WESTSIDE SUBWAY EXTENSION

Final Smart Growth Evaluation Report

Metro

August 2010

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Acronyms and Abbreviations

DRM	direct ridership model
HRT	heavy rail transit
Metro	Los Angeles County Metropolitan Transportation Authority
SCAG	Southern California Association of Governments
TDM	transportation demand management
TOD	transit oriented development
UCLA	University of California, Los Angeles
VMT	vehicle miles traveled

1.0 INTRODUCTION

This report describes the 5Ds smart growth project evaluation used to produce the vehicle trip and parking demand reduction potential at each of the Westside Subway Extension 22 candidate station locations:

1. Wilshire/Crenshaw
2. Wilshire/La Brea
3. Wilshire/Fairfax
4. Wilshire/Fairfax (East – Optional)
5. Wilshire/La Cienega
6. Wilshire La Cienega (Transfer Station – Optional)
7. Wilshire/Rodeo
8. Century City (Santa Monica Blvd)
9. Century City (Constellation Boulevard – Optional)
10. Westwood/UCLA (Off-street)
11. Westwood/UCLA (On-street – Optional)
12. Westwood/VA Hospital
13. Westwood/VA Hospital (North – Optional)
14. Wilshire/Bundy
15. Wilshire/26th
16. Wilshire/16th
17. Wilshire/4th
18. Hollywood/Highland
19. Santa Monica/La Brea
20. Santa Monica/Fairfax
21. Santa Monica/San Vicente
22. Beverly Center Area

The purpose of the smart growth project evaluation is to consider the effect that built environment variables can have in predicting fewer vehicle trips than conventional travel demand models.

The 5Ds, which include *Density*, *Diversity*, *Design*, *Destination Accessibility*, and *Distance to Transit*, predict the degree to which built environment variables not typically captured in traditional analysis approaches can reduce a project's vehicle trip generation and demand for parking.[1] To implement this technique, land use and built environment data was collected within a ½-mile walking distance from each of the candidate station locations. The results were used to estimate the potential vehicle trip reductions and short-term reductions in parking demand with the proposed full buildout of the Metro Westside Subway Extension (Alternative 5).

The analysis was performed in a two-step process, first utilizing the 4Ds and then accounting for the fifth D, Distance to Transit, with a direct ridership model (DRM).

1.1 4Ds

First, potential vehicle trip reductions associated with the increased Density, Diversity, Design, and Destination Accessibility that would occur around each station area between base year (2006) and Year 2035 conditions were determined through the use of the 4Ds process. The analysis was applied to 2035 forecasts, including the No Build Alternative and Alternative 5. Due to Federal Transit Administration (FTA) requirements for project evaluation, the future land use plan for each alternative is identical, indicating that the 4Ds process should be applied uniformly to all alternatives. Had the built environment effects of a subway been accounted for in the land use plan for the Build Alternatives, illustrating station area population and employment densities and mix of uses as an improvement over the No Build Alternative, additional trip reductions could be forecast.

1.2 Direct Ridership Model (DRM)

Effects of the fifth D, Distance to Transit, were then estimated for Alternative 5 by calculating potential additional transit ridership at each of the candidate stations through the use of a DRM. A time-of-day factor, mode of travel factor, and vehicle occupancy factor based on estimates in the Metro Regional Travel Demand model were then applied to the additional transit ridership to estimate potential vehicle trip reductions and short-term reduction in parking demand during the AM and PM peak hours within a ½-mile walking distance of each of the 22 candidate station locations.

[1] A detailed introduction to the Ds is contained as Appendix A

2.0 4DS

The literature on travel behavior indicates that built environment variables such as land use **D**ensity, land use **D**iversity, pedestrian **D**esign, and access to regional **D**estinations have a significant effect on travel demand. The main analytical tool for forecasting the long-term effects of land use on transportation networks is the travel demand forecasting (TDF) model. Typical TDF models are insensitive to most smart growth development characteristics. This is because the 4Ds are based on highly localized variables, while TDF models are generally based on regional data. Traditional TDF models do well at predicting travel demand characteristics of homogenous areas with standard land uses, but tend to overestimate the number of vehicle trips from smart growth areas.

Fehr & Peers has developed the 4Ds process to adjust the output of traditional TDF models to more accurately reflect the benefits of smart growth development. The purpose of the 4Ds adjustment process is to enhance the sensitivity of conventional models and provide policy makers with more reliable forecasts of the likely effects of their policies.

The 4Ds are intended to predict relative changes in vehicle trips resulting from changes in built environment variables which have been shown through national research to reduce per-capita auto use. The following four built environment variables were used to estimate the vehicle trip and vehicle-miles traveled (VMT) reductions potentially missed by the Metro Regional Travel Demand Model.

- Density – residential and non-residential development per acre
- Diversity – mix of residential and non-residential development
- Design – connectivity and walkability of the transportation network
- Destination Accessibility – relative location of land use to major regional attractions, as infill sites generate fewer and shorter vehicle trips than fringe area development

The 4Ds process uses an elasticity derived for each of the built environment variables to predict vehicle trip reductions between two alternative land use scenarios. For this application, the 4Ds elasticities were applied to land use differences between the base year and future year (2035) Metro Regional Travel Demand Model. However, the Metro Regional Travel Demand Model is based on highly aggregate data and may not fully capture the smart growth effects of the interaction between land use and transit and changes in the built environment. Therefore, the future year (2035) Metro Travel Demand Model could potentially be underestimating the reduction in vehicle trips as a result of land use changes between the base year and future year (2035) model which can be quantified through the use of the 4Ds.

