The Economics of Land Use

Appendix A

16th Street Multimodal Corridor TIGER FY 2014 Benefit-Cost Analysis

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Table of Contents

List of Tables

1. INTRODUCTION AND SUMMARY OF FINDINGS

Introduction

This Appendix presents the key findings and describes the methodology and assumptions behind the Benefit-Cost Analysis (BCA) for the 16th Street Multimodal Corridor TIGER FY 2014 grant application. The analysis and findings are based on research and analysis conducted by a team of technical consultants with input and direction from the SFMTA.[1]

As illustrated in Exhibit 1, the factors evaluated in this BCA specifically address the key selection criteria identified in the Department of Transportation's (DOT) Notice of Funding Availability (NOFA) for the TIGER FY 2014 grant. For example, the net economic benefits associated with reduced travel time directly address the "economic competitiveness" criteria.

Figure 1: Summary of BCA Analysis

Long-Term Outcome	Types of Societal Benefits	Monetized in CBA
Livability	Land Use Changes that Reduce VMT	No
	Increased Accessibility	No
	Property Value Increases	No
Economic Competiveness	Travel Time Savings	Yes
	Operating Cost Savings	Yes
Safety	Prevented Accidents (Property Damage), Injuries, and Fatalities	Yes
State of Good Repair	Deferral of Complete Replacement	No
	Maintenance & Repair Savings	Yes
	Reduced VMT from Not Closing Bridges.	No
Environmental Sustainability	Environmental Benefits from Reduced Emissions	Yes

[1] The consultant team includes Economic & Planning Systems (EPS), a land use economics consulting firm, Industrial Economics, Incorporated (IEc), an applied economics firm with a specialization in regulatory analysis, and Fehr & Peers, a transportation planning and traffic engineering consulting firm.

Analytical Framework

This BCA compares the "social" costs associated with TIGER projects with the "social" benefits and, to the extent possible, monetizes the net impact based on a "net present value"[2] calculation. "Social" costs and benefits refer to the actual gains or losses to society as a whole as opposed to transfers of goods and resources from one group or region to another. The BCA calculation only includes factors where both costs and benefits can be effectively monetized based on best practices defined by DOT's. Project-related costs or benefits that cannot be monetized have been excluded from the formal BCA calculation but discussed qualitatively throughout this application.

DOT directs applicants to measure costs and benefits of the proposed project against a "baseline," defined as the way the world would look if the project did not receive the requested TIGER FY 2014 funding. This BCA compares three alternative scenarios that are designed to reflect costs and benefits in a world "with" and a world "without" the proposed TIGER VI funding. The definition and key analytical assumptions of these two scenarios is described below.

No Project Baseline

This alternative assumes the existing Fillmore trolley bus route remains with no physical street improvements or rerouting of the service. No complimentary shuttle service is assumed.

Shuttle Alternative

The 22 Fillmore trolley coach service would run from the current northern terminus to Kansas Street (route distance 4.62 miles one-way). The Shuttle motor coach service would run from the 16th Street/Mission Street intersection to Third Street, and north to the turnaround at Mission Bay Boulevard North and South (route distance of 2.19 miles one-way).

The 33 Stanyan trolley coach service, rerouted as described in the Transit Effectiveness Project along the former 22 Fillmore route east of Kansas (route distance of 7.38 miles one way).

No physical improvements or rerouting of the service is included.

16 Street Corridor Multimodal Project ("Preferred Project")

The 22 Fillmore trolley coach service from the current northern terminus, down 16th Street to Third Street, and north to the turnaround at Mission Bay Boulevard North and South (route distance of 5.65 miles one way). No shuttle service is included.

The 33 Stanyan trolley coach service would be rerouted as described in the Transit Effectiveness Project along the former 22 Fillmore route east of Kansas (route distance of 7.38 miles one way).

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[2] A net present value calculation accounts for the economic effects associated with differences in the timing of gains and losses (e.g. delayed costs or accelerated benefits are more valuable). Specifically, this analysis applies an annual discount rate of 7 percent to costs and benefits that accrue over time (as required by DOT, a 3 percent discount rate is also included to test the sensitivity of our results to the selected rate).

All capital improvements on 16th Street from Church to Third as described in the 22 Fillmore Travel Time Reduction Proposal, including transit-only lanes, sidewalk extensions or bus bulb-outs, pedestrian bulb-outs, new and upgraded signals, Pedestrian Countdown Signals, high-visibility crosswalks, landscaping and innovative storm-water management infrastructure..

Summary of Findings

Tables 1 through **3** summarize the monetized costs and benefits from the Preferred Project and Shuttle Alternative, respectively, for a 20 year time-frame. Future costs and benefits have been discounted back to a net present value estimate based on a 7 percent and 3 percent discount rate.

Table 1 Summary of Benefits for Preferred Project

Long-Term outcome	**Types of Societal Benefits**	**Monetized Benefit**
State of Good Repair	Maintenance & repair savings	Not monetized
Economic Competitiveness	Travel time savings	$25.7 to $46.3 million depending on discount rate
Environmental Sustainability	Environmental benefits from reduced emissions	Not monetized for Preferred Project
Safety	Prevented accidents (property damage), injuries, and fatalities	$42 to $74 million depending on discount rate
Total Monetized Benefits		**$ 67.7 to $120.3 million depending on discount rate**
Total TIGER Project Cost		**$ 67,138,614**

Current Status / Basleine & Problem to be Address	Change to Basline / Alternatives	Type of Impacts	Population affected by impacts	Economic Benefits	Summary of Results
Poor Connectivity and unsafe conditions for pedestrians and transit riders	Provide a variety of safety improveements and improve transit route	Improve safety, pedestrain and transit accessibility	8,000 + transit riders and pedestrians	Monetized value of reduced travel time and iinjury / fatality prevention	$2.7 million to $32 million in net benefits (after accounting for project costs) over 25 years

Table 2 Summary of BCA Analysis for Preferred Project

Project Year	Calendar Year	Value of Prevented Injuries / Fatalities (high estimate) @ 7%	Value of Prevented Injuries / Fatalities (high estimate) @ 3%	Discounted Value of Time Savings @ 7%	Discounted Value of Time Savings @ 3%	Total Project Costs (includes Capital and O&M) @ 7%	Total Project Costs (includes Capital and O&M) @ 3%	**Net Discounted Benefits** @ 7%	**Net Discounted Benefits** @ 3%
0	2014	$0	$0	$0	$0	$1,684,466	$1,749,883	($1,684,466)	($1,749,883)
1	2015	$0	$0	$0	$0	$2,203,974	$2,378,481	($2,203,974)	($2,378,481)
2	2016	$0	$0	$0	$0	$4,413,834	$4,948,296	($4,413,834)	($4,948,296)
3	2017	$0	$0	$0	$0	$550,011	$640,557	($550,011)	($640,557)
4	2018	$0	$0	$0	$0	$20,207,745	$24,448,410	($20,207,745)	($24,448,410)
5	2019	$0	$0	$0	$0	$18,885,743	$23,736,320	($18,885,743)	($23,736,320)
6	2020	$3,711,297	$4,845,644	$2,014,593	$2,630,347	$1,517,676	$1,981,550	$4,208,213	$5,494,441
7	2021	$3,468,501	$4,704,509	$1,912,922	$2,594,595	$1,418,389	$1,923,835	$3,963,034	$5,375,269
8	2022	$3,241,590	$4,567,484	$1,816,382	$2,559,329	$1,325,597	$1,867,801	$3,732,374	$5,259,012
9	2023	$3,029,523	$4,434,451	$1,724,714	$2,524,542	$1,238,876	$1,813,399	$3,515,361	$5,145,594
10	2024	$2,831,330	$4,305,292	$1,637,672	$2,490,228	$1,157,828	$1,760,582	$3,311,174	$5,034,938
11	2025	$2,646,103	$4,179,895	$1,555,023	$2,456,380	$1,082,082	$1,709,303	$3,119,044	$4,926,973
12	2026	$2,472,994	$4,058,151	$1,476,545	$2,422,992	$1,011,292	$1,659,517	$2,938,247	$4,821,626
13	2027	$2,311,209	$3,939,952	$1,402,028	$2,390,058	$945,133	$1,611,182	$2,768,105	$4,718,829
14	2028	$2,160,008	$3,825,196	$1,331,272	$2,357,572	$883,302	$1,564,254	$2,607,978	$4,618,514
15	2029	$2,018,699	$3,713,783	$1,264,086	$2,325,527	$825,515	$1,518,693	$2,457,270	$4,520,617
16	2030	$1,886,635	$3,605,614	$1,200,291	$2,293,918	$771,510	$1,474,459	$2,315,416	$4,425,073
17	2031	$1,763,210	$3,500,596	$1,139,716	$2,262,739	$721,037	$1,431,514	$2,181,889	$4,331,821
18	2032	$1,647,860	$3,398,637	$1,082,197	$2,231,983	$673,866	$1,389,819	$2,056,191	$4,240,801
19	2033	$1,540,056	$3,299,648	$1,027,582	$2,201,645	$629,782	$1,349,339	$1,937,856	$4,151,954
20	2034	$1,439,305	$3,203,542	$975,722	$2,171,720	$588,581	$1,310,038	$1,826,446	$4,065,224
21	2035	$1,345,145	$3,110,235	$926,480	$2,142,202	$550,076	$1,271,882	$1,721,549	$3,980,555
22	2036	$1,257,145	$3,019,645	$879,723	$2,113,084	$514,090	$1,234,837	$1,622,778	$3,897,893
23	2037	$1,174,901	$2,931,694	$835,326	$2,084,363	$480,457	$1,198,870	$1,529,770	$3,817,187
24	2038	$1,098,039	$2,846,305	$793,169	$2,056,032	$449,026	$1,163,952	$1,442,182	$3,738,385
25	2039	$1,026,204	$2,763,403	$753,140	$2,028,086	$419,650	$1,130,050	$1,359,695	$3,661,438
Total		$42,069,755	$74,253,679	$25,748,583	$46,337,342	$65,149,540	$88,266,822	**$2,668,798**	**$32,324,198**

