Overview

	Current Status/Baseline & Problem to be Addressed	Change to Baseline/Alternative	Type of Impact	Population Affected By Impacts	Economic Benefit	Summary of Results (7% Discount, 20 years)	Page Reference in BCA (Spreadsheet)
2	* Regional 2014 Constrained Long Range Plan assumptions and networks for 2014/2015 and 2040 prorated over 21 year analysis period (2020 to 2040). * Severe congestion exists north of the beltway on the US 29 corridor and is forecast to exacerbate in the future 2040 condition. This leads to extremely slow general purpose lane speeds in the peak period with transit vehicles caught in the general flow. * The study area has a strong transit market, including an average weekday daily Metrorail ridership of approximately 13,000 for Silver Spring Station and more than 15,000 boardings for the Metrobus Z line buses, Ride On buses, and MTA commuter buses. * Two regional activity centers, Silver Spring and White Oak/FDA, serve as an engine for activities and travel in the study area. * Strong employment growth in these two regional activity centers is forecasted for 2040, with a growth of almost 80% over current levels. * Intra-study-area trips represent a significant share of travel market for the study area, with approximately 40% of total trips in 2014 and are expected to increase by nearly 30% in 2040. * DC-bound commuting trips were a major out-flow of trips from the study area, with approximately 20,000 residents living in the study area and commuting to DC. * Another major DC-bound commuting flow of approximately 10,000 was from Howard County.	* US 29 BRT service from Burtonsville to Silver Spring * 13.5 miles with 11 stations * Bus on Shoulder, and mixed flow ROW * Frequent (7.5 min. peak, 10 min. offpeak headways along the trunk) * All Day service in both directions * Related bicycle and pedestrian improvements such as Bikeshare stations where feasible * Improved station amenities (canopies, seating, passenger information, bike parking, etc.) * Branding and Marketing * Transit Signal Priority * Specialty BRT Vehicles * Service revisions to the WMATA Express Lines that run dupliate service. * Implementation of feeder and circulator service to BRT stations.	Change in system use (transit riders, road volumes, etc.)	Nobuild Transit Users that change route Nobuild Auto Users that change mode	Input into other impacts (below)	Travellers changing to transit from autos increases from 3,950 in 2020 to 5,700 in 2040 (62%). US 29 BRT Dailiy Boardings increase from 13,300 to 20,000 in 2040. Savings in Regional VMT is 26,400 in 2020 and 34,600 in 2040.	Demand Analysis & Travel time NVP
3			Travel Time Savings	Existing transit users will divert to the new US 29 BRT service New transit users will divert to the US 29 BRT service	Monetized value of travel time savings	$218,163,568	Travel Time NVP
4			User Cost Savings	New transit riders that divert from using autos	Monetized value of User Cost Savings	$41,157,061	User Cost NPV
5			Air Quality reduction in emissions	New transit riders that divert from using autos All auto users	Monetized value of emission reductions	$670,864	Air Quality NPV
6			Reduced accidents on roadways due to lower VMT	Auto users on roadway after US 29 BRT implementation	Monetized value of accident costs	$141,231,927	Safety NPV
7			Good Repair savings	Reduction in parallel service provided by WMATA Metrobus Z Express Lines, and Ride On Service to White Oak	Savings in Ride On Operations and Maintenance Costs	Qualitative at this time	In main narrative
8			Quality of Life due to lower congestion, increased bike use, healthier users	US 29 BRT Riders, and all residents, workers within corridor.		Qualitative at this time	In main narrative

Benefit-Cost Analysis Summary (2015$)

			Discount Rate		
			No Discount	7%	3%
Benefits					
Good Repair	**Qualitative at this time**				
Economic	**User Time Savings**		$605,396,242	$218,163,568	$379,785,330
Competitveness	**User Cost Savings**		$111,141,990	$41,157,061	$70,565,878
Quality of Life	**Qualitative at this time**				
Sustainability	**Greenhouse Gas & Emissions Cost Reductions**		$1,642,439	$670,864	$1,089,589
Safety	**Accident Reduction**		$368,635,273	$141,231,927	$237,808,961
	Total Benefits		$ 1,086,815,944	$ 401,223,419	$ 689,249,758
Costs					
	Capital Costs		$111,609,505	$44,607,834	$63,454,217
	O&M Costs		$122,293,395	$87,193,500	$105,491,357
	Total Costs		$233,902,900	$131,801,335	$168,945,574
Benefits - Costs			$852,913,043	$269,422,085	$520,304,184

Picture

Station to Station Travel Times

	C	D	E	F	H	I
	Assumptions					
	Dwell	30 secs				
	ROW Treatment	Speed	Current	Future		
	Mixed	No Build Congested Speed (adjusted to peak period transit)	~15 to 25			
	Bus On Shoulder	Min(20 MPH > Congested Speed, Free Flow Speed)	~ 45 mph	Degraded in Model		
		Note adjustments were made based upon Nobuild to convert Peak Hour Highway Speed to Peak Period (1.25 to 1.5 factor)				
	Assume US 29 BRT Alternative B with managed lanes changed to Mixed Flow					
	Station or intersection	Station or intersection				
	US 29 (SB) (AM)					Minutes
	BRT Burtonsville PNR	US29/Briggs Chaney Intersection	SPEED=	45	Mixed	2.99
	US29/Briggs Chaney Intersection	BRT US29/Fairland Rd	SPEED=	45	Shoulder	1.19
	BRT US29/Fairland Rd	BRT US29/Tech Rd	SPEED=	45	Shoulder	1.73
	BRT US29/Tech Rd	Stewart And April Lane	SPEED=	21	Mixed	4.51
	Stewart Lane And April Lane	BRT White Oak TrnCtr	SPEED=	25	Mixed	1.97
	BRT Briggs Chaney PNR	Castle Blvd/Briggs Chaney	SPEED=	30	Mixed	0.74
	Castle Blvd/Briggs Chaney	US29/Briggs Chaney Intersection	SPEED=	30	Mixed	0.36
	Castle Blvd/Castle Ridge Circle	CastleBlvd/Briggs Chaney	SPEED=	25	Mixed	1.13
	BRT White Oak TrnCtr	BRT LockwoodDr/OakLeaf	SPEED=	25	Mixed	0.79
	BRT LockwoodDr/OakLeaf	BRT US29/Hillwood Dr	SPEED=	25	Mixed	1.56
	BRT US29/Hillwood Dr	BRT US29/MD193	SPEED=	15	Mixed	3.72
	BRT US29/MD193	BRT US29/Franklin Ave	SPEED=	17	Mixed	2.93
	BRT US29/Franklin Ave	BRT US29/Fenton St	SPEED=	20	Mixed	2.76
	BRT US29/Fenton St	BRT SilverSprng TrnCtr	SPEED=	22	Mixed	0.95
	BRT US29/Tech Rd	BRT US29/Hillwood Dr	SPEED=	21	Mixed	7.31
	US 29 (NB)					
	BRT SilverSprng TrnCtr	BRT US29/Fenton St	SPEED=	28		0.75
	BRT US29/Fenton St	BRT US29/Franklin Ave	SPEED=	24		1.43
	BRT US29/Franklin Ave	BRT US29/MD193	SPEED=	35		1.58
	BRT US29/MD193	BRT US29/Hillwood Dr	SPEED=	30		1.86
	BRT US29/Hillwood Dr	BRT LockwoodDr/OakLeaf	SPEED=	30		1.30
	BRT LockwoodDr/OakLeaf	BRT White Oak TrnCtr	SPEED=	25		0.79
	BRT US29/Hillwood Dr	BRT US29/Tech Rd	SPEED=	35		4.39
	Transit Cooperative Research Program Report 118: Bus Rapid Transit Practicioner's Guide, Kittelson Associates, et.al., Transportation Research Board, Washington DC, 2007					
	Basued upon 6 stations per mile which is much more dense than the US29 BRT					