2.1 Inputs

The 4Ds analysis uses residential and non-residential land use and built environment characteristics within a ½-mile walking distance of each of the 22 candidate station locations. A ¼ mile walking distance has typically been the pedestrian catchment area assumed for transit. However, recent research has shown that transit riders are willing to walk ½ mile (about a 15 minute walk) to reliable, fixed guideway transit (FTA, 2009;

Mineta, 2006; Victoria, 2009). Therefore, a ½ mile walking distance from each station was selected for this analysis, because the potential for build environment variables to reduce vehicle trips and parking demand could occur up to a ½ mile walking distance from each station.

Land use within the ½-mile walking distance was derived with traffic analysis zone (TAZ) data from the base year and future year (2035) Metro Travel Demand Model. For each station location, a set of demand model TAZs were defined from which to include land uses. For TAZs entirely within the ½-mile walking distance, all of the land use was used. In cases where part of the TAZ was within the ½-mile distance, parcel level land use data, aerials, and the roadway network were examined to determine the appropriate percentages of the residential and non-residential land uses within each TAZ to be included in the station-related data.

The parcel level land use data was also used to determine the number of acres of residential and non-residential land uses within a ½-mile walking distance of each station as well as built environment characteristics used to calculate changes in the Design variable such as sidewalk completeness, block size, and route directness. Changes in Destination Accessibility were calculated by the trip distribution component of the Metro Travel Demand Model.

The following data was used to calculate the percent change in Density and Diversity between the base year and future year (2035) models.

- Number of households
- Acres of households
- Number of jobs
- Acres of jobs

The calculated number of households and jobs from the base year and future year (2035) Metro Travel Demand Model within a ½-mile walking distance of each of the 22 candidate station locations is shown in Table 2-1.

As shown in Table 2-1, the future year (2035) model assumes a 13% increase in households and a 34% increase in jobs within a ½-mile walking distance of the 22 candidate stations when compared to 2006 land use.

Table 2-1: Base (2006) and Future Year (2035) Station-Area Land Use within ½ Mile Walking Distance

#	Station	Households			Jobs		
		Base Year (2006)	Future Year (2035)	Change 2006-2035	Base Year (2006)	Future Year (2035)	Change 2006-2035
1	Wilshire/Crenshaw	3,363	3,967	604	4,350	5,493	1,142
2	Wilshire/La Brea	4,220	5,261	1,041	4,613	7,077	2,464
3	Wilshire/Fairfax	2,749	3,808	1,059	14,151	15,598	1,448
4	Wilshire/Fairfax Optional	2,792	3,921	1,129	15,276	16,983	1,707
5	Wilshire/La Cienega	2,774	2,898	124	12,615	10,533	-2,082
6	Wilshire/La Cienega Optional	3,490	3,578	88	12,929	10,031	-2,898
7	Wilshire/Rodeo	3,029	2,462	-567	16,316	25,678	9,361
8	Century City	1,229	1,444	215	20,126	34,544	14,419
9	Century City Optional	1,862	1,395	-467	15,648	33,059	17,412
10	UCLA/Westwood	4,111	4,896	785	14,821	27,835	13,013
11	UCLA/Westwood Optional	3,922	4,930	1,008	14,183	27,191	13,008
12	VA Facility	143	147	4	7,011	4,888	-2,122
13	VA Facility Optional	143	147	4	7,011	4,888	-2,122
14	Wilshire/Bundy	6,021	6,921	900	7,104	9,340	2,236
15	Wilshire/26th	2,778	2,825	47	6,774	8,300	1,526
16	Wilshire/16th	5,054	4,931	-123	6,259	6,946	687
17	Wilshire/4th	4,343	4,629	286	8,391	17,503	9,112
18	Hollywood/Highland	5,141	6,229	1,087	13,252	10,495	-2,757
19	Santa Monica/La Brea	3,438	3,975	536	6,581	9,264	2,683
20	Santa Monica/Fairfax	6,652	7,248	596	2,857	3,365	509
21	Santa Monica/San Vicente	4,442	5,471	1,028	12,979	13,281	301
22	Beverly Center Area	3,433	3,634	201	17,014	15,051	-1,963
Total		**75,128**	**84,716**	**9,588**	**240,259**	**317,342**	**77,084**

2.2 Results

The percent change in each of the 4D variables between base year and future year (2035) conditions were then calculated for each ½-mile walk shed. An elasticity associated with each of the 4Ds was then applied to predict the percent change in vehicle trips based on the percent change in each built environment variable. The total vehicle trips produced by each TAZ within the ½-mile walk shed in the future year (2035) Metro Travel Demand Model were then multiplied by the corresponding percent reduction in vehicle trips estimated by the 4Ds. The potential vehicle trip reductions for each TAZ were then aggregated by walk shed to determine the total vehicle trip reduction from the TAZs within each ½-mile walk shed.

Additionally, the potential reduction in study area VMT was also estimated by first determining the average trip length of vehicle trips with an origin or destination in the study area (excludes cut-through traffic). The AM and PM peak hour total VMT from the future year (2035) Metro Travel Demand Model was divided by the total number of vehicle trips in the study area to obtain the average trip length of vehicle trips with an origin or destination in the study area. The average trip length was then multiplied by the total vehicle trips from each ½-mile walk shed to determine the total VMT associated with each walk shed. The total VMT was then multiplied by the percent reduction in VMT to determine the total VMT reduction from each ½-mile walk shed. The VMT, total vehicle trips, and average trip length used to estimate reductions in study are VMT are shown in Table 2-2.