Table 3 Summary of BCA Analysis for the Shuttle Alternative

Project Year	Calendar Year	Discounted Value of Time Savings		Discounted Cost of Increased Emissions		Increased Operating Costs		**Net Discounted Benefits**	
		@ 7%	@ 3%	@ 7%	@ 3%	@ 7%	@ 3%	@ 7%	@ 3%
0	2014	$0	$0	$0	$0	$0	$0	$0	$0
1	2015	$0	$0	$0	$0	$0	$0	$0	$0
2	2016	$0	$0	$0	$0	$0	$0	$0	$0
3	2017	$0	$0	$0	$0	$0	$0	$0	$0
4	2018	$0	$0	$0	$0	$0	$0	$0	$0
5	2019	$0	$0	$0	$0	$0	$0	$0	$0
6	2020	$192,919	$251,885	$9,475,551	$12,371,727	$5,992,164	$7,823,653	($15,274,796)	($19,943,496)
7	2021	$182,462	$247,483	$8,855,655	$12,011,386	$5,600,154	$7,595,780	($14,273,347)	($19,359,683)
8	2022	$172,572	$243,158	$8,276,313	$11,661,539	$5,233,788	$7,374,543	($13,337,530)	($18,792,925)
9	2023	$163,217	$238,908	$7,734,872	$11,321,883	$4,891,391	$7,159,751	($12,463,046)	($18,242,725)
10	2024	$154,370	$234,733	$7,228,852	$10,992,119	$4,571,393	$6,951,214	($11,645,876)	($17,708,601)
11	2025	$146,002	$230,631	$6,755,937	$10,671,961	$4,272,330	$6,748,752	($10,882,265)	($17,190,081)
12	2026	$138,088	$226,601	$6,313,960	$10,361,127	$3,992,832	$6,552,186	($10,168,704)	($16,686,712)
13	2027	$130,603	$222,641	$5,900,897	$10,059,346	$3,731,619	$6,361,346	($9,501,913)	($16,198,052)
14	2028	$123,524	$218,750	$5,514,857	$9,766,356	$3,487,494	$6,176,064	($8,878,828)	($15,723,670)
15	2029	$116,828	$214,927	$5,154,072	$9,481,899	$3,259,340	$5,996,179	($8,296,584)	($15,263,150)
16	2030	$110,495	$211,171	$4,816,890	$9,205,727	$3,046,113	$5,821,533	($7,752,507)	($14,816,089)
17	2031	$104,506	$207,481	$4,501,766	$8,937,599	$2,846,834	$5,651,973	($7,244,094)	($14,382,092)
18	2032	$98,841	$203,855	$4,207,258	$8,677,281	$2,660,593	$5,487,353	($6,769,010)	($13,960,779)
19	2033	$93,483	$200,292	$3,932,017	$8,424,544	$2,486,535	$5,327,527	($6,325,069)	($13,551,779)
20	2034	$88,416	$196,792	$3,674,782	$8,179,169	$2,323,865	$5,172,356	($5,910,231)	($13,154,733)
21	2035	$83,623	$193,353	$3,434,376	$7,940,941	$2,171,836	$5,021,705	($5,522,589)	($12,769,293)
22	2036	$79,090	$189,974	$3,209,697	$7,709,651	$2,029,753	$4,875,442	($5,160,360)	($12,395,119)
23	2037	$74,803	$186,654	$2,999,717	$7,485,098	$1,896,966	$4,733,439	($4,821,879)	($12,031,883)
24	2038	$70,748	$183,392	$2,803,474	$7,267,086	$1,772,865	$4,595,572	($4,505,590)	($11,679,265)
25	2039	$66,913	$180,187	$2,620,069	$7,055,423	$1,656,883	$4,461,720	($4,210,039)	($11,336,956)
Total		$2,391,504	$4,282,868	$107,411,009	$189,581,862	$67,924,750	$119,888,089	**($172,944,254)**	**($305,187,083)**

2. TRAVEL TIME SAVINGS BENEFITS

This section estimates the transportation time savings for transit riders along the 16th Street corridor. These estimated time savings are monetized based on DOT guidance for the value of personal and business related commutes. The analysis excludes the potential vehicle commute time savings associated congestion relief created by the added transit service and improved bicycle/pedestrian facilities included in the project.

Travel Time Savings Context

According to data from the SFMTA, the 22 Fillmore currently accommodates approximately 8,000 trips. This number is expected to grow in the future due to significant land use expansion along the corridor, most notably in Mission Bay. When fully built, Mission Bay will include a new campus of the University of California San Francisco (UCSF), future sites of three hospitals primarily serving children, women and cancer patients. In addition, the Golden State Warriors have announced the purchase of waterfront property for a new 18,000 seat professional basketball arena near the proposed 22 Fillmore terminus at the east end of 16th Street.

Development in Mission Bay, even without the new arena, is expected to create more than 6,000 housing units and 32,000 jobs in addition to nearly nine million square feet of educational, research and development, and office space.

To help catalyze Mission Bay development, the Department of Transportation is investing $10,000,000 in Fourth Cycle TIGER funds for an array of street and light rail infrastructure investments. The 16th Street Project will build on that investment to provide a direct link from Mission Bay to jobs, residencies and regional transit options to the west.

The 16th Street Corridor is currently served by the 22 Fillmore transit route. Carrying over 8,000 weekday customers, the route operates at an average speed of 7 miles per hour during peak periods. This slow speed is due in large part to closely spaced stops and traffic. Vehicle congestion and transit delays are anticipated to grow substantially in tandem with the development along the corridor, further slowing transit service.

Additionally, narrow sidewalks, a lack of street trees, and several unsignalized and complex intersections make the corridor difficult and unpleasant to navigate on foot.

In sum, over 43,000 people (51% minority, 25% low-income) live within a quarter-mile of the project area. Approximately 2,800 businesses employing over 23,000 individuals also call the area home. The proposed project will connect and engage these communities to improve reliability, travel time, safety, and accessibility for all regardless of mode of travel. It will also provide ladders of opportunity in the form of better transportation choices, whether people choose to walk, bike or take transit.

