Street, and associated replacement of two (2) outdated waterlines, which are between 100 and 120 years old, running the length of the corridor. In 2010, Washington Street was designated as one of the Top 10 ""Great Streets" by the American Planning Association. In 2014, the City of Hoboken initiated a thorough and extensive public planning process to inventory the existing conditions along Washington Street, document existing deficiencies and opportunities in streetscape, parking and loading operations, transportation infrastructure and operations, and environmental consideration. Working with the stakeholders and the community, the City developed alternatives and recommended common design elements to achieve a vision for Washington Street befitting a "Great Street":

> "Washington Street will be:
>
> - an economic engine that supports local business and attracts visitors and residents,
> - a walkable and bike-friendly street where there is mutual respect for all users,
> - safe for pedestrians,
> - convenient for accessing bus transit,
> - well-connected to surrounding neighborhoods, public destinations, and the waterfront,
> - a model "Green Street" with trees and vegetation, and
>
> Washington Street will provide:
>
> - efficient traffic flow and convenient parking,
> - innovative technologies for the safety and convenience of the traveling public,
> - places for art, social interaction, and recreation,
> - opportunities to promote and display City history and historic architecture,
> - state of the art strategies to address stormwater and mitigate flooding."

The Complete Street redesign of Washington Street is a necessary component to achieve this vision. The conceptual design will improve functionality, safety, convenience, and comfort for walkers, bicyclists, drivers, buses, loading and unloading operations, emergency vehicles – everyone who uses the street for accessing businesses and residences, and commuting to/from work. Balancing the needs of all street users is at the core of the Complete Street approach.

An important objective of the Complete Streets redesign of Washington Street is to rehabilitate the existing infrastructure, while preserving the historic charm and character of Washington Street. The redesign has been planned to:

- Introduce measures to improve pedestrian safety, bicycle accommodation, and traffic flow

- Refresh, reconfigure, and replace street furnishings
- Improve or provide additional amenities in the streetscape
- Define and reinforce a unique identity through a well-considered and consistently applied aesthetic, and
- Incorporate strategic green infrastructure measures to improve the treatment of stormwater runoff from the sidewalks and roadway.

This technical memorandum serves as a supplement to the BCA for the TIGER grant application for the proposed Complete Street redesign of Washington Street and associated water line reconstruction. It has been prepared in response to the requirements of the Notice of Funding Availability for the Department of Transportation's National Infrastructure Investments under the Consolidated and Further Continuing Appropriations Act, 2015 (Pub. L. 113-235 December 16, 2014).

The technical memorandum details the methodology, assumptions, and calculations used in the BCA. Additionally, the memorandum details the results of a sensitivity analysis to demonstrate how the calculated benefit-cost ratio may vary with changes in the value of key inputs.

This memorandum does not attempt to source every document used in the analysis except where it is relevant in discussing the methodology applied (assumptions and sources are detailed at the calculation level in the BCA Spreadsheet).

2.0 BCA SPREADSHEET FORMAT

The BCA Spreadsheet is designed to be a useful tool to reviewers and is organized to facilitate a quick understanding of the methodologies being employed.

High-level assumptions are located in the Benefit Inputs tab. Savings in vehicle miles traveled (VMT), a critical input for many benefit calculations that follow, are located in the VMT Savings tab. VMT savings are based on a 10% reduction in daily auto trips directly attributed to the Complete Streets investment of the project.

Calculated benefits are organized in five different tabs representing the five primary selection criteria of the TIGER Grant. The residual project value for major infrastructure items at the end of the analysis period is calculated in the Residual Value tab. A Consumer Price Index (CPI) tab also is provided to convert the value of dollars saved from previous years to base year 2015 dollars. Project costs are detailed in the Costs tab.

Total project benefits and costs are itemized by year in the Benefit Cost Itemized Summary tab of the Spreadsheet. An overall summary of the analysis period costs and benefits is provided in the Benefits Summary tab. In all tabs, efforts have been made to source, annotate, or otherwise explain the methodology in use in order to ensure transparency and the ability to reproduce results and to allow reviewers to modify input parameters at their discretion.

3.0 BENEFIT-COST ANALYSIS PERIOD

For the purposes of this BCA, a 21-year time period that starts from the beginning of construction is used to total benefits and costs associated with the Complete Streets redesign and water main replacement. This represents a period in time during which the long-term impacts can be confidently forecasted and is consistent with the minimum analysis period required by the TIGER program.

The initial costs of construction are applied to the year during which construction begins 2016 (year 0). Construction is assumed to take up to 12 months. As a result, project benefits are assumed to begin in 2017 (year 1). Annual project costs and benefits are calculated at the full-year value for each subsequent year.

All costs and benefits were estimated in year 2015 dollars and are based on the recommend monetized values provided in the Department of Transportation's *TIGER BCA Resource Guide*. Costs and benefits are valued in the year they occur and discounted to year 2015 to return to a present value. Discount rates of 3 percent and 7 percent were applied to the calculated values per TIGER guidelines.

It is expected that the service life of major infrastructure elements of the Complete Streets redesign and water line replacement will exceed the analysis period. As a conservative measure, a residual value was calculated for these infrastructure elements based on the service life that remains at the end of the 21-year period. Residual value is treated as a "negative cost" in economic analyses that is applied at the end of the final year of the analysis period. The residual value was determined using parabolic depreciation.

4.0 BASE CASE AND ALTERNATE CASE SCENARIOS

This BCA compares the base case of the transportation network (existing conditions with programmed roadway and transit projects) against a "build scenario" of the transportation network with the addition of the Complete Streets Redesign elements and water line replacement. The benefits of the project are only those net benefits that exist beyond the service that is provided by the base scenario. The majority of the project benefit calculations are driven by VMT savings that would result due to a mode switch from a personal auto to transit or bicycle or walking, directly attributable to the investment in Complete Streets. Accordingly, this VMT savings and subsequent equations account for a net benefit from the base case transportation network.

The base case scenario is further described as:

- Identical roadway conditions, and the operation of these networks, for the duration of the analysis period (with consistent intervals of maintenance and rehabilitation as normally scheduled)

- Population, employment, and household growth are consistent with regional forecasts for years beyond 2015.

- Traffic volume and multimodal growth that are consistent with observed regional growth trends.

It is reasonable to assume that any organic mode switch that would occur under the base-case scenario also will occur under the build scenario which eliminates the need to further "net" the savings.