Table 2-2: Average Weekday AM and PM Peak Hour Performance Characteristics from the 2035 Metro Model

Performance Measure	AM Peak Hour			PM Peak Hour		
	Base Year	No Build	Alternative 5	Base Year	No Build	Alternative 5
Average Trip Length (miles)	1.85	2.03	2.03	1.64	1.83	1.84
Total Vehicle Trips	223,898	261,615	259,215	269,394	312,060	310,159
VMT	413,450	532,046	526,124	440,520	572,492	570,364

Vehicle trips category excludes cut-through (external to external) trips

The potential percent reduction in vehicle trips and VMT from the 4Ds process, as well as the total vehicle trip and VMT reductions for each of the ½-mile walk sheds in the AM and PM peak hours are presented in Table 2-3 and Table 2-4, respectively.

Table 2-3: AM Peak Hour Vehicle Trip and VMT Reductions

#	Station	Vehicle Trip Reductions			VMT Reductions		
		Reduction %	Total Vehicle Trips	Total Reduction	Reduction %	Total VMT	Total Reduction
1	Wilshire/Crenshaw	1.6%	1,770	28	2.0%	9,454	192
2	Wilshire/La Brea	3.4%	2,617	90	4.2%	13,975	581
3	Wilshire/Fairfax	3.1%	4,708	146	3.4%	25,142	850
4	Wilshire/Fairfax Optional	3.3%	4,708	153	3.6%	25,142	895
5	Wilshire/La Cienega	0.6%	1,995	13	0.3%	10,654	36
6	Wilshire/La Cienega Optional	0.5%	1,995	11	0.1%	10,654	13
7	Wilshire/Rodeo	-1.0%	4,505	0	0.0%	24,055	0
8	Century City	1.8%	4,258	77	3.0%	22,739	681
9	Century City Optional	1.8%	4,258	77	3.0%	22,739	681
10	UCLA/Westwood	2.5%	14,715	373	3.9%	78,579	3,057
11	UCLA/Westwood Optional	3.1%	14,715	450	4.5%	78,579	3,532
12	VA Facility	1.7%	2,645	45	1.0%	14,125	137
13	VA Facility Optional	1.7%	2,645	45	1.0%	14,125	137
14	Wilshire/Bundy	1.9%	7,203	140	2.4%	38,463	918
15	Wilshire/26th	0.3%	6,327	17	0.6%	33,786	211
16	Wilshire/16th	0.2%	8,371	13	0.3%	44,703	122
17	Wilshire/4th	2.5%	4,626	116	4.0%	24,701	993
18	Hollywood/Highland	1.8%	7,610	139	1.5%	40,639	623
19	Santa Monica/La Brea	1.6%	6,064	95	2.2%	32,382	726
20	Santa Monica/Fairfax	1.4%	7,979	113	1.6%	42,606	694
21	Santa Monica/San Vicente	1.8%	2,532	46	1.9%	13,520	261
22	Beverly Center Area	0.7%	3,946	27	0.5%	21,072	99
Total		**1.8%**	**120,194**	**2,213**	**2.4%**	**641,834**	**15,439**

Table 2-4: PM Peak Hour Vehicle Trip and VMT Reductions

#	Station	Vehicle Trip Reductions			VMT Reductions		
		Reduction %	Total Vehicle Trips	Total Reduction	Reduction %	Total VMT	Total Reduction
1	Wilshire/Crenshaw	1.6%	3,092	48	2.0%	20,251	412
2	Wilshire/La Brea	3.4%	4,828	166	4.2%	31,621	1,315
3	Wilshire/Fairfax	3.1%	5,871	182	3.4%	38,454	1,300
4	Wilshire/Fairfax Optional	3.3%	5,871	191	3.6%	38,454	1,368
5	Wilshire/La Cienega	0.6%	2,812	18	0.3%	18,416	62
6	Wilshire/La Cienega Optional	0.5%	2,812	15	0.1%	18,416	22
7	Wilshire/Rodeo	-1.0%	6,695	0	0.0%	43,851	0
8	Century City	1.8%	4,895	89	3.0%	32,059	961
9	Century City Optional	1.8%	4,895	89	3.0%	32,059	961
10	UCLA/Westwood	2.5%	22,293	565	3.9%	146,017	5,680
11	UCLA/Westwood Optional	3.1%	22,293	682	4.5%	146,017	6,563
12	VA Facility	1.7%	3,651	62	1.0%	23,915	232
13	VA Facility Optional	1.7%	3,651	62	1.0%	23,915	232
14	Wilshire/Bundy	1.9%	8,374	163	2.4%	54,848	1,309
15	Wilshire/26th	0.3%	8,586	23	0.6%	56,241	352
16	Wilshire/16th	0.2%	9,561	15	0.3%	62,622	171
17	Wilshire/4th	2.5%	6,369	160	4.0%	41,717	1,677
18	Hollywood/Highland	1.8%	9,163	167	1.5%	60,020	920
19	Santa Monica/La Brea	1.6%	10,227	160	2.2%	66,990	1,502
20	Santa Monica/Fairfax	1.4%	9,282	132	1.6%	60,798	990
21	Santa Monica/San Vicente	1.8%	3,253	59	1.9%	21,309	411
22	Beverly Center Area	0.7%	5,742	39	0.5%	37,613	177
Total		**1.9%**	**164,214**	**3,087**	**2.5%**	**1,075,602**	**26,617**

As shown in Table 2-3 and Table 2-4, the 4Ds process estimates a reduction for all future year 2035 alternatives of approximately 2,000 AM and 3,000 PM peak hour vehicle trips compared to the vehicle trip projections forecasted by the Metro Travel Demand Model.