Travel Time Savings Calculations

The travel time savings calculated herein are based on (1) improved travel times for the 22 Fillmore, (2) expanded transit ridership due to population and employment growth, (3) expanded transit ridership due improved transit service, including more frequent and efficient service, and (4) the proposed route change which brings transit riders closer to key origins an destinations along the Corridor, most notably in Mission Bay. The key travel time savings are summarized as follows.

Alternatives	Extents	One-way travel time for length of route	One-Way Travel time savings from "No Project"
No Project	current travel time for 22 Fillmore from Bay/Fillmore to 20th/3rd, T Third from 20th to UCSF/Mission Bay stop, plus transfer time	**64 min**	**-**
55 Shuttle	travel time for the 22 Fillmore from Bay/Fillmore to Kansas, the motor coach service from 16th/Mission to Mission Bay Terminal, plus transfer time	**63 min**	**1 min**
Preferred Project	travel time for the full length of the new route, Bay/Fillmore to Mission bay Terminal	**54 min**	**10 min**

The ridership changes are summarized as follows based on transportation model forecasts the project; other rates based on rates for similar projects in San Francisco.

- No Project: 1% (just growth)
- 55 Shuttle: 1.2% (growth + service to Mission Bay)
- Preferred Project: 1.6% (growth + service to Mission Bay + transit network improvements and lack of transfer)

The key assumptions underlying the time savings calculations are also summarized in **Table 4.**

Table 4 Key Assumptions for Transit Rider Time Savings

Assumption	22 Fillmore
Project Completion (1st year of benefits)	2020
Baseline Average Daily Ridership[1]	
Weekdays	8,000
Saturday (@ 73% of weekday)	5,840
Sunday (@ 69% of weekday)	5,520
Annual Average Growth in Ridership[1]	
No Project (Baseline Growth)	1.0%
55 Shuttle Alternative	1.2%
16th St. BRT Project	1.6%
Ridership by Type	
Personal	95.4%
Business	4.6%
Time Value Assumptions / Hour	
Personal	*$12.42/ hr*
Business	*$25.23/ hr*
Average Time Savings on Route (one-way)[1]	
No Project	0
55 Shuttle Alternative	1 minute
16th St. BRT Project	10 minutes
Average Time Savings / Rider on Transit[2]	
No Project	0
55 Shuttle Alternative	.5 minutes
16th St. BRT Project	5.0 minutes

[1] Estimate for the portion of the route to be affected by improvements only.
[2] Assumes the average rider benefits from 50% of the oneway trip time savings (i.e. 1/2 of a full one-way trip).

Sources: SFMTA; DOT

The monetization of the travel time benefits for both the 16th Street BRT Project (Preferred) and 55 Shuttle Alternative are calculated in **Table 5** and **Table 6** respectively.

Table 5 22 Fillmore Transit Travel Time Savings Benefit Calculation

Project Year	Calendar Year	Average Daily Ridership[1]		Total Annual Ridership[3]			Annual Time Savings (minutes)[4]			Value of Time Savings Per Year (in undiscounted 2013$s)			Discounted Travel Time Savings Per Year	
		Weekday	Weekend[2]	Total	Business	Personal	Business	Personal	Total	Business	Personal	Total	7% Discount Rate	3% Discount Rate
	Assumptions:			*100.0%*	*4.6%*	*95.4%*	*5.0*	*5.0*		*$25.23/ hr*	*$12.42/ hr*			
5	2019	8,833	6,271	2,937,032	135,103	2,801,928	-	-	-	$0	$0	$0	$0	$0
6	2020	8,974	6,372	2,984,024	137,265	2,846,759	686,326	14,233,795	14,920,120	$288,600	$2,946,396	$3,234,995	$2,014,593	$2,630,347
7	2021	9,118	6,473	3,031,768	139,461	2,892,307	697,307	14,461,536	15,158,842	$293,217	$2,993,538	$3,286,755	$1,912,922	$2,594,595
8	2022	9,263	6,577	3,080,277	141,693	2,938,584	708,464	14,692,920	15,401,384	$297,909	$3,041,434	$3,339,343	$1,816,382	$2,559,329
9	2023	9,412	6,682	3,129,561	143,960	2,985,601	719,799	14,928,007	15,647,806	$302,676	$3,090,097	$3,392,773	$1,724,714	$2,524,542
10	2024	9,562	6,789	3,179,634	146,263	3,033,371	731,316	15,166,855	15,898,171	$307,518	$3,139,539	$3,447,057	$1,637,672	$2,490,228
11	2025	9,715	6,898	3,230,508	148,603	3,081,905	743,017	15,409,525	16,152,542	$312,439	$3,189,772	$3,502,210	$1,555,023	$2,456,380
12	2026	9,871	7,008	3,282,196	150,981	3,131,215	754,905	15,656,077	16,410,982	$317,438	$3,240,808	$3,558,246	$1,476,545	$2,422,992
13	2027	10,029	7,120	3,334,712	153,397	3,181,315	766,984	15,906,574	16,673,558	$322,517	$3,292,661	$3,615,178	$1,402,028	$2,390,058
14	2028	10,189	7,234	3,388,067	155,851	3,232,216	779,255	16,161,080	16,940,335	$327,677	$3,345,343	$3,673,020	$1,331,272	$2,357,572
15	2029	10,352	7,350	3,442,276	158,345	3,283,931	791,723	16,419,657	17,211,380	$332,920	$3,398,869	$3,731,789	$1,264,086	$2,325,527
16	2030	10,518	7,468	3,497,352	160,878	3,336,474	804,391	16,682,371	17,486,762	$338,246	$3,453,251	$3,791,497	$1,200,291	$2,293,918
17	2031	10,686	7,587	3,553,310	163,452	3,389,858	817,261	16,949,289	17,766,551	$343,658	$3,508,503	$3,852,161	$1,139,716	$2,262,739
18	2032	10,857	7,708	3,610,163	166,068	3,444,096	830,338	17,220,478	18,050,815	$349,157	$3,564,639	$3,913,796	$1,082,197	$2,231,983
19	2033	11,031	7,832	3,667,926	168,725	3,499,201	843,623	17,496,006	18,339,628	$354,743	$3,621,673	$3,976,417	$1,027,582	$2,201,645
20	2034	11,207	7,957	3,726,613	171,424	3,555,188	857,121	17,775,942	18,633,063	$360,419	$3,679,620	$4,040,039	$975,722	$2,171,720
21	2035	11,386	8,084	3,786,238	174,167	3,612,071	870,835	18,060,357	18,931,192	$366,186	$3,738,494	$4,104,680	$926,480	$2,142,202
22	2036	11,569	8,214	3,846,818	176,954	3,669,864	884,768	18,349,322	19,234,091	$372,045	$3,798,310	$4,170,355	$879,723	$2,113,084
23	2037	11,754	8,345	3,908,367	179,785	3,728,582	898,924	18,642,912	19,541,836	$377,998	$3,859,083	$4,237,080	$835,326	$2,084,363
24	2038	11,942	8,479	3,970,901	182,661	3,788,240	913,307	18,941,198	19,854,505	$384,046	$3,920,828	$4,304,874	$793,169	$2,056,032
25	2039	12,133	8,614	4,034,435	185,584	3,848,851	927,920	19,244,257	20,172,177	$390,190	$3,983,561	$4,373,752	$753,140	$2,028,086
Total (20 years of Benefits)												**$75,546,018**	**$25,748,583**	**$46,337,342**

[1] Average daily ridership counts passengers based on number of boardings, therefore, one passenger round-trip would be counted as a ridership of 2, one boarding for each leg of the trip, to- and from. Ridership is projected to increase at an average growth rate of 1.6% per year or an annual total of 4.03 million by 2039.

[2] Calculation of average daily ridership on weekends:

	Days per Year	% of Weekday	Daily Ridership in 2014	Data source and notes
Weekday	253	100%	8,000	SFMTA
Saturday		73%	5,840	SFMTA
Sunday		69%	5,520	SFMTA
Avg. Weekend	112	**71%**	**5,680**	

[3] Based on 253 days of weekday operations and 112 weekend days of operations.