EXHIBIT 5-5 Typical Effects of BRT Running Way Components

	Component	Estimated Effects	Savings Compared to Base*	Comments
Off-street	Elevated	40 mph, 1.5 min/mi	4.5 min/mi	Assumed speed
	Some grade separation	35 mph, 1.7 min/mi	4.3 min/mi	Reflects wide station spacing
	At-grade	25 mph, 2.4 min/mi	3.6 min/mi	
On-street	Median arterial busway	13.3 mph, 4.5 min/mi	1.5 min/mi	Assumes no change in station spacing
	Bus lane (new construction or striping)	12.2 mph, 4.9 min/mi	1.1 min/mi	From TCRP A-23A April-June 2005 Quarterly Progress Report (7)
Traffic treatments	Queue bypass	—	6 sec/int	Estimated
	Curb extension	—	4 sec/int	From TC&QSM (8), Exhibit 4-5, 400 vehicles per hour
	TSP	—	5 sec/int	From Los Angeles, Oakland
	Special signal phase	—	—	Has important safety benefits

* Benefits are keyed to a base running speed of 10 mph (6 minutes/mile and 6 stations/mile).
NOTE: int = intersection
SOURCE: Derived from project profiles

TSP typically reduces transit travel times by 8% to 12%.

TSP saved buses 0.3 to 0.5 minute per mile on average in Los Angeles.

Bus Travel Time

Travel time savings associated with TSP in North America and Europe have ranged from 2% to 18%, depending on the length of corridor, particular traffic conditions, bus operations, and the TSP strategy deployed. A reduction of 8% to 12% has been typical. The reduction in bus delay at signals has ranged from 6% to 80%.

In Los Angeles, in the initial Wilshire-Whittier and Ventura BRT corridors, average running time along both corridors decreased by 7.5%; the decrease was attributed directly to TSP. This decrease corresponds to 0.5 minute per mile on Wilshire-Whittier Boulevard and 0.3 minute per mile on Ventura Boulevard. The reduction in bus signal delay at intersections with TSP was 33% to 36%. In Chicago, buses realized an average 15% to 18% reduction in running time along Cermak Road, with the reductions varying from 7% to 20% depending on the time of day. Along San Pablo Avenue in Oakland, each bus saved an average of 5 seconds per intersection with TSP. BRT vehicles along Vancouver's 98B line saved up to 1.5 minutes per trip.

	A	B	C	D	F	G	H	I	J	K	L	M	N
1		US 29 BRT B (mixed use and reduced service)											
2			**Transit Boardings Factor**										
3													
4					**Regional Linked Transit Trips**	**US 29 BRT Boardings**					**Auto**		
5			**Year**				**Veh Trips**	**VMT**	**VMT/Trip**	**Ave Spd**	**VHT**	**Occ**	**APHT**
6		**Model**	**2015**	**No Build**	1159626		16681291	165465035	9.92	32.28	5126358	1.41	7228165
7				**US 29**	1163147	11612	16,678,451	165440731	9.92	32.28	5124491	1.41	7225532
8				**Change**	3521		-2840	-24304			-1867		-2632
9													
10		**Model**	**2040**	**No Build**	1583928		20452069	207777313	10.16	27.59	7531933	1.43	10770664
11				**US 29**	1589604	19942	20447914	207742726	10.16	27.59	7528724	1.43	10766075
12				**Change**	5676		-4155	-34587			-3209		-4589
13													
14		**% change**	**2015-2040**	**Nobuild**	36.59%		22.60%	25.57%	0.02	-0.15	0.47		0.49
15		**% change**	**2015-2040**	**BRT**	36.66%	71.74%	22.60%	25.57%	0.02	-0.15	0.47		0.49
16													
17		Source: US 29 BRT Study Model (MWCOG V 2.3.57 Regional Travel Demand Model 2014 CLRP and Round 8.3 Cooperative Forecasts with White Oak Science Gateway Land Use) pivot analyses.											
18		Trip Generation and Trip Distribution Fixed											
19		Final iteration											
26						**From Regional Model**		**2015**	**2040**	Weights			
27							Boardings	11612	19942	In vehicle time	1		
28							Pass. Miles	43635	82749	Drive Access	1.5		
29							Pass. Hours	2488	4640	Walk Access	2		
30							trip length	3.757750603	4.1494835				
31							Avg time (min)	12.85566655	13.960485				
32							Avg speed	17.53818328	17.833836				
33										Other Out of Veh	2.5		
34						**Assume for Analysis (See Travel Time NVP)**								
35							Boardings	11600	20000				
36							Change linked trips	3500	5700				
37							Avg mile	3.9	4.1				
38							Speed 1	15	13				
39							Speed 2	18	16	(use model factor from Mwcog 2.3.57a)			
40							Factor	0.011111111	0.0159231				
41							ch time/trip	0.043333333	0.0652846				
42							ch time min	2.6	3.9		2015	2040	
43							ch OVTT	4	5	Headway	7.5	6	
44							time 1 (min)	76560	178341.54	Average OVTT	3.75	3	
45							time 1 (hr)	1276	2972.359				
46													
47							Percieved Time = 2.5 OVTT						
48							ch POVTT	10	12.5				
49							time 2 (min)	146160	328342				
50							time 2 (hr)	2436	5472				
51													
52													
53					2014 BRT Line Statistics								
54							Peak			Offpeak			Daily
55							In	Out	Total	In	Out	Total	
56					Boardings		3189	2481	5670	2950	2992	5942	11612
57					Passenger Miles		22555	9762	32317	5875	5443	11318	43635
58					Passenger Hours		1254	576	1830	327	331	658	2488
59					Average Trip Length (miles)		7.1	3.9	5.7	2.0	1.8	1.9	3.8
60					Average Trip Length (minutes)		23.6	13.9	19.4	6.7	6.6	6.6	12.9
61					Speed		18.0	16.9	17.7	18.0	16.4	17.2	17.5
62													
63													
64					2040 BRT Line Statistics								
65							Peak			Offpeak			Daily
66							In	Out	Total	In	Out	Total	
67					Boardings		5620	3872	9492	6122	4328	10450	19942
68					Passenger Miles		41946	14414	56360	16555	9834	26389	82749
69					Passenger Hours		2261	853	3114	935	591	1526	4640
70					Average Trip Length (miles)		7.5	3.7	5.9	2.7	2.3	2.5	4.1
71					Average Trip Length (minutes)		24.1	13.2	19.7	9.2	8.2	8.8	14.0
72					Speed		18.6	16.9	18.1	17.7	16.6	17.3	17.8