Figure 2-1 shows the AM and PM peak hour additional vehicle trip reductions and indicates the largest additional vehicle trip reductions occur near the UCLA/Westwood and Wilshire/Fairfax/La Brea candidate stations. Figure 2-2 shows the total study area vehicle trips from the base year and future year (2035) VISUM models with the potential vehicle trip reductions from the 4Ds process in red.

The 4Ds analysis reveals the vehicle trip reductions can be achieved through smart growth policies that improve upon an area's density, diversity, design, and destination accessibility. The trip reductions projected for the Westside Subway Extension are based on the land use changes between the base year and 2035 and are valid for all alternatives including the No Build alternative. The trip reduction benefits of the Westside Subway Extension are likely being understated because land use-including the built environment characteristics on which the 4Ds analysis is based-around station areas would be different with a subway than without.

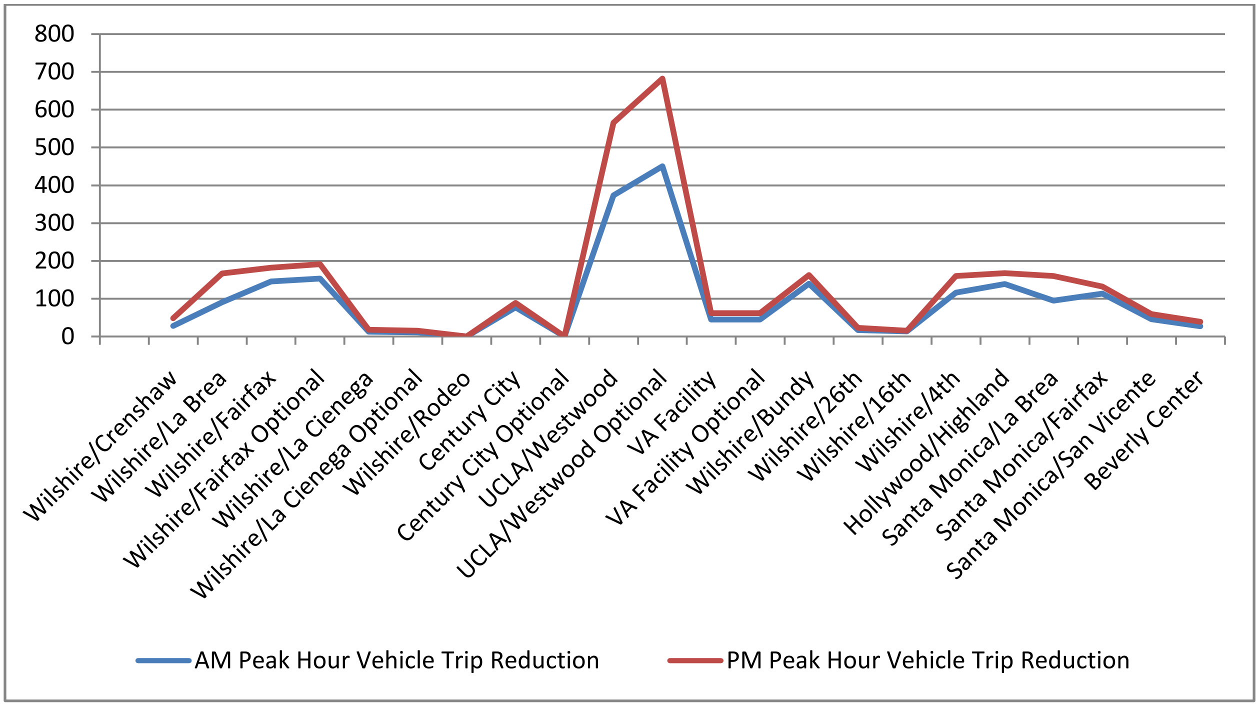

Figure 2-1: AM and PM Peak Hour Vehicle Trip Reduction due to the 4Ds

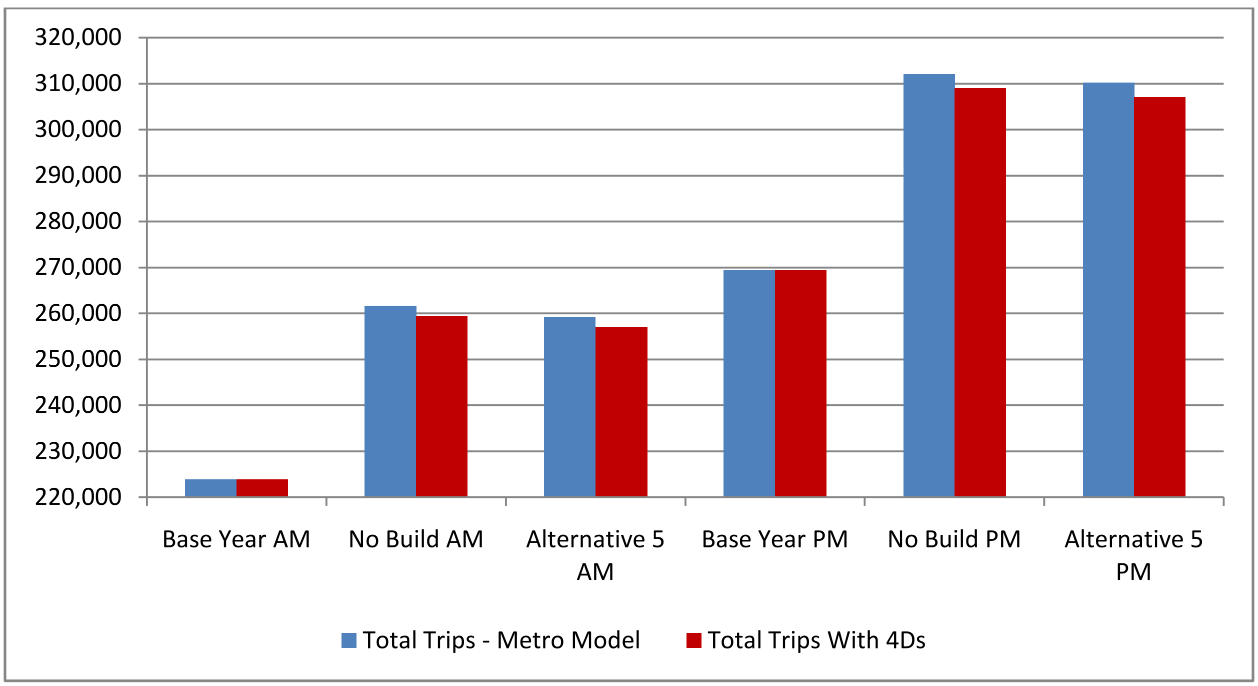

Figure 2-2: Study Area Vehicle Trips with 4Ds Reduction

3.0 DIRECT RIDERSHIP MODELING

Direct Ridership Models (DRMs) use multivariate regression based on empirical data to determine the station characteristics that influence rail transit patronage. They respond directly to factors such as parking, feeder bus levels, station-area households and employment, and the effects of transit oriented development (TOD). Rail ridership is traditionally forecast with region-wide travel demand models, which often represent transportation networks and land use at an aggregate scale. Such models are typically unresponsive to changes in station-level land use and transit service characteristics. DRMs are directly and quantitatively responsive to land use and transit service characteristics within the immediate vicinity and with the catchment area of transit stations.

The DRM used for this study was based on the DRM[2] developed for the Bay Area Rapid Transit (BART) Demand Management Study. This model predicts changes in ridership at individual stations along the BART heavy rail system during the AM and PM peak hours and was based on empirical relationships found through statistical analysis of BART system ridership data and the 2008 BART Station Profile Study (BART, 2008) for the BART system. To determine if the DRM developed for the BART system was suitable for use on the Metro Westside Extension, the DRM was compared to daily ridership data collected in 2008 along the existing Metro Heavy Rail Transit (HRT) service in Los Angeles.

3.1 Model Validation