[4] Based on a total route one-way-trip reduction of 10 minutes (or 5 minutes), and assumes the typical passenger-trip is 50% of one-way route length.

Sources: San Francisco Metropolitan Transit Agency; U.S. Department of Transportation, 2014 TIGER BCA Guide.

Table 6 Shuttle Transit Travel Time Savings Benefit Calculation

Project Year	Calendar Year	Average Daily Ridership[1]		Total Annual Ridership[3]			Annual Time Savings (minutes)[4]			Value of Time Savings Per Year (in undiscounted 2013$s)			Discounted Travel Time Savings Per Year	
		Weekday	Weekend[2]	Total	Business	Personal	Business	Personal	Total	Business	Personal	Total	7% Discount Rate	3% Discount Rate
	Assumptions:			*100.0%*	*4.6%*	*95.4%*	*0.5*	*0.5*		*$25.23/ hr*	*$12.42/ hr*			
5	2019	8,492	6,029	2,823,646	129,888	2,693,759	-	-	-	$0	$0	$0	$0	$0
6	2020	8,594	6,101	2,857,530	131,446	2,726,084	65,723	1,363,042	1,428,765	$27,637	$282,150	$309,786	$192,919	$251,885
7	2021	8,697	6,175	2,891,821	133,024	2,758,797	66,512	1,379,398	1,445,910	$27,968	$285,535	$313,504	$182,462	$247,483
8	2022	8,801	6,249	2,926,522	134,620	2,791,902	67,310	1,395,951	1,463,261	$28,304	$288,962	$317,266	$172,572	$243,158
9	2023	8,907	6,324	2,961,641	136,235	2,825,405	68,118	1,412,703	1,480,820	$28,644	$292,429	$321,073	$163,217	$238,908
10	2024	9,014	6,400	2,997,180	137,870	2,859,310	68,935	1,429,655	1,498,590	$28,987	$295,939	$324,926	$154,370	$234,733
11	2025	9,122	6,476	3,033,147	139,525	2,893,622	69,762	1,446,811	1,516,573	$29,335	$299,490	$328,825	$146,002	$230,631
12	2026	9,231	6,554	3,069,544	141,199	2,928,345	70,600	1,464,173	1,534,772	$29,687	$303,084	$332,771	$138,088	$226,601
13	2027	9,342	6,633	3,106,379	142,893	2,963,485	71,447	1,481,743	1,553,189	$30,043	$306,721	$336,764	$130,603	$222,641
14	2028	9,454	6,712	3,143,655	144,608	2,999,047	72,304	1,499,524	1,571,828	$30,404	$310,401	$340,805	$123,524	$218,750
15	2029	9,567	6,793	3,181,379	146,343	3,035,036	73,172	1,517,518	1,590,690	$30,769	$314,126	$344,895	$116,828	$214,927
16	2030	9,682	6,874	3,219,556	148,100	3,071,456	74,050	1,535,728	1,609,778	$31,138	$317,896	$349,034	$110,495	$211,171
17	2031	9,798	6,957	3,258,190	149,877	3,108,314	74,938	1,554,157	1,629,095	$31,512	$321,710	$353,222	$104,506	$207,481
18	2032	9,916	7,040	3,297,289	151,675	3,145,613	75,838	1,572,807	1,648,644	$31,890	$325,571	$357,461	$98,841	$203,855
19	2033	10,035	7,125	3,336,856	153,495	3,183,361	76,748	1,591,680	1,668,428	$32,272	$329,478	$361,750	$93,483	$200,292
20	2034	10,155	7,210	3,376,899	155,337	3,221,561	77,669	1,610,781	1,688,449	$32,660	$333,432	$366,091	$88,416	$196,792
21	2035	10,277	7,297	3,417,421	157,201	3,260,220	78,601	1,630,110	1,708,711	$33,052	$337,433	$370,484	$83,623	$193,353
22	2036	10,401	7,384	3,458,430	159,088	3,299,343	79,544	1,649,671	1,729,215	$33,448	$341,482	$374,930	$79,090	$189,974
23	2037	10,525	7,473	3,499,932	160,997	3,338,935	80,498	1,669,467	1,749,966	$33,850	$345,580	$379,429	$74,803	$186,654
24	2038	10,652	7,563	3,541,931	162,929	3,379,002	81,464	1,689,501	1,770,965	$34,256	$349,727	$383,982	$70,748	$183,392
25	2039	10,780	7,654	3,584,434	164,884	3,419,550	82,442	1,709,775	1,792,217	$34,667	$353,923	$388,590	$66,913	$180,187
Total												**$6,955,589**	**$2,391,504**	**$4,282,868**

[1] Average daily ridership counts passengers based on number of boardings, therefore, one passenger round-trip would be counted as a ridership of 2, one boarding for each leg of the trip, to- and from. Ridership is projected to increase at an average growth rate of 1.2% per year or an annual total of 3.58 million by 2039.

[2] Calculation of average daily ridership on weekends:

	Days per Year	% of Weekday	Daily Ridership in 2014	Data source and notes
Weekday	253	100%	8,000	SFMTA
Saturday		73%	5,840	SFMTA
Sunday		69%	5,520	SFMTA
Avg. Weekend	112	**71%**	**5,680**	

[3] Based on 253 days of weekday operations and 112 weekend days of operations.

[4] Based on a total route one-way-trip reduction of 10 minutes (or 5 minutes), and assumes the typical passenger-trip is 50% of one-way route length.

Sources: San Francisco Metropolitan Transit Agency; U.S. Department of Transportation, 2014 TIGER BCA Guide.

3. AIR EMISSIONS COSTS

Both the Preferred Project and Baseline alternatives assume zero emission transit vehicles for the 22 Fillmore routes. Consequently, this BCA has not calculated any emission reduction benefits associated with the Preferred Project relative to the Baseline. To the extent that the bicycle and pedestrian improvements included in the 16th Street Corridor improvements lead to mode shift away from vehicles, this assumptions represents an underestimate of actual emission reductions that might result.

However, the costs of additional air emissions are calculated for the Shuttle Alternative since this represents the introduction of a biodiesel motor coach to operate transit service along the corridor. The assumptions and calculations for the likely emission costs associated with this alternative are provide in **Table 7** and **Table 8** below.

Table 7 Key Assumptions for Emissions Costs Produced Under the Shuttle Alternative

	Types of Emissions				
Item Description	Volatile Organic Compounds (VOCs)	Nitrogen Oxides (NOx)	Particulate Matter (PM)	**Total Costs (2013$)**	**Data Source**
Values ($2013)					
$ / metric ton	$1,999	$7,877	$360,383		TIGER BCA Guide
Annual Transit Vehicle Emissions					
Emissions per Mile (Grams)	0.10	2.4	0.11		TEP DEIR
Daily VMT	709.60	709.60	709.60		
Annual Vehicle Miles Travelled (VMTs)	259,004	259,004	259,004		
Annual Emissions Produced (Grams)	25,900	621,610	28,490		
Metric Tons	25.9	621.6	28.5		
Annual Social Costs of Emissions	**$51,775**	**$4,896,419**	**$10,267,470**	**$15,215,664**	