Some benefits calculations are not driven by VMT savings and can be more difficult to derive net balances. These benefits are approached in two manners. First, the benefits to society that are not easily quantified (but none the less tangible and relevant to the discussion of the project's utility) are described in the Project Narrative of this TIGER Grant Application and qualitatively in this Technical Memorandum. Second, for benefits that are quantifiable yet difficult to relate to the base case, an effort is made to use lower values among an acceptable range to prevent overstating the potential benefits. In all instances, every effort is made to calculate only true, net benefits and to avoid the inclusion of transfers in the analysis (i.e., perceived benefits gained by one group that come at a cost to another group).

A sensitivity analysis is presented at the conclusion of this memorandum to show both the variability of the results with respect to changes in input values and to demonstrate the performance of the Complete Streets redesign against competing alternatives.

5.0 AFFECTED POPULATION

In an attempt to focus the methodology of the BCA on real and measureable benefits associated with the Complete Streets redesign and revitalization of Washington Street, VMT savings resulting from mode shift was chosen as the primary input in the benefit calculations. Accordingly, the affected population that is considered in this analysis includes:

- Motorists – The average daily traffic along Washington Street, the City's "Main Street" (i.e., main commercial corridor), is approximately 10,000 vehicles, which includes local traffic and through commuters. The BCA considers existing and future motorists that use Washington Street and future travelers that would have previously used a personal car in the absence of additional Complete Streets elements.

- Pedestrians and Bicyclists – There are approximately 18,000 pedestrians per day that enter the Washington Street & Newark Street intersection, and there are more pedestrians than vehicles approaching each of the intersections for more than half of the corridor. While there are no current bicycle facilities along Washington Street, approximately 100 bicycles per day travel the corridor. This BCA considers the existing and future pedestrian and bicyclist populations along Washington Street.

- Transit Riders: There are 14,000 transit riders per day along Washington Street. This BCA considers the existing and future transit use along Washington Street.

- Populations with the opportunity for personal auto travel: More than 35 percent of households in Hoboken do not own a private vehicle and nearly 12 percent of residents live below the poverty level. Additionally, there is a significant population of both elderly and young people that cannot or do not have the ability to drive. The intent of the Washington Street plan is to make the corridor safer for users of all abilities and modes of transportation, including those without the means to afford a private vehicle. As a major regional center of employment and commerce, the Washington Street redesign will increase access for low-income groups, persons with disabilities, and the elderly to jobs, economic opportunities, and a variety of public transportation options. Accordingly, this BCA considers the additional benefits to auto-independent populations.

6.0 SCOPE AND LIMITATION OF BCA

Calculations and estimates used in this BCA and any economic forecast are subject to uncertainty. Where possible, efforts were made to use values and assumptions from nationally recognized and accepted sources [e.g., the Environmental Protection Agency (EPA), DOT, etc.], that arrived at these values through extensive research and study. In many instances, after careful consideration of a range of values and forecasts, the more conservative estimates were used to not overstate the magnitude of the benefit.

The methodology presented herein and the derived results represent the best effort to comprehensively yet conservatively forecast the benefits and cost of the project. The analysis is only as accurate as the validity of the underlying assumptions and parameters. The purpose of the BCA is not to provide the absolute measure of the project's costs and benefits, but instead to demonstrate that a cross-cutting sample of expected benefits justify the costs.

The sensitivity analysis presented at the end of this memorandum provides a range of possible BCA ratios that would result from a change in the value of key input parameters.

7.0 METHODOLOGY

The remainder of this technical memorandum introduces the methodology, general assumptions, and specific inputs that were used in the BCA. Project costs were based on capital expenditures, operations and maintenance expenditures, and additional societal disadvantages that would occur as a result of the project.

Each calculated benefit was categorized under one of the five primary selection criteria as suggested in the DOT TIGER BCA guidelines. The societal impacts of these individual benefits and costs were expressed as a monetary value in year 2015 dollars. These values were calculated annually for each long-term outcome category. The summation of these annual values results in the total project value assigned to each primary selection criteria during the analysis period.

As stated previously, there are a number of benefits and costs under each selection criteria that were not easily quantifiable. Where possible, the TIGER Grant Application

Project Narrative and this technical memorandum attempts to describe, at least qualitatively, these additional factors to demonstrate the breadth of impact of this investment.

7.1 BCA Assumptions

There are many high-level assumptions that were made to facilitate the calculation of costs and benefits for this project during the analysis period.

- All final costs and benefits are expressed in 2015 dollars to be consistent with recommended monetary values provided in the *TIGER BCA Resource Guide*
- The average consumer price index is used to convert previous-year dollars to 2015 dollars. A rate of 3 percent (assuming 3 percent annual inflation) may be used to bring future year dollars to 2015 dollars (used in quantification of future year carbon monoxide and carbon dioxide emission cost savings)
- Benefits were derived from annual VMT savings due to commuters who replace all or part of their commute with no auto modes (walking, biking, transit, or a multimodal combination)
- As a conservative measure, only the annual VMT savings based on an average of 251 standard workdays was considered in this analysis
- Number of affected motorists (used later in travel time savings equations) can be quantified by multiplying the number of vehicles by an average vehicle occupancy
- While VMT savings are expected year-round, the potential addition of more transit riders could lead to the necessary increase in the number of transit routes (and associated transit VMT). Accordingly, while conservative, VMT savings results are only considered for 251 days of the year to account for any transfer of benefits and costs from one travel mode to another
- Costs and benefits may be quantified using the calculated total VMT savings at each year and a rate or equation that relates to a change in VMT to a change in the performance of a selection criteria and the associated change in monetary value
- Net benefits are calculated by finding the difference between benefits and costs. For example, mode shift will reduce the energy consumption of auto modes by the amount of VMT saved, but also will increase the energy consumption of transit modes due to additional ridership (i.e., more passengers could lead to more loads on acceleration, deceleration, etc.). It should be noted for some benefits there is a negligible corresponding cost due to mode shift (i.e., transit is less sensitive to additional riders due to its significantly larger capacity)

Project assumptions are detailed in the Benefit Inputs tab and used to calculate VMT savings in the VMT Savings tab.