The purpose of the validation of the BART DRM was to ensure the model was statistically valid and capable of predicting current daily ridership, both boardings and alightings, for the existing Metro HRT service in Los Angeles. The model was also validated to ensure the model was capable of responding to input changes, and therefore able to predict future transit ridership at the 22 candidate stations.

Daily ridership data collected in 2008 for the following 13 stations along the Metro HRT service in Los Angeles was provided by Metro for the DRM validation.

1. Metro Red Line North Hollywood Station
2. Metro Red Line Universal City Station
3. Metro Red Line Hollywood/Highland Station
4. Metro Red Line Vermont/Sunset Station
5. Metro Red Line Vermont/Santa Monica Station
6. Metro Red Line Vermont/Beverly Station
7. Metro Red Line Hollywood/Western Station
8. Metro Red Line Hollywood/Vine Station

[2] The model development report is contained as Appendix B.

9. Metro Red/Purple Line Wilshire/Vermont Station
10. Metro Red/Purple Line Westlake/MacArthur Station
11. Metro Red/Purple Line 7th Street/Metro Center Station
12. Metro Purple Line Wilshire/Western Station
13. Metro Purple Line Wilshire/Normandie Station

Station-related demographic, land use, and transit data within a ½-mile walking distance of each of the 13 stations were derived with TAZ data from the base year Metro Regional Travel Demand Model. The data was derived using the same process used for the 4Ds process but was expanded to include population, retail employment, non-retail employment, and college enrollment. The TAZ data was also used to develop station catchment population and employment data to account for kiss and ride patrons as well as patrons who may park nearby. Feeder transit, transit frequency, and other transit-related data were collected from the Los Angeles Metropolitan Transportation Authority's website. The following data was developed for each of the 13 stations and inputted into the DRM model.

- Total population within a ½ mile walk shed
- Total employment within a ½ mile walk shed
- Retail employment within a ½ mile walk shed
- Non-retail employment within a ½ mile walk shed
- College enrollment within a ½ mile walk shed
- Neighborhood (on-street) parking spaces within ½ mile walk shed
- Total vehicle parking spaces within ½ mile walk shed
- Total catchment population
- Total catchment non-retail employment
- Station bike parking spaces
- Pedestrian accessibility and design rating
- Number of trains arriving and departing in the AM and PM peak hours
- Number of supporting bus routes

The model validation results for daily boardings and alightings at all 13 stations are presented in Table 3-1 along with the results from the Metro Regional Travel Demand Model for the same 13 stations.