Table 8 Annual Social Costs of Emissions under the Shuttle Alternative

Project Year	Calendar Year	Types of Emissions: Volatile Organic Compounds (VOCs)	Types of Emissions: Nitrogen Oxides (NOx)	Types of Emissions: Particulate Matter (PM)	Undiscounted Total Emission Costs (2013$) [1]	Discounted Social Costs of Emissions @ 7%	Discounted Social Costs of Emissions @ 3%
5	2019	$0	$0	$0	$0	$0	$0
6	2020	$51,775	$4,896,419	$10,267,470	$15,215,664	$9,475,551	$12,371,727
7	2021	$51,775	$4,896,419	$10,267,470	$15,215,664	$8,855,655	$12,011,386
8	2022	$51,775	$4,896,419	$10,267,470	$15,215,664	$8,276,313	$11,661,539
9	2023	$51,775	$4,896,419	$10,267,470	$15,215,664	$7,734,872	$11,321,883
10	2024	$51,775	$4,896,419	$10,267,470	$15,215,664	$7,228,852	$10,992,119
11	2025	$51,775	$4,896,419	$10,267,470	$15,215,664	$6,755,937	$10,671,961
12	2026	$51,775	$4,896,419	$10,267,470	$15,215,664	$6,313,960	$10,361,127
13	2027	$51,775	$4,896,419	$10,267,470	$15,215,664	$5,900,897	$10,059,346
14	2028	$51,775	$4,896,419	$10,267,470	$15,215,664	$5,514,857	$9,766,356
15	2029	$51,775	$4,896,419	$10,267,470	$15,215,664	$5,154,072	$9,481,899
16	2030	$51,775	$4,896,419	$10,267,470	$15,215,664	$4,816,890	$9,205,727
17	2031	$51,775	$4,896,419	$10,267,470	$15,215,664	$4,501,766	$8,937,599
18	2032	$51,775	$4,896,419	$10,267,470	$15,215,664	$4,207,258	$8,677,281
19	2033	$51,775	$4,896,419	$10,267,470	$15,215,664	$3,932,017	$8,424,544
20	2034	$51,775	$4,896,419	$10,267,470	$15,215,664	$3,674,782	$8,179,169
21	2035	$51,775	$4,896,419	$10,267,470	$15,215,664	$3,434,376	$7,940,941
22	2036	$51,775	$4,896,419	$10,267,470	$15,215,664	$3,209,697	$7,709,651
23	2037	$51,775	$4,896,419	$10,267,470	$15,215,664	$2,999,717	$7,485,098
24	2038	$51,775	$4,896,419	$10,267,470	$15,215,664	$2,803,474	$7,267,086
25	2039	$51,775	$4,896,419	$10,267,470	$15,215,664	$2,620,069	$7,055,423
Total					**$304,313,279**	**$107,411,009**	**$189,581,862**

[1] Refer to Table 7 for calculation of annual undiscounted social costs in 2013 dollars.

4. IMPROVED SAFETY BENEFITS

The 16th Street Corridor project includes a variety of elements or "counter-measures" that are designed to improve the overall safety for pedestrians, bicyclists, and motorists, and others. This analysis provides a quantitative estimate of the benefits from improved safety based on DOT guidance related to the monetizing the value associated with reduced injuries and fatalities. Given lack of available data the analysis has not estimated benefits from reduced property damage impacts.

The analysis is based primarily on accident data on the 16th Street Corridor gathered as part of the WalkFirst project.[3] This data documents significant safety concerns along this corridor, with approximately 117 injury pedestrian accidents and 3 fatalities from 2007 through 2011. Note that two of these fatalities involved automobiles and the other a pedestrian and auto. With the exception of the two auto fatalities, all other auto related injuries (and property damage) are excluded from the analysis due to data limitation. **Appendix B** provides detailed accident data.

The SFMTA has converted the accident data described above into to DOT accident categories and values based on DOT guidance, as summarized in **Table 9** below.

Table 9 Conversion of Accident Data Into DOT Injury/Fatality Categories

			US DOT VSL Guidance, 2013				
SWITRS Collision Severity	AIS Collision Severity (ex injury)		Value of a Statistical Life (VSL), 2013$	Fraction of VSL	Value of Injury Prevention	Fraction of VSL - Aggregated	Value of Injury Prevention - Aggregated
0 – property damage only							
4 – injury – complaint of pain	4	1 minor (superficial laceration)	$9,200,000	0.003	$27,600	0.003	$27,600
3 – injury – other visible	3	2 moderate (fractured sternum)	$9,200,000	0.047	$432,400	0.047	$432,400
	2	3 serious (open fracture of humerus)	$9,200,000	0.105	$966,000		
2 – injury – severe		4 severe (perforated trachea)	$9,200,000	0.266	$2,447,200	0.354	$3,260,020
		5 critical (ruptured liver with tissue loss)	$9,200,000	0.593	$5,455,600		
1 – fatal	1	6 maximum/fatal	$9,200,000	1.000	$9,200,000	1.000	$9,200,000
		9 not further specified					

Notes:
Value of a Statistical Life (VSL) is defined as the valuation of reductions in risk - an additional cost that individuals would be willing to bear for improvements in safety that, in aggregate, reduce the
Value of injury prevention for SWITRS collision severity 2 calculated as weighted average of AIS severity 3-5 values based on AIS collision severity frequency from SF General Hospital trauma center

The analysis also relies on Crash Reduction Factors developed by the Federal Highway Administration. A Crash Reduction Factor (CRF)[4] is the percentage crash reduction that might be expected after implementing a given countermeasure. A summary of the academic literature as it pertains to the street improvement planned for the 16th Street Multimodal Corridor project is provide in **Table 10**.

[3] WalFirst is a collaborative effort of the San Francisco Office of the Controller, SFMTA, SF Planning Department and the SF Department of Public Health. Note that two of the fatalities are based on data from The Statewide Integrated Traffic Records System (**SWITRS**), a database that serves as a means to collect and process data gathered from a collision scene...

[4] Report No. FHWA-SA-07-015. U.S. Department of Transportation, Federal Highway Administration. September 2007

Table 10 Summary of Academic Literature on Counter Measure Safety Effectiveness

Countermeasure	Evaluation sources			Crash Modification Factor (proportion expected to remain) Source: FHWA Toolbox	Other Quantifiable Measures of Effectiveness Source: SFMTA CM Summary, PBIC Lit Review	Impact Category					Research Notes
	FHWA Toolbox	SFMTA CM Summary	PBIC Literature Review			High	Med	Low	N/A		
Signalization											
Ped countdown heads	X	X		0.75	22% reduction	X				H	Reduction in ped collisions noted here (also evaluated for all red-light-running traffic collisions); Sources are consistent
Leading ped phase/Leading pedestrian intervals (LPI)	X	X	X	0.95	12% reduction		X			M	SFMTA, reduction for ped/left-turn conflicts in NYC; effective for decreasing collisions and severity, especially with heavy turn volumes and adopted as CM in NYC, and 3-second LPI makes ped crossing easier
Improve signal timing (to match ITE specified intervals);	X	X		0.63		X				H	From FHWA and SFMTA
Add new traffic signals at unsignalized intersections when warranted	X			All crashes - .75			X			M	From FHWA
Accessible Pedestrian Signals (APS)		X	X		drop in late ped crossing from 27% to 17%			X		L	Focus on decrease in late crossings (not reduction in crashes)
Geometric										0	
Corner bulb outs		X	X	--	14% and 7% decreases in speeds; reduced overall severity rate, statistically significant increase in yielding and increase in yielding distance		X			M	PBIC Lit Review - recommended to enhance pedestrian safety
Chokers/ curb extensions		X	X	--	14% and 7% decreases in speeds; reduced overall severity rate, statistically significant increase in yielding and increase in yielding distance		X			M	PBIC Lit Review - recommended to enhance pedestrian safety
Pedestrian refuge islands/raised median	X	X	X	0.44	36% reduction; 23% reduction when converting painted median to raised refuge island	X				H	PBIC Lit Review - recommended to enhance pedestrian safety, associated with significantly lower rate of ped crashes on multi-lane roads with either marked or unmarked crosswalks, especially on roads with 15,000 ADT
	X			All crashes - .75						0	
	X			0.54 - marked crosswalk						0	
	X			0.61 - unmarked crosswalk						0	
Raised crosswalks	X	X	X	All crashes - .70; Fatal - .64	69-91% improvement in driver yielding behavior		X			M	
Speed tables	X	X	X	All crashes - .70; Fatal - .64	69-91% improvement in driver yielding behavior		X			M	
Narrow roadway cross section from 4 to 3 lanes/ Road diets	X	X		All crashes - .71	29-53% reduction	X				H	CMF applies to "All crashes", rather than Ped only
Bus bulb outs, and other traffic calming near transit boarding		X	X	--	NA				0	0	Evaluation in SFMTA summary focused on travel time savings; PBIC lit review notes, "No information for this section" under Transit Stop Improvements and Access to Transit headings
Curb ramps				--				X		L	Increases accessibility; ADA compliant curb ramps provide detectable warning and allow pedestrians to access crosswalks without moving into line of traffic
Removal of multiple turn lanes				--					0	0	Recommend grouping this countermeasure with road diet
Rumble strips										0	No evaluation source
Signs, Markings, Operational										0	
No left turn	X	X		0.90	10% reduction		X			M	SFMTA, 10% reduction in ped collisions; FHWA and SMTA sources are consistent
Segment lighting	X	X		All crashes - .80; Injury - .77	42% reduction at midblock, 79/42% reduction in fatal/injury	X				H	CMF applies to "All crashes", rather than Ped only; SFMTA, refers to FHWA and NCHRP; Noted that in SF most high ped volume streets have lighting, so option would be to enhance lighting, and no data are available about such improvements
High-vis crosswalk (includes continental crosswalks)	X		X	0.52		X				H	PBIC Lit Review conflicts with FHWA toolbox - group with all other crosswalks, as study found no statistically significant difference in ped crash risk for different crosswalk types (main differences noted when paired with other treatments such as signs and beacons)
Right turn pockets									0	0	Noted in feedback from SFDPH, used in the TEP; this may be more focused on reducing transit delay
Increase enforcement (along corridors for yielding in marked crosswalks)	X			0.77		X				H	From FHWA
High-vis crosswalk in conjunction with illuminated overhead crosswalk sign			X		8-40% improvement in driver yielding behavior (8% at night, 30-40% during daylight)	X				H	High visibility crosswalks improve crosswalk safety more when paired with illuminated pedestrian crossing signs
Speed humps and other traffic calming		X			25% decrease in speeds, 5-50% reduction in crashes on urban/suburban roads		X			M	AASHTO research variability suggests increase or decrease in collisions; FHWA evaluation for all crash types and severity types suggest collision reduction of 40-50%
Portable Speed Trailer/and Radar speed display signs		X			change from 68-83% driver yielding at downstream crosswalks, reduced speeds 1-6 mph		X			M	From FHWA study
Street trees		X							0	0	Texas study found that tree-lined streets cause motorists to drive more carefully/slowly; Toronto study found 5-20% reduction in mid-block vehicle collisions in areas with trees or planters; no findings related to pedestrian collisions