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1				**Time Savings**										
2											**Current Year =**	**2015**		
3			**Year**	Transit Time Savings (Hours)	Auto Time Savings (Hours)	Ave. Wk. day Time Savings (Hrs)	Annualization Factor	Annual Time Savings (Hrs)	VOT (All Trips) (2015$)/hr	**Total 2015 $**	**NPV 7%**	**NPV 3%**		
4			**2015**						$13.45					
5			**2016**						$13.61					
6		Startup	**2017**						$13.77					
7			**2018**						$13.94					
8			**2019**						$14.11					
9		1	**2020**	1615	3024	4639	290	1345316	$14.28	$ 19,206,545	$ 13,694,001	$ 16,567,735		
10		2	**2021**	1683	3102	4785	290	1387688	$14.45	$ 20,049,211	$ 13,359,636	$ 16,790,899		
11		3	**2022**	1751	3180	4931	290	1430060	$14.62	$ 20,909,335	$ 13,021,283	$ 17,001,203		
12		4	**2023**	1819	3259	5077	290	1472432	$14.80	$ 21,787,216	$ 12,680,358	$ 17,199,029		
13		5	**2024**	1887	3337	5223	290	1514804	$14.97	$ 22,683,154	$ 12,338,133	$ 17,384,749		
14		6	**2025**	1955	3415	5370	290	1557176	$15.15	$ 23,597,457	$ 11,995,751	$ 17,558,724		
15		7	**2026**	2022	3493	5516	290	1599548	$15.34	$ 24,530,437	$ 11,654,234	$ 17,721,310		
16		8	**2027**	2090	3572	5662	290	1641920	$15.52	$ 25,482,411	$ 11,314,495	$ 17,872,851		
17		9	**2028**	2158	3650	5808	290	1684292	$15.71	$ 26,453,700	$ 10,977,345	$ 18,013,682		
18		10	**2029**	2226	3728	5954	290	1726664	$15.89	$ 27,444,630	$ 10,643,501	$ 18,144,134		
19		11	**2030**	2294	3806	6100	290	1769036	$16.09	$ 28,455,533	$ 10,313,595	$ 18,264,524		
20		12	**2031**	2362	3885	6246	290	1811408	$16.28	$ 29,486,746	$ 9,988,181	$ 18,375,165		
21		13	**2032**	2430	3963	6392	290	1853780	$16.47	$ 30,538,611	$ 9,667,742	$ 18,476,362		
22		14	**2033**	2497	4041	6538	290	1896152	$16.67	$ 31,611,474	$ 9,352,694	$ 18,568,409		
23		15	**2034**	2565	4119	6685	290	1938524	$16.87	$ 32,705,688	$ 9,043,395	$ 18,651,597		
24		16	**2035**	2633	4198	6831	290	1980896	$17.07	$ 33,821,611	$ 8,740,147	$ 18,726,206		
25		17	**2036**	2701	4276	6977	290	2023268	$17.28	$ 34,959,607	$ 8,443,203	$ 18,792,511		
26		18	**2037**	2769	4354	7123	290	2065640	$17.49	$ 36,120,044	$ 8,152,770	$ 18,850,780		
27		19	**2038**	2837	4432	7269	290	2108012	$17.70	$ 37,303,298	$ 7,869,014	$ 18,901,273		
28		20	**2039**	2905	4511	7415	290	2150384	$17.91	$ 38,509,749	$ 7,592,067	$ 18,944,245		
29		21	**2040**	2972	4589	7561	290	2192756	$18.12	$ 39,739,782	$ 7,322,022	$ 18,979,941		
30									**Total**	$ 605,396,242	$218,163,568	$ 379,785,330		
31														
32														
33				Recommended Local Travel Value of Time: 2016 TIGER and Fast Lane BCA Resource Guide										
34					(2015$) /Hour									
35				Personal	$12.90									
36				Business	$24.90									
37				All Purposes	$13.45									
38														
39				VOT recommended to grow at 1.2% a year before discounting.										
40				See The Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis (USDOT, July 2014), Page 14										
41														
42				2013 National Transit Database, Montgomery County Maryland Ride On										
43					Annual Passenger Miles		96,519,501							
44					Annual Unlinked Trips		26,603,229							
45					Average Weekday Unlinked Trips		88,161							
46					Average Saturday Unlinked Trips		47,094							
47					Average Sunday Unlinked Trips		34,722							
48					Annual Trips to Average Weeday		302							
49					Annualization Factor		290							
50				Typical Annualizaiton Factors Used vary from 260 where there is little weekend Ridership to a maximum of 300.										
51				For New Starts Grants FTA asks that values equal or greater than 300 be justified.										
52				There will be less benefits per trip for non-weekday service (less congestion) and therefore 290 is a reasonable annualizaiton factor.										
53														
54				**Difference (US 29 BRT - Nobuild)**										
55														
56			Year	Change in Transit Person Trips	US 29 BRT Boardings	Vehicle Trips	Vehicle VMT	Auto Person hours Traveled Saved (hrs saved)	Transit Time Saved From Boardings Analysis (hrs saved)	Transit Percieved Time Saved From Boardings (hrs saved)				Boardings
57			2015	3521	11612	-2840	-24304	2,632	1,276	2,436				15530
58			2016	3607	11945	-2893	-24715	2711	1344	2557				15827
59			2017	3693	12278	-2945	-25127	2789	1412	2679				16124
60			2018	3780	12612	-2998	-25538	2867	1480	2800				16421
61			2019	3866	12945	-3050	-25949	2945	1547	2922				16718
62			2020	3952	13278	-3103	-26361	3024	1615	3043				17015
63			2021	4038	13611	-3156	-26772	3102	1683	3165				17312
64			2022	4124	13944	-3208	-27183	3180	1751	3286				17609
65			2023	4211	14278	-3261	-27595	3259	1819	3408				17906
66			2024	4297	14611	-3313	-28006	3337	1887	3529				18203
67			2025	4383	14944	-3366	-28417	3415	1955	3651				18500
68			2026	4469	15277	-3419	-28829	3493	2022	3772				18797
69			2027	4555	15610	-3471	-29240	3572	2090	3893				19094
70			2028	4642	15944	-3524	-29651	3650	2158	4015				19392
71			2029	4728	16277	-3576	-30062	3728	2226	4136				19689
72			2030	4814	16610	-3629	-30474	3806	2294	4258				19986
73			2031	4900	16943	-3682	-30885	3885	2362	4379				20283
74			2032	4986	17276	-3734	-31296	3963	2430	4501				20580
75			2033	5073	17610	-3787	-31708	4041	2497	4622				20877
76			2034	5159	17943	-3839	-32119	4119	2565	4744				21174
77			2035	5245	18276	-3892	-32530	4198	2633	4865				21471
78			2036	5331	18609	-3945	-32942	4276	2701	4987				21768
79			2037	5417	18942	-3997	-33353	4354	2769	5108				22065
80			2038	5504	19276	-4050	-33764	4432	2837	5229				22362
81			2039	5590	19609	-4102	-34176	4511	2905	5351				22659
82			2040	5676	19942	-4155	-34587	4589	2972	5472				22956
83			Annual Change	86.20	333.20	-52.60	-411.32	78.26	67.85	121.45				297.04
84														
85				43.62%										
86														
87				Change in Transit Person Trips	US 29 BRT Boardings	Vehicle Trips	Vehicle VMT							
88			2020	3952	13278	-3103	-26360.6							
89			2040	5676	19942	-4155	-34587							
90														
91				Change in										
92				Transit	US 29 BRT									
93				Person Trips	Boardings	Vehicle Trips	Vehicle VMT							
94			2020	3952	13278	-3103	-26360.6							
95			2040	5676	19942	-4155	-34587							
96														