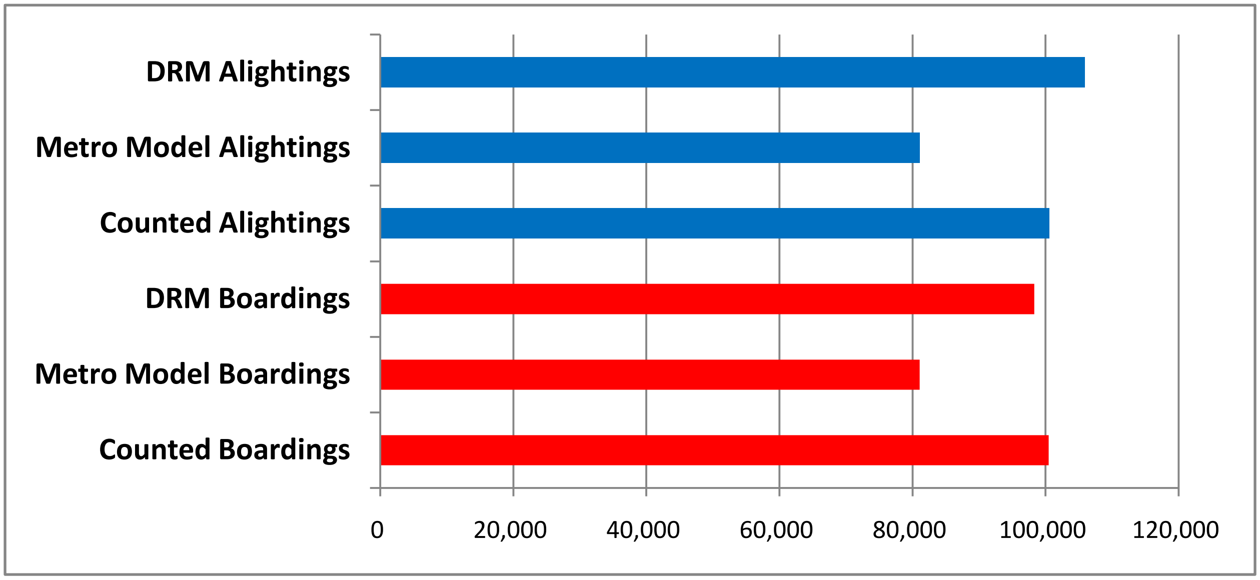

Figure 3-1: DRM Model Validation Results

As shown in Figure 3-1, the DRM under-predicts system-wide Metro Red/Purple Line daily boardings by approximately 2% and over-predicts daily alightings by approximately 5%, while the Metro Regional Travel Demand Model under-predicts both boardings and alightings by approximately 19%.

Based on the model validation results, it was determined that for purposes of the smart growth evaluation the model was suitable for forecasting daily ridership (boardings and alightings) in 2035 at each of the 22 candidate stations for the Metro Westside Subway Extension.

3.2 Model Results

The same data collected for the 13 existing subway stations used to validate the DRM was assembled for the 22 candidate station locations from the future year (2035) Metro Regional Travel Demand Model.

3.2.1 Daily Ridership

Using this data set, estimated daily ridership projected with the DRM (including both boardings and alightings) at the 22 candidate station locations is shown in Table 3-1. Year 2035 estimated daily ridership from the Metro Regional Travel Demand Model for Alternative 5 is also shown in Table 3-1. The DRM, which is sensitive to station-level land use and transit service characteristics suggests higher expected ridership than currently projected by the Metro Regional Travel Demand Model.

Table 3-1: Estimated Weekday Daily Boardings and Alightings by Station

#	Station	Boardings			Alightings		
		Metro Model Alt 5	DRM Model	Delta	Metro Model Alt 5	DRM Model	Delta
1	Wilshire/Crenshaw	4,356	4,087	-269	4,356	4,476	121
2	Wilshire/La Brea	3,423	4,525	1,102	3,423	4,885	1,462
3	Wilshire/Fairfax	5,361	6,407	1,046	5,361	6,712	1,351
4	Wilshire/Fairfax Optional	5,361	6,789	1,428	5,361	7,100	1,739
5	Wilshire/La Cienega	5,418	5,213	-205	5,418	5,483	65
6	Wilshire/La Cienega Optional	5,418	5,252	-166	5,418	5,558	140
7	Wilshire/Rodeo	6,649	10,286	3,638	6,649	10,519	3,871
8	Century City	6,390	11,471	5,082	6,390	11,618	5,229
9	Century City Optional	6,390	10,810	4,421	6,390	10,946	4,557
10	UCLA/Westwood	11,978	10,319	-1,659	11,978	10,601	-1,377
11	UCLA/Westwood Optional	11,978	11,496	-482	11,978	11,780	-198
12	VA Facility	6,662	2,264	-4,398	6,662	2,278	-4,384
13	VA Facility Optional	6,662	2,264	-4,398	6,662	2,278	-4,384
14	Wilshire/Bundy	5,759	5,657	-102	5,759	6,148	389
15	Wilshire/26th	5,630	4,362	-1,268	5,630	4,629	-1,001
16	Wilshire/16th	4,323	4,842	519	4,323	5,213	890
17	Wilshire/4th	6,639	7,581	943	6,639	7,888	1,250
18	Hollywood/Highland	7,360	6,054	-1,306	7,360	6,480	-880
19	Santa Monica/La Brea	2,628	5,139	2,512	2,628	5,448	2,821
20	Santa Monica/Fairfax	2,270	4,157	1,887	2,270	4,641	2,371
21	Santa Monica/San Vicente	1,905	6,429	4,524	1,905	6,791	4,886
22	Beverly Center Area	2,933	7,909	4,976	2,933	8,284	5,352
Total		**125,488**	**143,313**	**17,825**	**125,488**	**149,756**	**24,268**

As shown in Table 3-1, the DRM estimates 56,000 additional boardings and 62,000 additional alightings beyond those predicted by the Metro Regional Travel Demand Model. Figure 3-1 illustrates how daily boardings and alightings estimated by the DRM model tend to trend closely with station-area population and job density suggesting a strong correlation between those built environment variables and ridership.