Notes:
Crash Modification Factor (CMF) is the proportion of crashes that are expected to *remain* after the countermeasure is implemented, as defined in the FHWA Toolbox of Countermeasures
Impact categories - High, Med, Low, N/A:
- High: measurable effect, greater than 10% pedestrian crash reduction if known
- Medium: known improved ped experience or driver yielding/compliance (includes speed reduction), less than 10% pedestrian crash reduction if known
- Low: possible improvement, unknown impact
- N/A = no direct impact on collisions

Based on this analysis EPS assumed that the collective impact of the safety improvements planned for the corridor would reduce accidents rates by roughly 40 percent over baseline conditions. Although it is difficult to estimate this value with precision given the wide variety of factors involved in particular location, the accident reduction for many of the countermeasure include in the 16th Street Multimodal Corridor Project exceed this level. The combined effect of implementing a number of them in a complimentary fashion along an entire corridor is likely to have added advantages. It is also worth noting that use of historical data from a five year period is considered conservative since, as traffic volumes increase due to corridor growth, the number

of collisions and other vehicle and pedestrian accidents is likely to increase relative to baseline conditions.

The monetized value of prevented accidents and fatalities is presented in **Table 11**.

Table 11 Annual Social Costs from Improved Safety for the Preferred Project Alternative

Injury Severity	Total Injuries[1]	Annual Injuries[1]	Value of Injury Prevention - Aggregated[2]	Baseline Annual Loss	Annual Value of Prevented Injuries / Fatalities @ 40% reduction in corridor accident rate [3]
4	72	14	$27,600	$397,440	$158,976
3	36	7	$432,400	$3,113,280	$1,245,312
2	9	2	$3,260,060	$5,868,108	$2,347,243
1	3	1	$9,200,000	$5,520,000	$2,208,000
Total				**$14,898,828**	**$5,959,531**

[1] Based on WalkFirst data that included 5 years of accident reports from 2007 - 2011.
[2] US DOT VSL Guidance, 2012

[3] Based on Crash Modification Factors (CMFs) associated with the proposed corridor improvements as supported by FHWA sourced and other research. See Table # for research support.

The detailed calculations converting the benefits of improved safety into a monetized value over a 20 year period is presented in **Table 12**.

Table 12 Discounted Value of Reduced Fatalities/Injuries

Project Year	Calendar Year	Discounted Value of Prevented Injuries / Fatalities (high estimate) @ 7%	@ 3%
5	2019	$0	$0
6	2020	$3,711,297	$4,845,644
7	2021	$3,468,501	$4,704,509
8	2022	$3,241,590	$4,567,484
9	2023	$3,029,523	$4,434,451
10	2024	$2,831,330	$4,305,292
11	2025	$2,646,103	$4,179,895
12	2026	$2,472,994	$4,058,151
13	2027	$2,311,209	$3,939,952
14	2028	$2,160,008	$3,825,196
15	2029	$2,018,699	$3,713,783
16	2030	$1,886,635	$3,605,614
17	2031	$1,763,210	$3,500,596
18	2032	$1,647,860	$3,398,637
19	2033	$1,540,056	$3,299,648
20	2034	$1,439,305	$3,203,542
21	2035	$1,345,145	$3,110,235
22	2036	$1,257,145	$3,019,645
23	2037	$1,174,901	$2,931,694
24	2038	$1,098,039	$2,846,305
25	2039	$1,026,204	$2,763,403
Total		**$42,069,755**	**$74,253,679**

[1] Refer to Table 11 for calculation of annual undiscounted social costs in 2013 dollars.

5. PROJECT SCHEDULE AND COSTS

This section describes the BCA analytical assumptions for both one-time capital and on-going operating and maintenance cost associated with the 16th Street Corridor Multimodal project and the Shuttle Alternative relative to the "No Project Alternative". A summary of the cost assumptions is provided in Table # below.

Table 13 Project Cost Summary

Cost Category	Calendar Year	No Project	55 Shuttle Alternative	16th St. BRT Project
One-Time Capital Costs				
Soft Costs				
Planning & Environmental Studies	2014	-	-	$1,802,379
Conceptual Engineering	2015	-	-	$2,523,330
Detailed Design	2016	-	-	$5,407,137
Pre-Development	2017	-	-	$720,952
Construction[1]				
Year 1	2018	-	-	$28,342,408
Year 2	2019	-	-	$28,342,408
Total Capital Costs		**$0**	**$0**	**$67,138,614**
Change in Annual Operating Costs (Relative to "No Project" Baseline)		$0	$9,622,107	$2,437,057

[1] Includes construction support and contingency.

One-time Capital Costs

The detailed schedule for the 16th St. Multimodal Corridor Project is summarized below.

Milestones	Start	End
Planning & Environmental Studies	May 2014	June 2015
Conceptual Engineering	January 2015	May 2016
Detailed Design	June 2016	July 2017
Advertise & Award Contract	August 2017	January 2018
Construction	February 2018	January 2020

The one-time capital costs estimates are detailed in **Table 14** below.