User Cost NPV

User Cost Savings From Change in VMT and New Transit Trip Calculations

Current Year = 2015

Year		Change in Transit Person Trips	Avg weekday change in Auto VMT	Avg weekday change in mile costs	Avg Weekday change in Parking Costs	Avg Weekday Fares Paid ($1.75/Trip)	Avg Weekday Cost Savings	Annual Auto Cost Savings	**Total 2015 $**	**NPV 7%**	**NPV 3%**
2015											
2016											
2017	Startup										
2018											
2019											
2020	1	3952	26361	$14,235	$6,359	$6,916	$13,678	$3,966,540	$ 3,966,540	$ 2,828,088	$ 3,421,572
2021	2	4038	26772	$14,457	$6,751	$7,067	$14,141	$4,100,756	$ 4,100,756	$ 2,732,507	$ 3,434,318
2022	3	4124	27183	$14,679	$7,142	$7,218	$14,603	$4,234,971	$ 4,234,971	$ 2,637,327	$ 3,443,419
2023	4	4211	27595	$14,901	$7,534	$7,369	$15,066	$4,369,187	$ 4,369,187	$ 2,542,907	$ 3,449,077
2024	5	4297	28006	$15,123	$7,925	$7,519	$15,529	$4,503,403	$ 4,503,403	$ 2,449,553	$ 3,451,483
2025	6	4383	28417	$15,345	$8,317	$7,670	$15,992	$4,637,619	$ 4,637,619	$ 2,357,530	$ 3,450,824
2026	7	4469	28829	$15,567	$8,708	$7,821	$16,455	$4,771,834	$ 4,771,834	$ 2,267,064	$ 3,447,275
2027	8	4555	29240	$15,790	$9,100	$7,972	$16,917	$4,906,050	$ 4,906,050	$ 2,178,345	$ 3,441,005
2028	9	4642	29651	$16,012	$9,491	$8,123	$17,380	$5,040,266	$ 5,040,266	$ 2,091,531	$ 3,432,176
2029	10	4728	30062	$16,234	$9,883	$8,274	$17,843	$5,174,481	$ 5,174,481	$ 2,006,753	$ 3,420,942
2030	11	4814	30474	$16,456	$10,275	$8,424	$18,306	$5,308,697	$ 5,308,697	$ 1,924,116	$ 3,407,451
2031	12	4900	30885	$16,678	$10,666	$8,575	$18,769	$5,442,913	$ 5,442,913	$ 1,843,703	$ 3,391,843
2032	13	4986	31296	$16,900	$11,058	$8,726	$19,231	$5,577,129	$ 5,577,129	$ 1,765,576	$ 3,374,254
2033	14	5073	31708	$17,122	$11,449	$8,877	$19,694	$5,711,344	$ 5,711,344	$ 1,689,781	$ 3,354,813
2034	15	5159	32119	$17,344	$11,841	$9,028	$20,157	$5,845,560	$ 5,845,560	$ 1,616,346	$ 3,333,641
2035	16	5245	32530	$17,566	$12,232	$9,179	$20,620	$5,979,776	$ 5,979,776	$ 1,545,288	$ 3,310,857
2036	17	5331	32942	$17,789	$12,624	$9,330	$21,083	$6,113,991	$ 6,113,991	$ 1,476,609	$ 3,286,572
2037	18	5417	33353	$18,011	$13,015	$9,480	$21,546	$6,248,207	$ 6,248,207	$ 1,410,303	$ 3,260,892
2038	19	5504	33764	$18,233	$13,407	$9,631	$22,008	$6,382,423	$ 6,382,423	$ 1,346,352	$ 3,233,921
2039	20	5590	34176	$18,455	$13,798	$9,782	$22,471	$6,516,638	$ 6,516,638	$ 1,284,733	$ 3,205,754
2040	21	5676	34587	$18,677	$13,015	$9,933	$21,759	$6,310,206	$ 6,310,206	$ 1,162,650	$ 3,013,789
				Total Auto Cost Per mile =		$0.540		**Total**	$ 111,141,990	$ 41,157,061	$ 70,565,878
				Annualization Factor =		290					
					Avg Fare =	$1.75					

Notes:

Average trip would ride 4.6 miles on the US 29 BRT Service in 2015 (modeled transit assignment)
Assume average auto miles saved to be 6 miles due to access and routing
Cost to own and operate an auto from the 2016 IRS standard Mileage rates:
http://www.irs.gov/pub/irs-drop/n-16-01.pdf
The standard mileage rate for transportation or travel expenses is 54 cents per mile for all miles of business use (business standard mileage rate).
The standard mileage rate for business is based on an annual study of the fixed and variable costs of operating an automobile, including depreciation, insuranc e, repairs, tires, maintenance, gas and oil.
Current Rates are $4.60 per day for WMATA Lots and ~$6.4/day for silver Spring Mo. Co. lots
Assume 1/4 pay $5.00 parking in 2015
Assume 1/2 pay $5.00 parking in 2040 due to densification along the corridor and TDM strategies in White Oak

Difference (US29 - Nobuild)

Year	Change in Transit Person Trips	Model Transit Time (hrs Saved)	Model Transit Percieved Time (hrs saved)	Change in Vehicle Trips	Change in Vehicle VMT	Change Parking Costs 2015: 1/4 pay $5 2040: 1/2 pay $5
2015	3521	0	0	-2840	-24304	4401
2016	3607	0	0	-2893	-24715	4793
2017	3693	0	0	-2945	-25127	5184
2018	3780	0	0	-2998	-25538	5576
2019	3866	0	0	-3050	-25949	5967
2020	3952	0	0	-3103	-26361	6359
2021	4038	0	0	-3156	-26772	6751
2022	4124	0	0	-3208	-27183	7142
2023	4211	0	0	-3261	-27595	7534
2024	4297	0	0	-3313	-28006	7925
2025	4383	0	0	-3366	-28417	8317
2026	4469	0	0	-3419	-28829	8708
2027	4555	0	0	-3471	-29240	9100
2028	4642	0	0	-3524	-29651	9491
2029	4728	0	0	-3576	-30062	9883
2030	4814	0	0	-3629	-30474	10275
2031	4900	0	0	-3682	-30885	10666
2032	4986	0	0	-3734	-31296	11058
2033	5073	0	0	-3787	-31708	11449
2034	5159	0	0	-3839	-32119	11841
2035	5245	0	0	-3892	-32530	12232
2036	5331	0	0	-3945	-32942	12624
2037	5417	0	0	-3997	-33353	13015
2038	5504	0	0	-4050	-33764	13407
2039	5590	0	0	-4102	-34176	13798
2040	5676	0	0	-4155	-34587	14190
Annual Change	86.20	0.00	0.00	-52.60	-411.32	391.55