7.2 Costs

The project costs of the Complete Street Redesign and water main reconstruction are described in **Table 7-1**. The total cost (including soft costs and contingencies) associated with the total project is $21,085,333. The requested TIGER Grant is for $14,000,000 to supplement over $7,000,000 in committed funds from various sources. Note that the project total below includes the addition of contingencies, preliminary engineering, and maintenance of traffic.

Table 7-1: Project Costs

Cost Element	Total
I. Washington Street Complete Street Redesign	
Roadway	$2,768,813
Traffic Signals/Intersections	$4,653,220
Lighting	$556,400
Sidewalk	$3,065,530
Streetscape	$1,760,200
Innovation/Technology	$1,300,000
Complete Streets Subtotal (approx.)	$14,104,163
II. Washington Street Water Main Reconstruction	$4,181,070
Soft Costs (design engineering and construction administration – approx. 15% of Complete Street Redesign)	$2,800,000
Project Total	**$21,085,333**

It was assumed that annual O&M costs of maintaining and rehabilitating the infrastructure elements would be similar between the base condition and the proposed project scenario. To be conservative and recognizing the addition of technology elements of the Complete Streets project, it was assumed that the proposed project would result in approximately $50,000 dollars more yearly O&M costs than under the base conditions. This value, included in the total project life-cycle costs, is subject to the sensitivity analysis at the end of this technical memorandum.

7.3 Primary Selection Criteria - Sustainability

DOT supports projects that promote environmental sustainability through improved energy efficiency, reduced dependence on oil, and reduced greenhouse gas emissions. Further, DOT supports projects that address stormwater through natural means, avoid or mitigate environmental impacts and otherwise benefit the environment, and improve or enhance the resiliency of a transportation system.

The planned Complete Street design for the corridor has inherent benefits in regards to improved sustainability of the corridor.

Qualitative sustainability benefits associated with the project, but not monetized include:

- Healthy and attractive street trees, improved tree pits design, permeable materials, and rain garden curb extensions –These green infrastructure improvements will provide increased water filtration along the corridor. This will decrease pollutants and runoff from the corridor into the combined sewer system and reduce urbanized flooding as part of a city-wide integrated water management strategy. Additionally, the inclusion of shade trees will reduce the urban heat island effect and enhance the ecological value of the corridor.

- Alternative-energy infrastructure elements – The project is planned to include solar-powered public phone charging stations, solar-powered benches for mobile phone charging with the capability to monitor air and sound quality levels, and electric vehicle charging stations. The improvements will enhance the attractiveness of the streetscape and further position walking, biking, and transit as viable and technologically innovative travel alternatives. These improvements will be implemented with minimal to no impact on the existing energy grid.

- Efficient distribution of water to homes and businesses in the service area – reconstruction of the 100+ year old water mains and laterals will allow for better quality and more efficient delivery of water. There will be less pressure loss and fewer service leaks, each resulting in less energy consumed to deliver water and less water wasted.

Quantitative Sustainability benefits associated with the project include emissions savings, water quality savings, indirect energy consumption savings, energy efficient trash receptacle savings, and street light conversion to LED energy savings. These benefits are further described below.

7.3.1 Air Quality

Every vehicle trip that is removed from the network creates reductions in the emissions of greenhouse gases and particulate matter, saving the region the costs associated with the release and mitigation of these emissions. Based on guidance from the *TIGER BCA Resource Guide*, the emissions that were measured in this analysis include carbon monoxide (CO), carbon dioxide (CO2), volatile organic compounds (VOC), nitrogen oxides (NOx), particulate matter (PM), and sulfur dioxide (SOx), and total hydrofluorocarbons (THC). It should be noted that the monetary value of THC emission is not considered in this analysis although the savings in metric tons of emission are reported.

The emission rate per VMT was based on rates published by EPA in October 2008 and September 2013 for light-duty vehicles. Rates not available in the 2013 data were estimated by multiplying the 2008 values by the ratio of carbon dioxide emission per VMT in the 2008 data to carbon dioxide emission per VMT in the 2013 data.

Emissions, expressed as grams per VMT, were converted to metric tons per VMT and multiplied by the societal cost of each specific emission per metric ton. These societal costs were provided in the TIGER BCA and are specified in the Sustainability tab of the

BCA Spreadsheet. The societal cost can be expressed as the burden (health, pollution costs, and mitigation) that society will feel as a result of the emissions.

The societal costs of CO2 vary annually and were estimated using the guidance of the Technical Support Document: *Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis* under Executive Order 12866 (Revised November 2013). The findings of that report are recreated in the Sustainability Calculations Worksheet.

The typical equations used to calculate air quality savings are:

$$CO_i = \left(VmtSavings_i \times {}^{CO}/_{VMT} * 3\right) \times Cost_{CO2i}$$

$$CO2_i = \left(VmtSavings_i \times {}^{CO2}/_{VMT}\right) \times Cost_{CO2i}$$

$$VOC_i = \left(VmtSavings_i \times {}^{VOC}/_{VMT}\right) \times Cost_{VOC}$$

$$NOX_i = \left(VmtSavings_i \times {}^{NOX}/_{VMT}\right) \times Cost_{NOX}$$

$$PM_i = \left(VmtSavings_i \times {}^{PM}/_{VMT}\right) \times Cost_{PM}$$

$$SOX_i = \left(VmtSavings_i \times {}^{SOX}/_{VMT}\right) \times Cost_{SOX}$$

$$AirQuality_i = CO_i + CO2_i + VOC_i + NOX_i + PM_i + SOX_i$$

Where:

CO_i = Value of total CO emissions savings in any year (has a 3 multiplier to account for global warming potential)

$CO2_i$ = Value of total CO_2 emissions savings in any year

VOC_i = Value of total VOC emissions savings in any year

NOX_i = Value of total NO_x emissions savings in any year

PM_i = Value of total PM emissions savings in any year

SOX_i = Value of total SO_x emissions savings in any year

$VmtSavings_i$ = VMT savings in any year

CO/VMT = average CO emitted per VMT

CO2/VMT = average CO_2 emitted per VMT

VOC/VMT = average VOC emitted per VMT

NOX/VMT = average NO_x emitted per VMT

PM/VMT = average PM emitted per VMT

SOX/VMT = average SO_x emitted per VMT

$Costs_{COi}$ = societal costs per unit emission CO in any year

$Costs_{CO2i}$ = societal costs per unit emission CO2 in any year

$Costs_{VOC}$ = societal costs per unit emission

$Costs_{NOX}$ = societal costs per unit emission

$Costs_{PM}$ = societal costs per unit emission

$Costs_{SOX}$ = societal costs per unit emission

$AirQuality_i$ = total air quality cost savings in any year

The total tons of emissions avoided and associated societal cost savings are contained in **Table 7-2** and **Table 7-3**, respectively.