Table 14 Detailed Capital Costs for 16th Street Multi-Modal Corridor

	#	Unit	Unit Cost	Project Cost Estimate
TRANSIT ENHANCEMENTS				**$ 10,144,720**
Transit Bulbs/Sidewalk Improvements	21	Each	$ 118,000	$ 2,478,000
OCS Ductbank Underground	1	Mile	$ 3,150,000	$ 3,150,000
OCS -foundation and poles	1	Mile	$ 1,367,300	$ 1,367,300
OCS - overground	1	Mile	$ 3,149,420	$ 3,149,420
OCS - Caltrain Crossing*	1		TBD	$ 0
STREETSCAPE ENHANCEMENTS				**$ 6,105,000**
Streetscape elements on bulbs (Greening)	21	Each	$ 75,000	$ 1,575,000
Pedestrian Bulb Outs	8		$ 50,000	$ 400,000
Accessible Curb Ramps	26		$ 5,000	$ 130,000
Pedestrian Scale Lighting, Trees and Landscaping	1		$ 4,000,000	$ 4,000,000
ROADWAY IMPROVEMENTS				**$ 3,900,000**
Repave Potrero to 7th Street	240,000	Sq. Ft.	$ 5	$ 1,200,000
Transit-Only Lanes (in red), Final Striping, bike lanes on 17th Street	500,000	Sq. Ft.	$ 1	$ 500,000
Traffic Signal Upgrade	5	Each	$ 200,000	$ 1,000,000
New Traffic Signal	4	Each	$ 300,000	$ 1,200,000
UTILITY RELOCATION				**$ 11,196,000**
Sewer	1	mile	$ 3,696,000	$ 3,696,000
Water	1	mile	$ 2,500,000	$ 2,500,000
Emergency Auxiliary Water Supply System	1	mile	$ 5,000,000	$ 5,000,000
Others- Allowance, mob/demob, hazard material management, traffic control, permits (15%)				$ 4,701,858
Hard Costs TIGER Project				**$ 36,047,578**
SOFT COSTS				
Environmental & Planning Outreach 5%				$ 1,802,379
Pre-development 2%				$ 720,952
Conceptual Engineering Report 7%				$ 2,523,330
Detail Design 15%				$ 5,407,137
Construction Support 20%				$ 7,209,516
Soft Cost TIGER Project				**$ 17,663,313**
Project Contingency 20%				**$ 13,427,723**
Total TIGER Project				**$ 67,138,614**

On-going Costs

The on-going O&M costs are based on typical fully loaded per hour operating costs for the type of transit vehicles included in each alternative, as calculated in **Table 15** below.

Table 15 Transit Vehicle Operating Hours and Costs

Peoject Alternative	Service Route Daily Hours				Costs[1]	
	22 Filmore	33 Stanyan	55 - Shuttle	Total	Daily	Annual
No Project						
Weekday	333	155	0	488	$72,341	$18,302,303
Weekend	236	110	0	346	51,362	$12,994,635
					$123,703	$31,296,939
55 - Shuttle Alternative						
Weekday	294	186	138	618	$94,582	$23,929,266
Weekend	209	132	98	439	67,153	$16,989,779
					$161,735	$40,919,045
16th BRT Project						
Weekday	352	174	0	526	$77,974	$19,727,483
Weekend	250	124	0	373	55,362	$14,006,513
					$133,336	$33,733,995

[1] Based on fully loaded NTD Operating Expense / Revenue Hour of $169.76 for Motor Coach (22 Filmore and 33 Stanan), and for $148.24 Trolley Coach (Shuttle), as reported by the SFMTA

This analysis calculates the project costs for the Preferred and Alternative projects as changes from the baseline.

APPENDIX B: DETAILED DATA AND CALCULATIONS FOR BCA

WalkFirst Pedestrian Accident Data

injury id	intrsctn fkey	case id ckey	party number	victim age	victim degree of injury	fatal	severe	ksi	child flag	senior flag	PrimaryRd	SecondaryRd
3844991-1	24022000	3844991	1	57	4	0	0	0	0	0	16TH ST	POTRERO AV
4140506-1	24022000	4140506	1	56	3	0	0	0	0	0	16TH ST	POTRERO AV
4299477-2	24022000	4299477	2	47	4	0	0	0	0	0	16TH ST	POTRERO AV
4077839-2	24048000	4077839	2	41	4	0	0	0	0	0	BRYANT ST	16TH ST
4114463-2	24048000	4114463	2	24	4	0	0	0	0	0	BRYANT ST	16TH ST
4652177-2	24048000	4652177	2	49	4	0	0	0	0	0	BRYANT ST	16TH ST
4901663-2	24048000	4901663	2	35	4	0	0	0	0	0	BRYANT ST	16TH ST
5477567-2	24048000	5477567	2	78	4	0	0	0	0	1	BRYANT ST	16TH ST
3250949-1	24055000	3250949	1	17	3	0	0	0	1	0	16TH ST	HARRISON ST
4195496-1	24055000	4195496	1	19	2	0	1	1	0	0	16TH ST	HARRISON ST
4968200-2	24055000	4968200	2	32	4	0	0	0	0	0	16TH ST	HARRISON ST
5303856-1	24055000	5303856	1	51	4	0	0	0	0	0	16TH ST	HARRISON ST
5477680-1	24055000	5477680	1	25	3	0	0	0	0	0	16TH ST	HARRISON ST
4195348-2	24138000	4195348	2	19	2	0	1	1	0	0	FOLSOM ST	16TH ST
5472498-1	24141000	5472498	1	998	3	0	0	0	0	0	SHOTWELL ST	16TH ST
2100024-2	24142000	2100024	2	19	2	0	1	1	0	0	SOUTH VAN NI	16TH ST
2100024-3	24142000	2100024	3	22	4	0	0	0	0	0	SOUTH VAN NI	16TH ST
2629215-2	24142000	2629215	2	21	4	0	0	0	0	0	SOUTH VAN NI	16TH ST
2657228-3	24142000	2657228	3	44	4	0	0	0	0	0	SOUTH VAN NI	16TH ST
2974187-2	24142000	2974187	2	60	2	0	1	1	0	0	SOUTH VAN NI	16TH ST
2987895-1	24142000	2987895	1	42	3	0	0	0	0	0	SOUTH VAN NI	16TH ST
3324972-1	24142000	3324972	1	39	4	0	0	0	0	0	SOUTH VAN NI	16TH ST
3433913-2	24142000	3433913	2	43	4	0	0	0	0	0	SOUTH VAN NI	16TH ST
3854096-1	24142000	3854096	1	34	3	0	0	0	0	0	SOUTH VAN NI	16TH ST
4513100-2	24142000	4513100	2	21	2	0	1	1	0	0	SOUTH VAN NI	16TH ST
4513100-3	24142000	4513100	3	21	3	0	0	0	0	0	SOUTH VAN NI	16TH ST
5427527-1	24142000	5427527	1	48	4	0	0	0	0	0	SOUTH VAN NI	16TH ST
5477513-2	24142000	5477513	2	82	4	0	0	0	0	1	SOUTH VAN NI	16TH ST
3196418-2	24168000	3196418	2	56	4	0	0	0	0	0	16TH ST	CAPP ST
3441454-2	24168000	3441454	2	36	4	0	0	0	0	0	16TH ST	CAPP ST
3550702-2	24168000	3550702	2	38	4	0	0	0	0	0	16TH ST	CAPP ST
3924549-1	24168000	3924549	1	25	4	0	0	0	0	0	16TH ST	CAPP ST
4411321-2	24168000	4411321	2	60	4	0	0	0	0	0	16TH ST	CAPP ST
5071404-2	24168000	5071404	2	52	4	0	0	0	0	0	16TH ST	CAPP ST
3342299-2	24170000	3342299	2	54	3	0	0	0	0	0	MISSION ST	16TH ST
3400078-1	24170000	3400078	1	92	3	0	0	0	0	1	MISSION ST	16TH ST
3719198-2	24170000	3719198	2	39	4	0	0	0	0	0	MISSION ST	16TH ST
3719198-3	24170000	3719198	3	2	3	0	0	0	1	0	MISSION ST	16TH ST
3731981-2	24170000	3731981	2	27	3	0	0	0	0	0	MISSION ST	16TH ST
3783568-1	24170000	3783568	1	37	4	0	0	0	0	0	MISSION ST	16TH ST
3888635-1	24170000	3888635	1	77	3	0	0	0	0	1	MISSION ST	16TH ST
3935873-2	24170000	3935873	2	87	4	0	0	0	0	1	MISSION ST	16TH ST
4256121-1	24170000	4256121	1	47	2	0	1	1	0	0	MISSION ST	16TH ST
4256121-2	24170000	4256121	2	47	4	0	0	0	0	0	MISSION ST	16TH ST
4562984-2	24170000	4562984	2	31	4	0	0	0	0	0	MISSION ST	16TH ST
4652792-1	24170000	4652792	1	49	4	0	0	0	0	0	MISSION ST	16TH ST
4789998-1	24170000	4789998	1	37	3	0	0	0	0	0	MISSION ST	16TH ST
4944510-1	24170000	4944510	1	36	3	0	0	0	0	0	MISSION ST	16TH ST
5427535-1	24170000	5427535	1	37	3	0	0	0	0	0	MISSION ST	16TH ST
3045972-2	24175000	3045972	2	42	3	0	0	0	0	0	16TH ST	HOFF ST
4253372-1	24177000	4253372	1	29	4	0	0	0	0	0	16TH ST	RONDEL PL
4818152-1	24177000	4818152	1	60	4	0	0	0	0	0	16TH ST	RONDEL PL
4279171-2	24183000	4279171	2	998	4	0	0	0	0	0	VALENCIA ST	16TH ST
4652776-2	24183000	4652776	2	31	4	0	0	0	0	0	VALENCIA ST	16TH ST
5055587-2	24183000	5055587	2	24	3	0	0	0	0	0	VALENCIA ST	16TH ST
5127382-1	24183000	5127382	1	33	4	0	0	0	0	0	VALENCIA ST	16TH ST
3791514-2	24184000	3791514	2	58	3	0	0	0	0	0	CALEDONIA ST	16TH ST
3804778-2	24184000	3804778	2	60	3	0	0	0	0	0	CALEDONIA ST	16TH ST
4876676-1	25695000	4876676	1	34	4	0	0	0	0	0	16TH ST	ALBION ST
3325026-1	25698000	3325026	1	34	2	0	1	1	0	0	16TH ST	GUERRERO ST
4384484-2	25698000	4384484	2	28	4	0	0	0	0	0	16TH ST	GUERRERO ST
5066000-1	25698000	5066000	1	23	3	0	0	0	0	0	16TH ST	GUERRERO ST
5238919-1	25698000	5238919	1	27	4	0	0	0	0	0	16TH ST	GUERRERO ST
4256097-2	25699000	4256097	2	59	4	0	0	0	0	0	16TH ST	ALBION ST
3037394-2	25706000	3037394	2	41	4	0	0	0	0	0	DOLORES ST	16TH ST
3037394-3	25706000	3037394	3	3	4	0	0	0	1	0	DOLORES ST	16TH ST
3038711-1	25706000	3038711	1	57	4	0	0	0	0	0	DOLORES ST	16TH ST
4199473-2	25706000	4199473	2	30	4	0	0	0	0	0	DOLORES ST	16TH ST