Air Quality NPV

Air Quality benefits from reductions in emissions due to changes in VMT

Current Year = 2015

Year		Avg Weekday Savings in Auto VMT	Annual Savings in Auto VMT	Change in CO (Metric Tons)	Change in Nox (Metric Tons)	Change in VOC (Metric Tons)	Change in PM2.5 (Metric Tons)	Value of CO 2015$	Value of Nox 2015$	Value of VOC 2015$	Value of PM2.5 2015$	Total Value Emissions (2015$)	**Total 2015 $**	**NPV 7%**	**NPV 3%**
2015															
2016															
2017	Startup														
2018															
2019															
2020	1	26361	7644574	118.24627	5.87103	3.99047	0.07645	$ 5,439	$ 47,027	8108.63022	$ 28,011	$ 88,586	$ 88,586	$ 63,160	$ 76,415
2021	2	26772	7763857	118.06963	5.74215	3.93162	0.07764	$ 5,549	$ 45,995	7989.04591	$ 28,448	$ 87,981	$ 87,981	$ 58,625	$ 73,683
2022	3	27183	7883140	117.83086	5.60649	3.86904	0.07883	$ 5,538	$ 44,908	7861.89927	$ 28,885	$ 87,193	$ 87,193	$ 54,299	$ 70,896
2023	4	27595	8002422	117.52998	5.46405	3.80275	0.08002	$ 5,641	$ 43,767	7727.19028	$ 29,322	$ 86,458	$ 86,458	$ 50,319	$ 68,251
2024	5	28006	8121705	117.16697	5.31484	3.73274	0.08122	$ 5,858	$ 42,572	7584.91896	$ 29,759	$ 85,774	$ 85,774	$ 46,656	$ 65,739
2025	6	28417	8240988	116.74184	5.15886	3.65900	0.08241	$ 5,954	$ 41,322	7435.08530	$ 30,196	$ 84,908	$ 84,908	$ 43,163	$ 63,179
2026	7	28829	8360271	116.25458	4.99610	3.58154	0.08360	$ 6,045	$ 40,019	7277.68930	$ 30,633	$ 83,975	$ 83,975	$ 39,896	$ 60,665
2027	8	29240	8479554	115.70520	4.82656	3.50036	0.08480	$ 6,132	$ 38,661	7112.73096	$ 31,070	$ 82,976	$ 82,976	$ 36,842	$ 58,198
2028	9	29651	8598836	115.09371	4.65025	3.41546	0.08599	$ 6,215	$ 37,249	6940.21029	$ 31,507	$ 81,911	$ 81,911	$ 33,990	$ 55,778
2029	10	30062	8718119	114.42008	4.46716	3.32683	0.08718	$ 6,293	$ 35,782	6760.12727	$ 31,944	$ 80,780	$ 80,780	$ 31,328	$ 53,405
2030	11	30474	8837402	113.68434	4.27730	3.23449	0.08837	$ 6,253	$ 34,261	6572.48192	$ 32,381	$ 79,468	$ 79,468	$ 28,803	$ 51,007
2031	12	30885	8956685	112.88647	4.08067	3.13842	0.08957	$ 6,322	$ 32,686	6377.27422	$ 32,819	$ 78,204	$ 78,204	$ 26,490	$ 48,734
2032	13	31296	9075968	112.02648	3.87725	3.03863	0.09076	$ 6,498	$ 31,057	6174.50419	$ 33,256	$ 76,985	$ 76,985	$ 24,371	$ 46,577
2033	14	31708	9195250	111.10437	3.66707	2.93512	0.09195	$ 6,555	$ 29,373	5964.17182	$ 33,693	$ 75,585	$ 75,585	$ 22,363	$ 44,398
2034	15	32119	9314533	110.12014	3.45010	2.82789	0.09315	$ 6,607	$ 27,635	5746.27711	$ 34,130	$ 74,119	$ 74,119	$ 20,494	$ 42,269
2035	16	32530	9433816	109.07378	3.22637	2.71694	0.09434	$ 6,654	$ 25,843	5520.82006	$ 34,567	$ 72,584	$ 72,584	$ 18,757	$ 40,188
2036	17	32942	9553099	107.96530	2.99585	2.60226	0.09553	$ 6,694	$ 23,997	5287.80068	$ 35,004	$ 70,982	$ 70,982	$ 17,143	$ 38,157
2037	18	33353	9672382	106.79470	2.75856	2.48387	0.09672	$ 6,728	$ 22,096	5047.21895	$ 35,441	$ 69,312	$ 69,312	$ 15,645	$ 36,174
2038	19	33764	9791664	105.56198	2.51450	2.36175	0.09792	$ 6,756	$ 20,141	4799.07489	$ 35,878	$ 67,574	$ 67,574	$ 14,255	$ 34,239
2039	20	34176	9910947	104.26713	2.26366	2.23591	0.09911	$ 6,777	$ 18,132	4543.36849	$ 36,315	$ 65,768	$ 65,768	$ 12,966	$ 32,353
2040	21	33353	9672382	99.23864	1.93448	2.03120	0.09672	$ 6,252	$ 15,495	4127.39868	$ 35,441	$ 61,316	$ 61,316	$ 11,297	$ 29,285
													Total	$ 1,642,439	$ 670,864	$ 1,089,589

Annualization Factor = 290

Pollution Emission by Mode (g/VMT) from the FTA New and Small Starts Evaluation and Rating Process Final Policy Guidance (August 2013)

Mode	Year	CO	Nox	VOC	PM2.5
Automobile	2015	16.77	0.91	0.6	0.01
Automobile	2040	10.26	0.2	0.21	0.01
Auto Change/year		-0.2604	-0.0284	-0.0156	0

Change in Air Quality Emissions Factors

	For Current Year Estimates				For 10-year Horizon Estimates				For 20-year Horizon Estimates			
	(grams/VMT)											
Mode	**CO**	**NO_x**	**VOC**	**$PM_{2.5}$**	**CO**	**NO_x**	**VOC**	**$PM_{2.5}$**	**CO**	**NO_x**	**VOC**	**$PM_{2.5}$**
Automobile	16.77	0.91	0.60	0.010	11.46	0.28	0.27	0.010	10.26	0.20	0.21	0.010
Bus - Diesel	5.83	8.67	0.73	0.48	3.26	2.08	0.24	0.09	2.89	1.14	0.16	0.03
Bus - Hybrid	5.83	8.67	0.73	0.480	3.26	2.08	0.24	0.09	2.89	1.14	0.16	0.03
Bus - CNG	39.62	3.84	1.46	0.010	20.30	3.41	1.15	0.010	17.16	3.35	1.11	0.010
Bus - Electric	6.45	5.83	0.12	0.378	5.39	4.39	0.10	0.313	5.04	3.98	0.10	0.299
Heavy Rail	7.06	6.38	0.13	0.413	6.85	5.58	0.13	0.398	6.73	5.32	0.13	0.399
Light Rail and Streetcar	10.51	9.50	0.19	0.615	10.20	8.31	0.19	0.593	10.01	7.91	0.20	0.593
Commuter Rail - Diesel locomotive (new) and DMU	16.80	13.20	0.55	0.190	16.80	13.20	0.55	0.190	16.80	13.20	0.55	0.190
Commuter Rail - Diesel locomotive (used) and DMU	16.80	93.00	4.36	4.600	16.80	43.00	1.26	1.330	16.80	20.90	0.44	0.470
Commuter Rail – Electric and EMU	12.81	11.57	0.24	0.750	12.43	10.12	0.23	0.722	12.19	9.64	0.24	0.723

Value of Emissions from the 2016 TIGER and Fast Lane BCA Resource Guide

Emission type	2015$/Metric Ton
Carbon Dioxide (CO2)	See Below
VOCs	$2,032
NOX	$8,010
PM(25)	$366,414
Sulfur Dioxide (SOX)	$47,341

Social Cost of Carbon

Year	2015$ /Metric Ton
2018	$45.00
2019	$46.00
2020	$47.00
2021	$47.00
2022	$48.00
2023	$50.00
2024	$51.00
2025	$52.00
2026	$53.00
2027	$54.00
2028	$55.00
2029	$55.00
2030	$56.00
2031	$58.00
2032	$59.00
2033	$60.00
2034	$61.00
2035	$62.00
2036	$63.00
2037	$64.00
2038	65
2039	67
2040	68