Table 7-2: Total Metric Tons of Emissions Saved

Project Year	Calendar Year	Metric Tons of Emissions					
		VOC	CO	NOX	CO2	PM	THC
0	2016	-	-	-	-	-	-
1	2017	0.350		0.230		0.003	0.360
2	2018	0.350	3.170	0.230	124.090	0.003	0.360
3	2019	0.350	3.180	0.230	124.710	0.003	0.360
4	2020	0.350	3.200	0.240	125.330	0.003	0.370
5	2021	0.350	3.210	0.240	125.940	0.003	0.370
6	2022	0.360	3.230	0.240	126.560	0.003	0.370
7	2023	0.360	3.250	0.240	127.180	0.003	0.370
8	2024	0.360	3.260	0.240	127.920	0.003	0.370
9	2025	0.360	3.280	0.240	128.540	0.003	0.380
10	2026	0.360	3.300	0.240	129.150	0.003	0.380
11	2027	0.360	3.310	0.240	129.770	0.003	0.380
12	2028	0.370	3.330	0.250	130.390	0.003	0.380
13	2029	0.370	3.350	0.250	131.130	0.003	0.380
14	2030	0.370	3.360	0.250	131.750	0.003	0.390
15	2031	0.370	3.380	0.250	132.360	0.003	0.390
16	2032	0.370	3.400	0.250	133.100	0.003	0.390
17	2033	0.380	3.410	0.250	133.720	0.003	0.390
18	2034	0.380	3.430	0.250	134.340	0.003	0.390
19	2035	0.380	3.450	0.250	135.080	0.003	0.390
20	2036	0.380	3.460	0.260	135.700	0.003	0.400
Total		7.28	62.96	4.87	2466.76	0.060	7.57

Table 7-3: Undiscounted Air Quality Costs Savings

Project Year	Calendar Year	Emission Savings
0	2016	-
1	2017	$3,599
2	2018	$10,265
3	2019	$10,575
4	2020	$10,833
5	2021	$10,872
6	2022	$11,211
7	2023	$11,393
8	2024	$11,583
9	2025	$11,767
10	2026	$11,953
11	2027	$12,281
12	2028	$12,571

Project Year	Calendar Year	Emission Savings
13	2029	$12,770
14	2030	$12,961
15	2031	$13,009
16	2032	$13,358
17	2033	$13,573
18	2034	$13,771
19	2035	$13,980
20	2036	$14,259
Total		**$236,584**

Cost savings for each emission type are contained in the Sustainability tab of the BCA Spreadsheet.

7.3.2 Water Quality

Water quality cost savings represent the savings in societal costs related to the release and mitigation of pollutant runoff into community waters. Every VMT saved reduces mobile source runoff and water quality impacts, including oil and fuel runoff and damage to water resources from emissions. Average water quality impact cost per VMT was derived from studies performed by the Victoria Transportation Policy Institute and assumed to be 0.1 cents per VMT. The water quality savings were calculated as:

$$WaterQualitySavings_i = WaterCost \times VmtSavings_i$$

Where:

$WaterQualitySavings_i$ = *savings in water quality impacts in any year i*

WaterCost = average water quality impact cost per VMT of passenger car travel (.1 cents/mile)

$VmtSavings_i$ = *VMT savings in year i*

Water quality costs savings are reported in **Table 7-4.**

Table 7-4: Undiscounted Water Quality Costs Savings

Project Year	Calendar Year	Water Quality Savings
0	2016	-
1	2017	$5,363
2	2018	$5,390
3	2019	$5,417
4	2020	$5,444
5	2021	$5,471
6	2022	$5,497
7	2023	$5,524
8	2024	$5,556

Project Year	Calendar Year	Water Quality Savings
9	2025	$5,583
10	2026	$5,610
11	2027	$5,637
12	2028	$5,664
13	2029	$5,696
14	2030	$5,723
15	2031	$5,750
16	2032	$5,782
17	2033	$5,809
18	2034	$5,835
19	2035	$5,868
20	2036	$5,894
Total		**$112,514**

7.3.3 Indirect Energy Consumption

Indirect energy consumption savings result from manufacturing costs that are avoided due to a reduction in VMT. The indirect energy consumption rate for personal cars per VMT was found in *Transportation Decision Making: Principles of Project Evaluation and Programming*, Chapter 15: Impacts on Energy Use, Pages 384-386, Table 15.6, published in 2007. This table is recreated (in part) in the Sustainability Calculations Worksheet. Energy consumption was calculated by multiplying this rate by the VMT saving any year. Consumption was then translated into cost savings by applying an average costs per barrel of crude oil used in the energy consumption, assumed to be $96.12 per barrel in 2013 dollars. The energy consumption savings were calculated as:

$$IndirEnergySavings_i = IndirEnergy_{Cost} \times TotVmtSaving_i \times Cost_{barrel}$$

Where:

$IndirEnergySaving_i$ = *Costs savings in indirect energy consumption*

$IndirEnergy_{cost}$ = *average cost per unit of indirect energy consumed*

$VmtSavings_i$ = *VMT savings, as previous described*

$Cost_{barrel}$ = *Cost per barrel of crude, $96.12 (as an energy consumption equivalent)*

The total barrels of crude oil saved are reported in the Sustainability tab of the BCA Spreadsheet. **Table 7-5** describes the undiscounted indirect energy consumption cost savings.