WalkFirst Pedestrian Accident Data

injury id	intrsctn fkey	case id ckey	party number	victim age	victim degree of injury	fatal	severe	ksi	child flag	senior flag	PrimaryRd	SecondaryRd
4080650-2	25724000	4080650	2	52	4	0	0	0	0	0	LANDERS ST	16TH ST
4083690-2	25726000	4083690	2	48	4	0	0	0	0	0	CHURCH ST	16TH ST
3258090-2	25727000	3258090	2	2	3	0	0	0	1	0	CHURCH ST	15TH ST
3324995-1	25727000	3324995	1	23	4	0	0	0	0	0	CHURCH ST	15TH ST
4629613-1	25727000	4629613	1	36	4	0	0	0	0	0	CHURCH ST	15TH ST
4629613-2	25727000	4629613	2	10	4	0	0	0	1	0	CHURCH ST	15TH ST
4427319-1	25876000	4427319	1	18	4	0	0	0	0	0	RESERVOIR ST	CHURCH ST
3371069-1	25878000	3371069	1	46	3	0	0	0	0	0	MARKET ST	14TH ST
3200005-2	25881000	3200005	2	27	3	0	0	0	0	0	MARKET ST	CHURCH ST
3381743-1	25881000	3381743	1	25	4	0	0	0	0	0	MARKET ST	CHURCH ST
3557913-1	25881000	3557913	1	52	4	0	0	0	0	0	MARKET ST	CHURCH ST
3766109-2	25881000	3766109	2	51	4	0	0	0	0	0	MARKET ST	CHURCH ST
3843320-1	25881000	3843320	1	26	3	0	0	0	0	0	MARKET ST	CHURCH ST
3869555-1	25881000	3869555	1	51	4	0	0	0	0	0	MARKET ST	CHURCH ST
4434194-1	25881000	4434194	1	25	3	0	0	0	0	0	MARKET ST	CHURCH ST
4584633-2	25881000	4584633	2	19	3	0	0	0	0	0	MARKET ST	CHURCH ST
4756148-1	25881000	4756148	1	30	3	0	0	0	0	0	MARKET ST	CHURCH ST
5112981-1	25881000	5112981	1	8	3	0	0	0	1	0	MARKET ST	CHURCH ST
5116287-1	25881000	5116287	1	24	3	0	0	0	0	0	MARKET ST	CHURCH ST
3873419-1	25882000	3873419	1	39	2	0	1	1	0	0	MARKET ST	14TH ST
4254824-1	25882000	4254824	1	63	4	0	0	0	0	0	MARKET ST	14TH ST
4690259-2	25882000	4690259	2	33	4	0	0	0	0	0	MARKET ST	14TH ST
4882171-1	25882000	4882171	1	33	4	0	0	0	0	0	MARKET ST	14TH ST
5127429-2	25882000	5127429	2	57	4	0	0	0	0	0	MARKET ST	14TH ST
3441477-2	25884000	3441477	2	35	4	0	0	0	0	0	CHURCH ST	DUBOCE AV
4975638-2	25888000	4975638	2	23	4	0	0	0	0	0	HERMANN ST	CHURCH ST
3853357-2	25973000	3853357	2	21	3	0	0	0	0	0	FILLMORE ST	TURK ST
4652800-2	25973000	4652800	2	65	4	0	0	0	0	1	FILLMORE ST	TURK ST
3019522-2	26590000	3019522	2	69	1	1	0	1	0	1	FILLMORE ST	GEARY ST
4199509-1	26590000	4199509	1	51	4	0	0	0	0	0	FILLMORE ST	GEARY ST
4384342-2	26590000	4384342	2	55	4	0	0	0	0	0	FILLMORE ST	GEARY ST
4656748-1	26590000	4656748	1	49	3	0	0	0	0	0	FILLMORE ST	GEARY ST
4924614-1	26590000	4924614	1	80	4	0	0	0	0	1	FILLMORE ST	GEARY ST
4939549-2	26590000	4939549	2	88	3	0	0	0	0	1	FILLMORE ST	GEARY ST
5387142-2	26590000	5387142	2	51	4	0	0	0	0	0	FILLMORE ST	GEARY ST
3224081-2	26751000	3224081	2	52	4	0	0	0	0	0	LOMBARD ST	FILLMORE ST
3227228-2	26751000	3227228	2	24	4	0	0	0	0	0	LOMBARD ST	FILLMORE ST
3719737-1	26751000	3719737	1	30	3	0	0	0	0	0	LOMBARD ST	FILLMORE ST
4469359-1	26751000	4469359	1	22	3	0	0	0	0	0	LOMBARD ST	FILLMORE ST
4489641-1	26751000	4489641	1	23	4	0	0	0	0	0	LOMBARD ST	FILLMORE ST
4817393-1	26751000	4817393	1	32	4	0	0	0	0	0	LOMBARD ST	FILLMORE ST
5230964-2	26751000	5230964	2	50	4	0	0	0	0	0	LOMBARD ST	FILLMORE ST
5272697-1	26751000	5272697	1	998	3	0	0	0	0	0	LOMBARD ST	FILLMORE ST
5440702-1	26751000	5440702	1	26	3	0	0	0	0	0	LOMBARD ST	FILLMORE ST
5106118					4	0					Kansas	16th
4352612					4	0					17th	De Haro
4847810					2	0	1				17th	De Haro
4751327					4	0					17th	Wisconsin
3791499					4	0					20th	3rd
4989717					4	0					Tennessee	20th