Year	Change in Transit Person Trips	Avg Weekday Change in Vehicle Trips	Avg. Weekday Change Vehicle VMT
2015	3521	-2840	-24304
2016	3607	-2893	-24715
2017	3693	-2945	-25127
2018	3780	-2998	-25538
2019	3866	-3050	-25949
2020	3952	-3103	-26361
2021	4038	-3156	-26772
2022	4124	-3208	-27183
2023	4211	-3261	-27595
2024	4297	-3313	-28006
2025	4383	-3366	-28417
2026	4469	-3419	-28829
2027	4555	-3471	-29240
2028	4642	-3524	-29651
2029	4728	-3576	-30062
2030	4814	-3629	-30474
2031	4900	-3682	-30885
2032	4986	-3734	-31296
2033	5073	-3787	-31708
2034	5159	-3839	-32119
2035	5245	-3892	-32530
2036	5331	-3945	-32942
2037	5417	-3997	-33353
2038	5504	-4050	-33764
2039	5590	-4102	-34176
2040	5676	-4155	-34587
Annual Change	86.20	-52.60	-411.32

Safety Benefits from reductions in crashes due to VMT reductions

Current Year = 2015

Year	Avg Weekday Savings in VMT	Annual Savings in VMT	Annual Change PDO Crashes	Annual Change Inj Crashes	Annual Change Fatal Crashes	Value PDO Crashes (2015$)	Value Inj Crashes (2014$)	Value Fatal Crashes (2015$)	Total Value Crashes (2015$)	Total 2015 $	NPV 7%	NPV 3%
2015												
2016												
Startup 2017												
2018												
2019												
1 2020	26361	7644574	6.06252	3.55442	0.03061	$ 25,450	$ 14,865,364	$ 293,888	$ 15,184,702	$ 15,184,702	$ 10,826,483	$ 13,098,457
2 2021	26772	7763857	6.15712	3.60988	0.03109	$ 25,848	$ 15,097,317	$ 298,473	$ 15,421,638	$ 15,421,638	$ 10,276,088	$ 12,915,379
3 2022	27183	7883140	6.25172	3.66534	0.03157	$ 26,245	$ 15,329,270	$ 303,059	$ 15,658,574	$ 15,658,574	$ 9,751,373	$ 12,731,853
4 2023	27595	8002422	6.34631	3.72081	0.03205	$ 26,642	$ 15,561,223	$ 307,645	$ 15,895,510	$ 15,895,510	$ 9,251,331	$ 12,548,062
5 2024	28006	8121705	6.44091	3.77627	0.03252	$ 27,039	$ 15,793,176	$ 312,230	$ 16,132,445	$ 16,132,445	$ 8,774,981	$ 12,364,176
6 2025	28417	8240988	6.53551	3.83173	0.03300	$ 27,436	$ 16,025,129	$ 316,816	$ 16,369,381	$ 16,369,381	$ 8,321,363	$ 12,180,357
7 2026	28829	8360271	6.63011	3.88719	0.03348	$ 27,833	$ 16,257,082	$ 321,402	$ 16,606,317	$ 16,606,317	$ 7,889,542	$ 11,996,757
8 2027	29240	8479554	6.72470	3.94265	0.03396	$ 28,230	$ 16,489,035	$ 325,987	$ 16,843,253	$ 16,843,253	$ 7,478,606	$ 11,813,519
9 2028	29651	8598836	6.81930	3.99811	0.03443	$ 28,627	$ 16,720,988	$ 330,573	$ 17,080,189	$ 17,080,189	$ 7,087,671	$ 11,630,778
10 2029	30062	8718119	6.91390	4.05358	0.03491	$ 29,025	$ 16,952,941	$ 335,159	$ 17,317,125	$ 17,317,125	$ 6,715,880	$ 11,448,660
11 2030	30474	8837402	7.00849	4.10904	0.03539	$ 29,422	$ 17,184,894	$ 339,745	$ 17,554,061	$ 17,554,061	$ 6,362,399	$ 11,267,284
12 2031	30885	8956685	7.10309	4.16450	0.03587	$ 29,819	$ 17,416,848	$ 344,330	$ 17,790,996	$ 17,790,996	$ 6,026,426	$ 11,086,761
13 2032	31296	9075968	7.19769	4.21996	0.03635	$ 30,216	$ 17,648,801	$ 348,916	$ 18,027,932	$ 18,027,932	$ 5,707,182	$ 10,907,196
14 2033	31708	9195250	7.29229	4.27542	0.03682	$ 30,613	$ 17,880,754	$ 353,502	$ 18,264,868	$ 18,264,868	$ 5,403,915	$ 10,728,685
15 2034	32119	9314533	7.38688	4.33088	0.03730	$ 31,010	$ 18,112,707	$ 358,087	$ 18,501,804	$ 18,501,804	$ 5,115,903	$ 10,551,320
16 2035	32530	9433816	7.48148	4.38635	0.03778	$ 31,407	$ 18,344,660	$ 362,673	$ 18,738,740	$ 18,738,740	$ 4,842,446	$ 10,375,186
17 2036	32942	9553099	7.57608	4.44181	0.03826	$ 31,804	$ 18,576,613	$ 367,259	$ 18,975,676	$ 18,975,676	$ 4,582,874	$ 10,200,361
18 2037	33353	9672382	7.67067	4.49727	0.03873	$ 32,201	$ 18,808,566	$ 371,844	$ 19,212,612	$ 19,212,612	$ 4,336,539	$ 10,026,918
19 2038	33764	9791664	7.76527	4.55273	0.03921	$ 32,599	$ 19,040,519	$ 376,430	$ 19,449,548	$ 19,449,548	$ 4,102,821	$ 9,854,925
20 2039	34176	9910947	7.85987	4.60819	0.03969	$ 32,996	$ 19,272,472	$ 381,016	$ 19,686,483	$ 19,686,483	$ 3,881,124	$ 9,684,445
21 2037	34587	10030230	7.95447	4.66366	0.04017	$ 33,393	$ 19,504,425	$ 385,602	$ 19,923,419	$ 19,923,419	$ 4,496,978	$ 10,397,883
		Annualization Factor =		290					**Total**	$ 368,635,273	$ 141,231,927	$ 237,808,961

Montgomery County

Accident Rates from Maryland State Highway Administration (provided May 2015): Crashes/Million VMT

Montgomery County

FC CODE	FC	Annual VMT (Millions)	PDO Crashes	PDO Rate	Inj. Crashes	Inj. Crash Rate	Fatal Crashes	Fatal Crash Rate	Total
1	RURAL PRINCIPAL ARTERIAL - INTERSTATE	134	40	0.2985	16	0.1194	0	0.0000	56
6	RURAL MINOR ARTERIAL	104	38	0.3654	35	0.3365	3	0.0288	76
7	RURAL MAJOR COLLECTOR	97	53	0.5464	34	0.3505	1	0.0103	88
8	RURAL MINOR COLLECTOR	43	26	0.6047	18	0.4186	0	0.0000	44
9	RURAL LOCAL	48	42	0.8750	21	0.4375	0	0.0000	63
11	URBAN PRINCIPAL ARTERIAL - INTERSTATE	2417	828	0.3426	448	0.1854	2	0.0008	1,278
12	URBAN PRINCIPAL ARTERIAL - OTHER FREEWAYS	404	138	0.3416	90	0.2228	0	0.0000	228
14	URBAN OTHER PRINCIPAL ARTERIAL	2105	2,461	1.1691	1,599	0.7596	12	0.0057	4,072
16	URBAN MINOR ARTERIAL	1027	916	0.8919	605	0.5891	8	0.0078	1,529
17	URBAN COLLECTOR	533	449	0.8424	250	0.4690	2	0.0038	701
19	URBAN LOCAL	506	753	1.4881	259	0.5119	4	0.0079	1,016
	Total Urban	6992	5,545	0.7930	3,251	0.4650	28	0.0040	
	Total Crashes:		**5,744**		**3,375**		**32**		**9,151**
	County Avg.:			**0.71**		**0.40**		**0.01**	