Table 7-5: Undiscounted Indirect Energy Consumption Cost Savings

Project Year	Calendar Year	Energy Savings
0	2016	-
1	2017	7,968
2	2018	8,007
3	2019	8,047
4	2020	8,087
5	2021	8,127
6	2022	8,167

Project Year	Calendar Year	Energy Savings
7	2023	8,207
8	2024	8,254
9	2025	8,294
10	2026	8,334
11	2027	8,374
12	2028	8,414
13	2029	8,462
14	2030	8,501
15	2031	8,541
16	2032	8,589
17	2033	8,629
18	2034	8,669
19	2035	8,717
20	2036	8,756
Total		**$167,145**

7.3.4 Energy Efficient Trash Receptacles

A well-maintained Washington Street is a place where people will feel comfortable gathering, sitting on benches, eating outdoors, window shopping, and enjoying the bustle of local commerce. Simply put, cleanliness will contribute to the qualities that make Washington Street a successful place to work, live, and visit. The City of Hoboken is deploying an advanced form of litter and trash collection along Washington Street. Manufactured by BigBelly® Solar of Newton, Massachusetts, the City will combine modular waste and recycling units into a single station at each corner along Washington Street. Powered by solar energy, these stations save on trash-related costs by alerting the City for just-in-time collection, self-compacting to maximize time between collections, and tabulating collection data to inform “hot spots” of trash activity. Through this technology, the City affords all citizens and visitors the opportunity to reduce their carbon footprint by contributing to a public-space recycling program and efficient public waste collection program.

The project will install 64 stations along the corridor. BigBelly® performed a life cycle cost assessment of their solar units compared to normal trash cans. Assuming an average collection cycle for normal trash cans (3 per day), each BigBelly® station would result in a life cycle cost savings of $10,140 compared to a normal trash can (inclusive of O&M cost differences and service life). For the deployment of 64 stations, over 20 years this will result in a savings of approximately $649,000 in life time costs. For the purposes of this BCA this total value is annualized to a savings of approximately $32,450 per year. The Sustainability tab of the BCA Spreadsheet details the energy efficient trash receptacle savings.

7.3.5 LED Street Light Conversion

The existing street lighting along Washington Street is deficient, producing poor and inadequate light levels that compromise safety and contribute to glare problems for drivers and pedestrians. Further, these older style lights have no cut-off capacity, contributing to light pollution and energy drain to wasted light.

Street lighting along Washington Street will be updated and refurbished to remedy existing deficiencies by incorporating LED lighting, cut-off fixtures, and a full spectrum light source. The proposed project will furnish Washington Street with 212 LED equipped street lights.

After a strategic deployment of LED street lights, the City of Boston found an up to 60 percent decrease in energy use and carbon emissions from LED lamps and that LED lamps last up to three times longer than traditional streetlights, reducing replacement costs significantly

A recent LED cost analysis found that the average annual dollars per kilowatt-hour for LED streetlights was $292 compared to $913 for a non-led street light. Accordingly LED streetlights result in an annual savings of $621 dollars per LED light on a pure energy usage basis. Accordingly, the total energy savings associated with the Complete Street redesign over the analysis period is approximately $2.6 million dollars. The Sustainability tab of the BCA Spreadsheet details the LED street light conversion savings. While it is recognized that there will be additional life cycle savings associated with LED usage and maintenance, these benefits are not quantified as part of this BCA.

7.4 Primary Selection Criteria – Safety

DOT supports projects that improve the safety of a transportation network and reduce the number, rate, and consequence of surface transportation-related crashes, injuries, and fatalities among drivers and/or non-drivers in the United States. DOT also considers the projects ability to foster safe, connected accessible transportation for multimodal movement of goods and people.

The planned Complete Street redesign for the corridor has inherent benefits in regards to improved safety of the corridor. Enhanced intersection improvements will improve safety for all users. The existing signalized intersections do not provide pedestrian signalization and are non-compliant with the MUTCD. The planned improvements will reconstruct the existing traffic signals along the corridor to be compliant with the MUTCD and include modern traffic signal heads and pedestrian countdown signal heads. The planned improvements also include intersection bulb-outs. The intersection bulb-outs will decrease the pedestrian walking distance, which will decrease the amount of time pedestrians are exposed to other modes of traffic in the roadway. The decreased pedestrian walk times also has have benefits for other modes of travel, as this will provide for more green time for the transit and personal vehicles traveling the corridor. This will decrease delay for the vehicular, bicycle, and transit users along the corridor.

Qualitative safety benefits associated with the project, but not monetized include:

Improved pedestrian safety – The proposed redesign includes curb extensions, ADA compliant curb ramps, high visibility crosswalks, and pedestrian countdown timers.

These components enhance the pedestrian experience, reduce crossing distances, and provide additional information to facilitate the safe interaction of pedestrian and vehicular travel modes.

Safer parking and loading operations – The proposed redesign includes designated loading areas and short-term spaces to reduce the occurrences of double parking observed along the corridor. Improving the parking experience reduces potential conflicts in the travel way for other motorists.

Enhanced bicycle facilities – The proposed redesign includes protected bike lanes and bicycle boxes at the intersections. These improvements provide bicyclists exclusive space and facilitates for safer navigation approaching and through intersections.

Quantitative safety benefits associated with the project include impacts to injury and property damage only (PDO) crashes as described below.

7.4.1 Injury Crash Savings

VMT-dependent injury reduction savings of this project are created by a shift from a higher crash risk mode to a lower crash risk mode.

City of Hoboken crash rates were calculated based on real crash information between 2010 and 2014. These rates were combined with the value of statistical life associated with injury or fatality crash outlined in the *TIGER BCA Resource Guide* to define safety cost savings. The typical safety cost savings equations are

$$InjuriesAvoided_i = Rate_{Injury} \times VmtSavings_i$$

$$InjurySavings_i = InjuriesAvoided_i \times Value_{injuries}$$

Where:

$InjuriesAvoided_i$ = *amount of injuries avoided in any year*

$Rate_{Injury}$ = *injury rate per VMT of passenger car travel*

$InjurySavings_i$ = *cost savings for injury reductions in any year*

$Value_{Injuries}$ = *average cost of injury crash costs in 2013 Dollars*

$Value_{Fatalities}$ = *$9,400,000, average cost of fatality crash costs in 2013 Dollars*

In addition to VMT-related crash savings, it is expected that the implementation of Complete Streets improvement will have a direct impact on the reduction of certain crash types (rear-end, same-direction sideswipe, parked vehicle collisions, backing, pedestrian, and cyclist collisions). As a conservative assumption, it was assumed that in year 1, the implementation of Complete Streets would reduce the average number of occurrences of these crash types by 50% and in year 2 by 25%. No further benefits were quantified for any subsequent years.

The individual cost savings associated with each accident severity level are described in the Safety tab of the BCA Spreadsheet. The resulting injury cost savings including VMT dependent savings and Complete Streets improvement attributable savings of the project are described in **Table 7-6**.