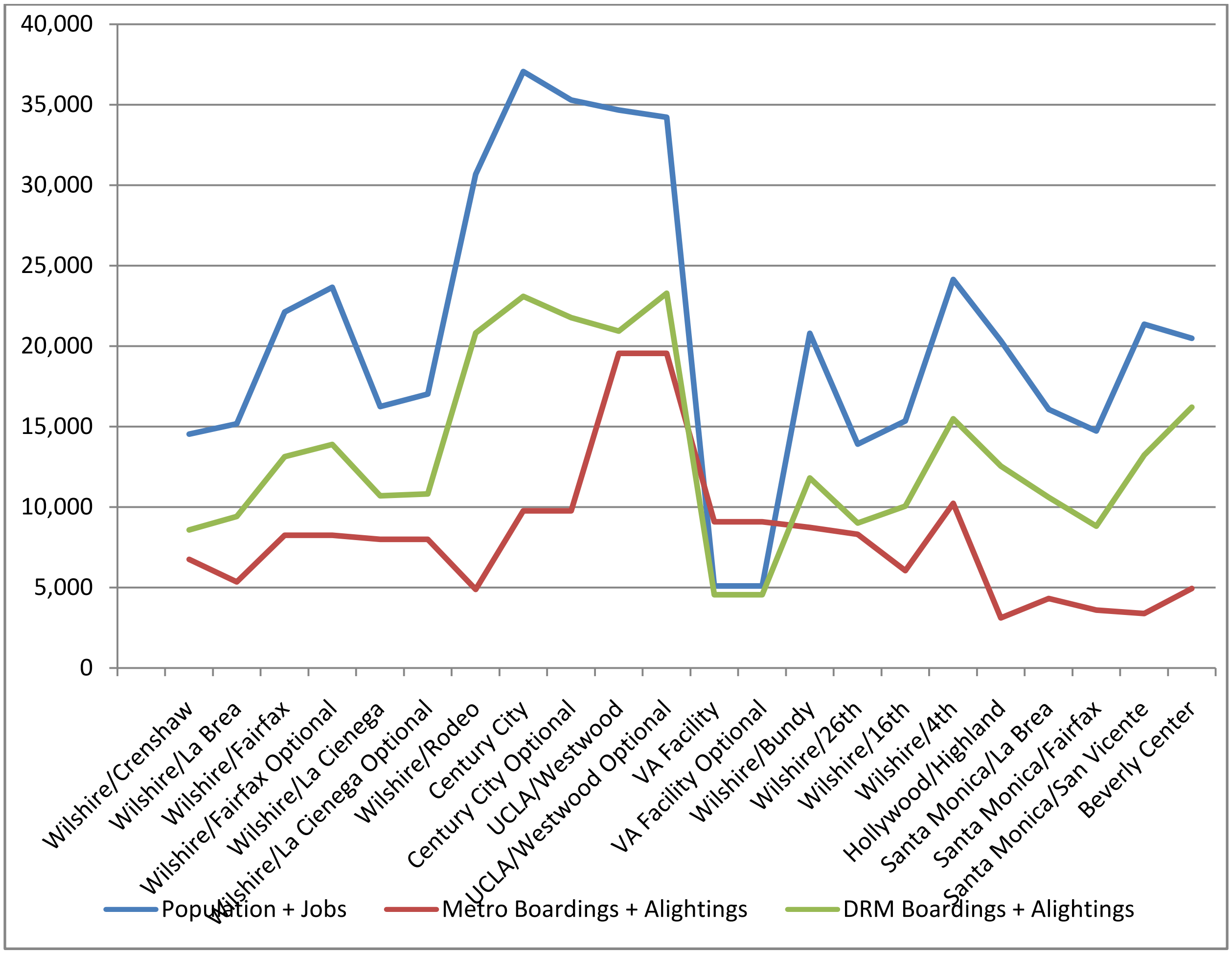

Figure 3-2: Population and Jobs Compared to Estimated Boardings and Alightings

3.2.2 Peak Hour Ridership

To estimate the potential additional transit ridership in the AM and PM peak hours, the ratio of daily ridership to peak hour ridership at each of the 22 candidate stations from the Metro Regional Travel Demand Model was used. The AM and PM peak hour additional ridership estimates are shown in Table 3-2 and Table 3-3, respectively.

Table 3-2: AM Peak Hour Additional Transit Ridership

#	Station	Boardings			Alightings		
		Metro Model Alt 5	DRM Model	Delta	Metro Model Alt 5	DRM Model	Delta
1	Wilshire/Crenshaw	632	593	-39	402	413	11
2	Wilshire/La Brea	406	537	131	400	571	171
3	Wilshire/Fairfax	497	594	97	794	994	200
4	Wilshire/Fairfax Optional	497	629	132	794	1,052	258
5	Wilshire/La Cienega	507	488	-19	695	703	8
6	Wilshire/La Cienega Optional	507	491	-16	695	713	18
7	Wilshire/Rodeo	561	868	307	969	1,533	564
8	Century City	332	596	264	1,207	2,195	988
9	Century City Optional	332	562	230	1,207	2,068	861
10	UCLA/Westwood	770	663	-107	2,226	1,970	-256
11	UCLA/Westwood Optional	770	739	-31	2,226	2,189	-37
12	VA Facility	538	183	-355	899	307	-592
13	VA Facility Optional	538	183	-355	899	307	-592
14	Wilshire/Bundy	456	448	-8	864	922	58
15	Wilshire/26th	365	283	-82	905	744	-161
16	Wilshire/16th	333	373	40	482	581	99
17	Wilshire/4th	345	394	49	1,334	1,585	251
18	Hollywood/Highland	1,576	1,296	-280	428	377	-51
19	Santa Monica/La Brea	396	774	378	187	388	201
20	Santa Monica/Fairfax	325	595	270	166	339	173
21	Santa Monica/San Vicente	161	543	382	229	816	587
22	Beverly Center	220	593	373	482	1,362	880
Total		**11,064**	**12,427**	**1,363**	**18,490**	**22,130**	**3,640**