Year	Change in Transit Person Trips	Avg Weekday Change in Vehicle Trips	Avg. Weekday Change Vehicle VMT
2015	3521	-2840	-24304
2016	3607	-2893	-24715
2017	3693	-2945	-25127
2018	3780	-2998	-25538
2019	3866	-3050	-25949
2020	3952	-3103	-26361
2021	4038	-3156	-26772
2022	4124	-3208	-27183
2023	4211	-3261	-27595
2024	4297	-3313	-28006
2025	4383	-3366	-28417
2026	4469	-3419	-28829
2027	4555	-3471	-29240
2028	4642	-3524	-29651
2029	4728	-3576	-30062
2030	4814	-3629	-30474
2031	4900	-3682	-30885
2032	4986	-3734	-31296
2033	5073	-3787	-31708
2034	5159	-3839	-32119
2035	5245	-3892	-32530
2036	5331	-3945	-32942
2037	5417	-3997	-33353
2038	5504	-4050	-33764
2039	5590	-4102	-34176
2040	5676	-4155	-34587
Annual Change	86.20	-52.60	-411.32

Accident Value (based upon2016 TIGER and Fast Lane BCA Resource Guide)

Crash Type	2015$
PDO	$ 4,198
Injury Only	$ 4,182,218
Fatality	$ 9,600,000

Inury Only Calculation from Page 3 of the 2016 TIGER and Fast Lane BCA Resource Guide

AIS Level	Severity	Fraction of VSL	Value (2015$)	Weighted Value
AIS 1	Minor	0.003	$28,000	$84.00
AIS 2	Moderate	0.047	$451,200	$21,206.40
AIS 3	Serious	0.105	$1,008,000	$105,840.00
AIS 4	Severe	0.266	$2,553,600	$679,257.60
AIS 5	Critical	0.593	$5,692,800	$3,375,830.40
		Weigted Avg		$4,182,218.40

Cost Items

	A	B	C	D	E	F	G	H	I	J
1						Unit Cost (2015$)		Total Cost (2015$)		
2		**Element**	**Starting Year**	**Economic Life [a]**	**Units**	**Capital**	**Annual O&M**	**Capital**	**Annual O&M**	
3	**Planning/Design**									
4		Planning, Engineering, Design	2017	-	1	$ 6,500,000		$ 6,500,000		Spread over 3 years
5	**Vehicles**									
6		Bus - BRT Articulated (including CAD/AVL and Fare Collecti	2020	12	14	$ 1,000,000	See US29 BRT Service	$ 14,000,000	See US29 BRT Service	
7		TSP OnBoard Purchase & Install (w Engineering)	2020	10	14	$ 20,000	$ 357	$ 280,000	$ 5,000	Vehicle TSP part of $1,000,000 TSP cost
8										
9	**Stops/Stations**									
10		Stations and amenities (10 + SSTC)	2020	25	10			$ 10,933,900	$ 546,695	13 M with signs and fare subtracted Assume 5% O&M
11		RTPI Signs	2020	5	17	$ 21,300	$ 1,000	$ 362,100	$ 17,000	Based on ITS JPO low end Kiosk O&M
12		Off Board Fare Collection Equipment	2020	25	16	$ 106,500	$ 7,988	$ 1,704,000	$ 127,800	7.5% annual
13										
14		Bike and Pedestrian Improvements	2020	25	Throughout			$ 2,000,000	$ 7,000	O&M Prorated from April
15	**Roadside/Right of Way**									
16		TSP Field Hardware & Install (w Engineering)	2020	10	15	$ 43,000	$ 1,200	$ 645,000	$ 18,000	
17		Signing and Marking of BAT and HOV Lanes (lane miles)	2020	20	0	$ 250,000	$ 12,500	$ -	$ -	
18		Signal changes for BAT Lane	2020	20	0	$ 500,000	$ 250	$ -	$ -	
19		Bus on Shoulder Burtonsville to Tech Road (lane miles)	2020	20	0	$ 2,000,000	$ 100,000	$ -	$ -	
20	**Central Facilities & Systems**									
21		TSP Traffic System Software	2020	20	1	$ 75,000	$ 2,000	$ 75,000	$ 2,000	Assumed Nominal $2,000
22		Grant Overhead and Administration (3% of Total)	2017 to 2020	-	1	$ 1,500,000	-	$ 1,500,000		Spread over 4 years
23	**US 29 BRT Service**									
24		Marketing & Startup	2019	-	1	$ 1,250,000	-	$ 1,250,000		
25		Operations	2020	-	1		$ 5,100,000	$ -	$ 5,100,000	Same
26	Subtotal							$ 39,250,000		
27	Other									
28		Contingency								
29	Total							$ 39,250,000		
30										
31	a	Economic Life: ITS from the ITS Joint Program Office Cost Database(5/12/2015): http://www.itscosts.its.dot.gov/its/benecost.nsf/AdjustedUnitCosts Transit Structures, Sidewalks, vehicles, from FTA New Starts/Small Starts Evaluation of Alternatives (5/12/2015): http://www.fta.dot.gov/12304_9718.html								