Table 7-6: Undiscounted Injury Cost Savings

Project Year	Calendar Year	Injury Crash Cost Savings
0	2016	-
1	2017	$1,349,051
2	2018	$760,816
3	2019	$172,581
4	2020	$173,436
5	2021	$174,290
6	2022	$175,144
7	2023	$175,999
8	2024	$177,024
9	2025	$177,878
10	2026	$178,733
11	2027	$179,587
12	2028	$180,441
13	2029	$181,467
14	2030	$182,321
15	2031	$183,175
16	2032	$184,201
17	2033	$185,055
18	2034	$185,909
19	2035	$186,935
20	2036	$187,789
Total		**$5,351,833**

7.4.2 Property Damage Only Crashes

The property damage only (PDO) crash cost savings is created by a shift from a higher crash risk mode to a lower crash risk mode (in terms of VMT). PDO crash savings are calculated similarly to the injury savings; PDO crash rates are multiplied by a cost associated with each crash specified by DOT guidance. The typical PDO costs savings equations are:

$$DamageAvoided_i = Rate_{Damage} \times TotVmtSavings_i$$

$$DamageSavings_i = DamageAvoided_i \times Value_{Damage}$$

Where:

$DamageAvoided_i$ = amount of PDO crashes avoided in any year

$Rate_{Damage}$ = Damage crash rate per VMT of passenger car travel

$DamageSavings_i$ = cost savings for PDO crash reductions in any year

$Value_{Damage}$ = $3927.00, average cost of PDO crash costs in 2013 Dollars

In addition to VMT-related PDO crash savings, it is expected that the implementation of Complete Streets improvements will have a direct impact on the reduction of certain crash types (rear-end, same-direction sideswipe, parked vehicle collisions, backing, pedestrian, and cyclist collisions). As a conservative assumption, it was assumed that in year 1, the implementation of Complete Streets would reduce the average number of occurrences of these crash types by 50% and in year 2 by 25%. No further benefits were quantified for any subsequent years.

The resulting number of PDO crashes avoided and related cost savings including VMT dependent savings and Complete Streets improvement attributable savings is described in **Table 7-7.**

Table 7-7: Undiscounted Property Damage Only Crashes Avoided and Related Cost Savings

Project Year	Calendar Year	PDO Crash Savings
0	2016	
1	2017	$209,749
2	2018	$118,999
3	2019	$28,249
4	2020	$28,389
5	2021	$28,529
6	2022	$28,668
7	2023	$28,808
8	2024	$28,976
9	2025	$29,116
10	2026	$29,256
11	2027	$29,396
12	2028	$29,535
13	2029	$29,703
14	2030	$29,843
15	2031	$29,983
16	2032	$30,151
17	2033	$30,291
18	2034	$30,430
19	2035	$30,598
20	2036	$30,738
Total		**$859,406**

7.5 Primary Selection Criteria – State of Good Repair

DOT supports projects that improve the condition of existing transportation facilities or systems, including minimized life-cycle costs. These projects are consistent with relevant state, regional, or local efforts to maintain facilities in a state of good repair or projects whose aim is the rehabilitation, reconstruction, or upgrade of surface transportation assets that, if left unimproved, threaten future transportation network efficiency, mobility of goods or people, or economic growth due to their poor conditions.

Washington Street is a critical link in the region's transportation network, connecting Hoboken to communities along the Hudson River Coast. Daily, Washington Street supports over 18,000 pedestrians, 14,000 transit riders, 10,000 vehicles, and 100 bicyclists on a daily basis. More than just an auto-centric corridor, Washington Street is a vibrant multimodal connector. A recent survey indicated that 72 percent of respondents use Washington Street to access public transportation; which consists of three NJ Transit bus lines and is a main route to Hoboken Terminal, a regional transportation hub with ferry, regional commuter rail, light rail, and subway connections to New York City and throughout New Jersey.

Considering the importance of Washington Street to both local and through travel, the City of Hoboken has committed to not allow the street to fall into disrepair. Going above and beyond the standard repair, patch, and repave style of maintenance, this Complete Streets redesign seeks to enhance every facet of Washington Street and position it to become a more complete corridor to accommodate future travel demand.

Qualitative state of good repair benefits associated with the project, but not monetized include:

- Refurbish and reconstruction of infrastructure elements – The proposed redesign will refurbish or reconstruct multiple elements of the existing Washington Street infrastructure including: asphalt roadway resurfacing, sidewalks, light poles, water lines, benches and furnishings, bus shelters, crosswalks, pedestrian ramps, and curb bulb-outs.

Quantitative state of good repair benefits associated with the project include VMT dependent pavement maintenance savings and emergency repair savings as identified below.

7.5.1 Pavement Maintenance Savings

The pavement maintenance benefits are the savings in funding major restorative pavement maintenance. Every VMT that is transferred from the auto mode to the transit mode accounts for approximately 1.33 cents saved in pavement rehabilitation costs according to the *FHWA Highway Cost Allocation Study* (1997, revised in 2000).

The typical pavement savings equation is:

$$PavementSavings_i = Rate_{Pave} \times TotVmtSavings_i$$

Where:
$PavementSavings_i$ = cost savings for reduced pavement rehabilitation in year i
$Rate_{Damage}$ = pavement cost per VMT

The resulting pavement maintenance cost savings of the project are described in **Table 7-8**. It should be noted that without the Complete Streets project, Washington Street is due to be resurfaced at a cost of $960,000. This cost was provided by the City based on the average cost per block to resurface a street in Hoboken ($60,000/block for 16 blocks).

Table 7-8: Undiscounted Pavement Maintenance Cost Savings

Project Year	Calendar Year	Pavement Maintenance Savings
0	2016	$960,000
1	2017	$46,128
2	2018	$46,590
3	2019	$46,820
4	2020	$47,051
5	2021	$47,282
6	2022	$47,512
7	2023	$47,789
8	2024	$48,020
9	2025	$48,250
10	2026	$48,481
11	2027	$48,711
12	2028	$48,988
13	2029	$49,219
14	2030	$49,450
15	2031	$49,726
16	2032	$49,957
17	2033	$50,188
18	2034	$50,464
19	2035	$50,464
20	2036	$50,695
Total		**$1,931,785**

7.5.2 Emergency Repair Savings

The existing water line infrastructure under Washington Street, which is over 100 years old, is falling into a state of disrepair and well beyond its useful life. There have been nine (9) water main breaks on Washington Street between 1994 and 2015. Based on information provided by United Water, the average cost of a water main break is $8,000. There have been 63 reported service leaks on Washington Street during the same time period. There were only 7 reported leaks prior to 2001, which suggests the frequency of service leaks is accelerating. An average cost of a repair to a service leak is $5,000.

Based on the reconstruction of the water main it is expected that the frequencies and occurrences of main failures and services leaks will significantly reduce. Based on the costs identified above, a total avoided emergency repair cost (or a realized emergency repair savings) for the analysis period is calculated at approximately $470,000. This cost is annualized over the analysis period in the State of Good Repair Tab of the BCA Spreadsheet.

7.6 Primary Selection Criteria – Economic Competiveness

DOT supports projects that contribute during the long-term to the growth in productivity of the local, regional, and national economy. These projects improve efficiency, reliability, or cost-competitiveness in the movement of workers or goods or make improvements that increase the economic productivity of land, capital, or labor. DOT also supports projects that improve economic mobility through enhanced multi-modal connections to centers of employment, education and services or the stimulation of such centers in Economic Development Areas.

Qualitative economic competitiveness benefits associated with the project, but not monetized include:

- Increased Accessibility - As a major regional center of employment and commerce, the Washington Street redesign will increase access for low-income groups, persons with disabilities, and the elderly to jobs and economic opportunities. Washington Street also provides a link to several non-vehicular modes of travel with direct access New York City.

- Commercial loading zones, short term parking – dedicated commercial loading zones for improved operations, circulation, and to facilitate commerce

- Business Activity – business activity will be stimulated by additional pedestrians and bicycles, populations that tend to spend more on average than motorists.

- Property values – Complete Streets investments have a documented history of increasing the property values of surrounding communities.

- Healthy and attractive street trees, improved tree pits design, permeable materials, and rain garden curb extensions – These improvements will provide shape along the corridor which will encourage increased pedestrian activity along the corridor better supporting the local businesses along the corridor.

- Lighting, street furniture, and wayfinding - "better streets mean better business." Safer streets attract more people and activity and boost retail sales. Local wayfinding specific to the corridor can also increase the branding for the corridor creating a place that is more attractive for both store owners and patrons.

- Advertising – potential advertising revenue on new energy efficient trash receptacles.

- Proactive versus reactive infrastructure repair – the proposed project raises the level of quality and serviceability of the entire corridor rather than the traditional spot by spot improvements. This proactive repair is anticipated to reduce O&M and life cycle costs versus normal maintenance, rehab, and repair.

- Job creation – the expected construction activities will create short-term jobs. Complete Streets projects, particularly those including bicycle infrastructure, have a documented history of long-term job creation, as well.

It is recognized that a few of the benefits identified above may actually represent transfer benefits that may come at a cost to another area or region. Accordingly, to avoid this issue, these benefits are not monetized.

Quantitative state of good repair benefits associated with the project include VMT dependent travel cost savings, travel time savings as a measure of productivity, and additional parking revenue.

7.6.1 Vehicle Operation Costs

Vehicle operating costs are based on year 2015 data from AAA. The typical vehicle operating cost savings equations are:

$$VehcileOpsSavings_i = VmtSavings_i \times Cost_{VehicleOps}$$

Where:

$VehicleOpsSavings_i$ = vehicle operating cost savings in any year

$Cost_{VehicleOps}$ = operating cost per VMT

The annual vehicle operating cost savings are shown in **Table 7-9**.

Table 7-9: Undiscounted Annual Vehicle Operating Cost Savings

Project Year	Calendar Year	Travel Cost Savings
0	2016	
1	2017	$58,404
2	2018	$58,988
3	2019	$59,280
4	2020	$59,572
5	2021	$59,864
6	2022	$60,156
7	2023	$60,507
8	2024	$60,799
9	2025	$61,091
10	2026	$61,383
11	2027	$61,675
12	2028	$62,025
13	2029	$62,317
14	2030	$62,609
15	2031	$62,960
16	2032	$63,252
17	2033	$63,544
18	2034	$63,894
19	2035	$63,894
20	2036	$64,186
Total		**$1,230,404**

7.6.2 Travel Time Savings

Travel time savings during the work commute were estimated using a "value of time" rate supplied by the *TIGER BCA Resource Guide.* Based on a review of existing and potential future travel time along the corridor, the complete streets improvements could result in an average travel time savings of approximately 17 seconds for vehicular, transit, and bicycle travel along the corridor. The reduction of the crossing area and the enhancement of traffic signal timing to include shorter cycle lengths will also reduce the delay experienced by each pedestrian. As a conservative estimate of time savings for pedestrians, it was assumed that each pedestrian could save 15 seconds crossing an intersection and that each pedestrian crossed at least 5 intersections. The typical time savings equation is:

$$TimeSavings_i = Value\ of\ Time \times Persons$$

Where:

$TimesSaving_i$ = time cost savings in any year

ValueofTime= Time value of any commute ($13.00 in year 2013)

Persons = number of people that time savings can be attributed to

Travel time cost savings are reported in **Table 7-10**.

Table 7-10: Undiscounted Travel Time Cost Savings

Project Year	Calendar Year	Travel Time Cost Savings
0	2016	-
1	2017	$2,177,532
2	2018	$2,182,331
3	2019	$2,184,748
4	2020	$2,187,178
5	2021	$2,189,619
6	2022	$2,192,073
7	2023	$2,194,539
8	2024	$2,197,017
9	2025	$2,199,508
10	2026	$2,202,011
11	2027	$2,204,527
12	2028	$2,207,055
13	2029	$2,209,596
14	2030	$2,212,150
15	2031	$2,214,716
16	2032	$2,217,295
17	2033	$2,219,888
18	2034	$2,222,493
19	2035	$2,222,493
20	2036	$2,225,111
Total		**$44,061,879**

7.6.3 Parking Revenue

An existing parking analysis revealed the following information about parking habits along Washington Street:

- The commercial mixed-use section (Observer Highway to 8th Street) has 244 parallel on-street parking spaces. These are metered from 9 a.m.-9 p.m., Monday- Saturday, at the rate of $0.25/15 minutes, with a 2-hour maximum. Field observations indicate that these spaces are at least 90% occupied all day, and often close to 100% occupied. Parking turnover is 6-9 times per day (based on meter transactions). Revenue is approximately $2,250 per day, or nearly $700,000 per year.