Cap Costs NPV

	A	B	C	D	E	F	G	H	I	J	K	L	P	Q	R	S	T	U	V
1									**Capital Cost Net Present Value Calculations**										
2					**Vehicles**			**Stops/Stations**				**Roadside ROW**	**Central**	**US 29 BRT Service**					
3				**Plan, Eng, Design**	Vehicles	TSP	Concreate Pad	Stations	RTPI Signs	Off Board Fare Equip.	Bike & Pedestrian	TSP Field Equip	TSP Software	Grant Admin	Marketing & Startup	US 29 BRT O&M		**Current Year =**	**2015**
4			**Life / Year**	--	12	10	20	25	5	25	25	10	20	-	-	-	**Total 2015 $**	**NPV 7%**	**NPV 3%**
5			**2015**																
6			**2016**														$ -	$ -	$ -
7			**2017**	$ 2,166,667										$ 375,000			$ 375,000	$ 327,540	$ 353,473
8			**2018**	$ 2,166,667										$ 375,000			$ 375,000	$ 306,112	$ 343,178
9		Startup	**2019**	$ 2,166,667	$ 14,000,000	$ 280,000	$10,933,900	$ 10,933,900	$ 362,100	$ 1,704,000	$ 2,000,000	$ 645,000	$ 75,000	$ 375,000	$ 625,000		$ 41,933,900	$ 31,991,172	$ 37,257,727
10		1	**2020**											$ 375,000	$ 625,000		$ 1,000,000	$ 712,986	$ 862,609
11		2	**2021**														$ -	$ -	$ -
12		3	**2022**														$ -	$ -	$ -
13		4	**2023**														$ -	$ -	$ -
14		5	**2024**														$ -	$ -	$ -
15		6	**2025**						$ 362,100								$ 362,100	$ 184,073	$ 269,436
16		7	**2026**														$ -	$ -	$ -
17		8	**2027**														$ -	$ -	$ -
18		9	**2028**														$ -	$ -	$ -
19		10	**2029**														$ -	$ -	$ -
20		11	**2030**			$ 280,000			$ 362,100			$ 645,000					$ 1,287,100	$ 466,504	$ 826,141
21		12	**2031**														$ -	$ -	$ -
22		13	**2032**		$ 14,000,000												$ 14,000,000	$ 4,432,041	$ 8,470,230
23		14	**2033**														$ -	$ -	$ -
24		15	**2034**														$ -	$ -	$ -
25		16	**2035**						$ 362,100								$ 362,100	$ 93,574	$ 200,486
26		17	**2036**														$ -	$ -	$ -
27		18	**2037**																
28		19	**2038**																
29		20	**2039**																
30		21	**2040**			$ 280,000	$10,933,900		$ 362,100			$ 645,000	$ 75,000				$ 12,296,000	$ 2,265,528	$ 5,872,638
31		**Residual**	7%		$ 4,625,693	$ 259,734	$10,667,190	$ 3,178,029	$ 299,134	$ 495,282	$ 581,317	$ 598,317	$ 73,171				$ 20,777,866	$ 3,828,305	
32		**Cap Value**	3%		$ 3,978,355	$ 255,575	$10,526,987	$ 2,334,005	$ 293,897	$ 363,744	$ 426,930	$ 588,736	$ 72,209				$ 18,840,439		$ 8,998,299
33																**Total**	$ 111,609,505	$ 44,607,834	$ 63,454,217
34		Remaining Years			3	9	19	4	4	4	4	9	19						
35		In Service Years			9	1	1	21	1	21	21	1	1						
36		r = discount rate			L= Econ Life	n = In Service Years													
37		**RCV = A*(B-C)/B**																	
38		r=			0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07						
39		A = (1+r)^n			1.838459212	1.07	1.07	4.140562375	1.07	4.140562375	4.140562375	1.07	1.07						
40		B = ((1+r)^L-1)/(r(1+r)^L)			7.942686297	7.023581541	10.59401425	11.65358318	4.100197436	11.65358318	11.65358318	7.023581541	10.59401425						
41		C = ((1+r)^n-1)/(r(1+r)^n)			6.515232249	0.934579439	0.934579439	10.83552733	0.934579439	10.83552733	10.83552733	0.934579439	0.934579439						
42		RCV at 7%			0.330406609	0.927622497	0.975607074	0.29065835	0.826109306	0.29065835	0.29065835	0.927622497	0.975607074						
43																			
44		r=			0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03						
45		A = (1+r)^n			1.304773184	1.03	1.03	1.860294572	1.03	1.860294572	1.860294572	1.03	1.03						
46		B = ((1+r)^L-1)/(r(1+r)^L)			9.954003994	8.530202837	14.87747486	17.41314769	4.579707187	17.41314769	17.41314769	8.530202837	14.87747486						
47		C = ((1+r)^n-1)/(r(1+r)^n)			7.786108922	0.970873786	0.970873786	15.41502414	0.970873786	15.41502414	15.41502414	0.970873786	0.970873786						
48		RCV at 3%			0.284168196	0.912769493	0.962784292	0.213465048	0.811645429	0.213465048	0.213465048	0.912769493	0.962784292						

O&M Costs NPV

	A	B	C	D	E	F	G	H	I	J	N	O	P	Q	R
1				**O&M Cost Net Present Value Calculations**											
2				**Vehicles**		**Stops/Stations**				**Roadside ROW**	**Central**			**Current Year =**	**2015**
3			**Year**	Vehicles[a]	TSP	Stations	RTPI Signs	Off Board Fare Equip	Station Amenities	TSP Field Equip	TSP Software	US 29 BRT O&M	**Total 2015 $**	**NPV 7%**	**NPV 3%**
4			**2015**												
5			**2016**												
6		Startup	**2017**												
7			**2018**												
8			**2019**												
9		1	**2020**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
10		2	**2021**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
11		3	**2022**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
12		4	**2023**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
13		5	**2024**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
14		6	**2025**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
15		7	**2026**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
16		8	**2027**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
17		9	**2028**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
18		10	**2029**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
19		11	**2030**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
20		12	**2031**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
21		13	**2032**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
22		14	**2033**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
23		15	**2034**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
24		16	**2035**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
25		17	**2036**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
26		18	**2037**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
27		19	**2038**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
28		20	**2039**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
29		21	**2040**		$ 5,000	$ 546,695	$ 17,000	$ 127,800	$ 7,000	$ 18,000	$ 2,000	$ 5,100,000	$ 5,823,495	$ 4,152,071	$ 5,023,398
30				a Vehicle maintenance included in the US 29 BRT Service O&M								**Total**	$122,293,395	$ 87,193,500	$105,491,357

CPI Factor Calculations

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	**Consumer Price Index - All Urban Consumers**															
2	**Original Data Value**															
3							Source									
4	**Series Id:**	CUSR0000SA0					http://data.bls.gov/timeseries/CUSR0000SA0									
5	**Seasonally Adjusted**						Accessed: April 12, 2016									
6	**Area:**	U.S. city average														
7	**Item:**	All items														
8	**Base Period:**	1982-84=100														
9	**Years:**	2005 to 2015														
10																
11	**Year**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**	**HALF1**	**HALF2**
12	**2005**	191.6	192.4	193.1	193.7	193.6	193.7	194.9	196.1	198.8	199.1	198.1	198.1	195.3		
13	**2006**	199.3	199.4	199.7	200.7	201.3	201.8	202.9	203.8	202.8	201.9	202.0	203.1	201.6		
14	**2007**	203.437	204.226	205.288	205.904	206.755	207.234	207.603	207.667	208.547	209.19	210.834	211.445	207.3		
15	**2008**	212.174	212.687	213.448	213.942	215.208	217.463	219.016	218.69	218.877	216.995	213.153	211.398	215.3		
16	**2009**	211.933	212.705	212.495	212.709	213.022	214.79	214.726	215.445	215.861	216.509	217.234	217.347	214.6		
17	**2010**	217.488	217.281	217.353	217.403	217.29	217.199	217.605	217.923	218.275	219.035	219.59	220.472	218.1		
18	**2011**	221.187	221.898	223.046	224.093	224.806	224.806	225.395	226.106	226.597	226.75	227.169	227.223	224.9		
19	**2012**	227.86	228.377	228.894	229.286	228.722	228.506	228.475	229.844	230.987	231.655	231.278	231.272	229.6		
20	**2013**	231.641	233.005	232.313	231.856	231.895	232.357	232.749	233.249	233.642	233.799	234.21	234.847	233.0		
21	**2014**	235.436	235.621	235.897	236.495	236.803	237.016	237.259	237.163	237.51	237.651	237.261	236.464	236.7		
22	**2015**	234.954	235.415	235.859	236.197	236.876	237.423	237.734	237.703	237.489	237.949	238.302	238.041	237.0		
23	**2016**	238.107	237.707	237.92										237.9		
24																
25																
26	Conversion Factors to 2015$															
27																
28	From 2013$	1.01730564														
29																
30																
31																
32				CPI												
33	Conversion Factor	to Year	2015	237.0												
34		From Year	2016	237.91												
35		Factor		0.9961												