- The residential mixed-use section of Washington Street (8th Street to 14th Street) has 277 angled on-street unmetered parking spaces with Permit Parking Only, allowing visitor parking in periods of 4 hours or less. Observations indicate that these spaces are nearly 100% full throughout the day, with parking over 100% full in the evening and on Saturdays, due to parking in non-parking spaces.

- Washington Street from 14th Street to 15th Street has 36 angled on-street metered parking spaces. These are metered from 9 a.m.-9 p.m., Monday-Saturday, at the rate of $0.25/15 minutes, with a 2-hour maximum. Observations indicate that these spaces are only 50% utilized before noon on weekdays, approximately 80% utilized through the day, and over 100% utilized in the evening and most of Saturday. (Utilization patterns appear to be skewed by the availability of free parking south of 14th Street). Observed parking turnover is 5-7 times per day (based on meter transactions). Revenue is approximately $300 per day, or nearly $100,000 per year.

The proposed parking plan will result in a slight increase in metered parking spaces in the commercial area all day and short term parking spaces after 2:00 PM in designated loading areas. Based on the existing information, the total revenue associated with this slight increase in parking space availability during the analysis period is approximately $1.4 million dollars. The Economic Impact Tab details the revenue associated with the short and long-term parking revenue.

7.7 Primary Selection Criteria – Quality of Life

DOT supports projects that have a positive impact on the qualitative measures of community life and that increase transportation choices and access to transportation services for people in communities across the United States. Specifically these projects further the six livability principles developed by the Partnership for Sustainable Communities:

1. Provide more transportation choices.
    - Develop safe, reliable and economical transportation choices to decrease household transportation costs, reduce our nation’s dependence on foreign oil, improve air quality, reduce greenhouse gas emissions and promote public health.
2. Promote equitable, affordable housing.

- Expand location- and energy-efficient housing choices for people of all ages, incomes, races and ethnicities to increase mobility and lower the combined cost of housing and transportation.

3. Enhance economic competitiveness.

    - Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services and other basic needs by workers as well as expanded business access to markets.

4. Support existing communities.

    - Target federal funding toward existing communities—through such strategies as transit-oriented, mixed-use development and land recycling—to increase community revitalization, improve the efficiency of public works investments, and safeguard rural landscapes.

5. Coordinate policies and leverage investment.

    - Align federal policies and funding to remove barriers to collaboration, leverage funding and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.

6. Value communities and neighborhoods.

    - Enhance the unique characteristics of all communities by investing in healthy, safe, and walkable neighborhoods—rural, urban, or suburban.
    - Creation of affordable and convenient transportation choices (particular consideration for projects that provide transportation choices to connect ED populations, non-drivers, senior citizens and persons with disabilities with employment, training and education)
    - Projects developed in coordination with land-use planning and economic development decisions, including through other federal programs

It is also recognized that many of quality of life benefits are also closely related with the other primary screening criteria. Qualitative quality of life benefits associated with the project, but not monetized include:

- Higher quality and more accessible mode choice – protected bicycle lanes to encourage bicycle travel. Redesigned bus shelters and bus stops and improved traffic signal timing to enhance access to and efficiency of public transportation.
- Walkability – Continues to position Washington Street as a “Great Street” that encourages and supports pedestrian travel.
- Location efficiency – potential to lower average household transportation cost through the availability of low-cost transportation opportunities and multimodal connections.

- Reduced environmental impacts that create better health opportunities for entire communities - Environmental stewardship creates vibrant, livable, centers of activity and is a hall mark of green placemaking.
- Enhanced safety - creates real benefits that reduce the risk of travel and that are equitably distributed to every member of the community. Street lighting that makes the community safer, and also extends the opportunity for evening activities.
- Economic activity- stimulates growth in communities can lower overall costs of living.
- State of Good Repair - raising infrastructure to an acceptable state of good repair adds value to communities and neighborhoods, attracts new development, and supports the local charm and character of historic Hoboken.

Many of these benefits were previously monetized and are not reported under the Quality of Life calculations to avoid double counting of benefits.

One specifically monetized Quality of Life savings is VMT-dependent noise related savings.

7.7.1 Noise Savings

There are savings realized by the reduced need for mitigating mobile source transportation noises. Noise costs per auto VMT are valued at 1.33 cents in year 2000 dollars based on the *FHWA Highway Cost Allocation Study* (1997, revised in 2000).

The typical noise savings equation is:

$$NoiseSavings_i = Rate_{Pave} \times VmtSavings_i$$

Where:

$NoiseSavings_i$ = cost savings for reduced noise rehabilitation in year i

$Rate_{Damage}$ = noise cost per VMT

The resulting noise cost savings of the project are described in **Table 7-11**.

Table 7-11: Undiscounted Noise Cost Savings

Project Year	Calendar Year	Noise Mitigation Savings
0	2016	
1	2017	$41,515
2	2018	$41,931
3	2019	$42,138
4	2020	$42,346
5	2021	$42,553
6	2022	$42,761
7	2023	$43,010
8	2024	$43,218

Project Year	Calendar Year	Noise Mitigation Savings
9	2025	$43,425
10	2026	$43,633
11	2027	$43,840
12	2028	$44,089
13	2029	$44,297
14	2030	$44,505
15	2031	$44,754
16	2032	$44,961
17	2033	$45,169
18	2034	$45,418
19	2035	$45,418
20	2036	$45,625
Total		**$874,606**

8.0 SENSITIVITY ANALYSIS

A sensitivity analysis is provided in **Table 8-1** to demonstrate the project's performance with regard to variances in key input parameters.

Table 8-1: Sensitivity Analysis

Sensitivity Factor	Benefit-Cost Ratio Undiscounted	Benefit-Cost Ratio @ 3% Discount	Benefit-Cost Ratio @ 7% Discount
Calculated BCA (no sensitivity):	4.06	2.54	1.67
2% VMT Savings	3.70	2.32	1.53
5% VMT Savings	3.83	2.41	1.58
30% Higher Project Costs	2.80	1.86	1.26
30% Lower Project Costs	7.35	4.03	2.49
50% More Time Saved per Trip (all modes)	5.54	3.47	2.26
50% Less Time Saved per Trip (all modes)	2.57	1.62	1.08