Table 3-3: PM Peak Hour Additional Transit Ridership

#	Station	Boardings			Alightings		
		Metro Model Alt 5	DRM Model	Delta	Metro Model Alt 5	DRM Model	Delta
1	Wilshire/Crenshaw	402	377	-25	632	650	18
2	Wilshire/La Brea	400	529	129	406	579	173
3	Wilshire/Fairfax	794	949	155	497	622	125
4	Wilshire/Fairfax Optional	794	1,005	211	497	658	161
5	Wilshire/La Cienega	695	669	-26	507	513	6
6	Wilshire/La Cienega Optional	695	674	-21	507	520	13
7	Wilshire/Rodeo	969	1,499	530	561	888	327
8	Century City	1,207	2,167	960	332	604	272
9	Century City Optional	1,207	2,042	835	332	569	237
10	UCLA/Westwood	2,226	1,918	-308	770	682	-88
11	UCLA/Westwood Optional	2,226	2,136	-90	770	757	-13
12	VA Facility	899	306	-593	538	184	-354
13	VA Facility Optional	899	306	-593	538	184	-354
14	Wilshire/Bundy	864	849	-15	456	487	31
15	Wilshire/26th	905	701	-204	365	300	-65
16	Wilshire/16th	482	540	58	333	402	69
17	Wilshire/4th	1,334	1,523	189	345	410	65
18	Hollywood/Highland	428	352	-76	1,576	1,388	-188
19	Santa Monica/La Brea	187	366	179	396	821	425
20	Santa Monica/Fairfax	166	304	138	325	665	340
21	Santa Monica/San Vicente	229	773	544	161	574	413
22	Beverly Center	482	1,300	818	220	622	402
Total		**18,490**	**21,284**	**2,794**	**11,064**	**13,076**	**2,012**

3.3 Vehicle Trip Reduction Potential

The outputs of the DRM were used to estimate peak period vehicle trip reductions that may not have been captured by the Metro Regional Travel Demand Model. To equate peak period vehicle trips to ridership involved a two step process. First, only ridership that shifted away from private auto use was included. The Metro Regional Travel Demand Model indicated that 43% of new daily and peak period Westside Subway Extension transit patrons would shift from the existing bus system. Therefore, a factor of 57%, which represents the percent of person trips shifting from autos to rail in the Metro Regional Travel Demand Model, was applied to the additional peak hour ridership at each station. Second, the auto-based person trips were adjusted based on vehicle occupancy rates since on average vehicles average more than one passenger. An average vehicle occupancy rate of 1.58, which is based on data presented in the SCAG 2001 Household

Survey (SCAG, 2001), was also applied to account for autos with multiple passengers shifting from auto to rail. The total estimated additional vehicle trip reductions in the AM and PM peak hours are shown in Table 3-4.

Table 3-4: AM and PM Peak Hour Estimated Additional Vehicle Trip Reductions

#	Station	AM Peak Hour Trip Reductions		PM Peak Hour Trip Reductions	
		From Boardings	From Alightings	From Boardings	From Alightings
1	Wilshire/Crenshaw	-14	4	-9	6
2	Wilshire/La Brea	47	62	46	63
3	Wilshire/Fairfax	35	72	56	45
4	Wilshire/Fairfax Optional	48	93	76	58
5	Wilshire/La Cienega	-7	3	-10	2
6	Wilshire/La Cienega Optional	-6	6	-8	5
7	Wilshire/Rodeo	111	204	191	118
8	Century City	95	356	346	98
9	Century City Optional	83	310	301	85
10	UCLA/Westwood	-38	-92	-111	-32
11	UCLA/Westwood Optional	-11	-13	-32	-5
12	VA Facility	-128	-213	-214	-128
13	VA Facility Optional	-128	-213	-214	-128
14	Wilshire/Bundy	-3	21	-6	11
15	Wilshire/26th	-30	-58	-74	-23
16	Wilshire/16th	14	36	21	25
17	Wilshire/4th	18	91	68	23
18	Hollywood/Highland	-101	-18	-27	-68
19	Santa Monica/La Brea	137	72	64	153
20	Santa Monica/Fairfax	97	63	50	122
21	Santa Monica/San Vicente	138	212	196	149
22	Beverly Center	135	317	295	145
Total		**492**	**1,313**	**1,008**	**726**

As shown in Table 3-4, the DRM estimates that approximately 1,700 more vehicle trips could be removed from the study area roadway network in the either the AM or PM peak hours when compared to the projections made by the Metro Regional Travel Demand Model. Table 3-4 shows the reduction potential visually.

3.3.1 AM Alightings and Parking Reduction Potential

In the AM peak hour, the DRM predicts over 1,300 additional vehicle trip reductions that would be attributed to alightings. These reductions represent vehicle trips attracted to a study area destination that would have entered ½-mile station-area walk shed but instead shifted to the subway. This mode shift from auto to transit indicates that greater traffic relief benefits and potentially significant reductions in station-area parking demand could occur that are not being captured in the Metro Regional Travel Demand Model.

Because the DRM is only looking at the AM peak hour for vehicle trip reductions, the total parking reduction potential is greater because station-area trip generators attract trips throughout the day.

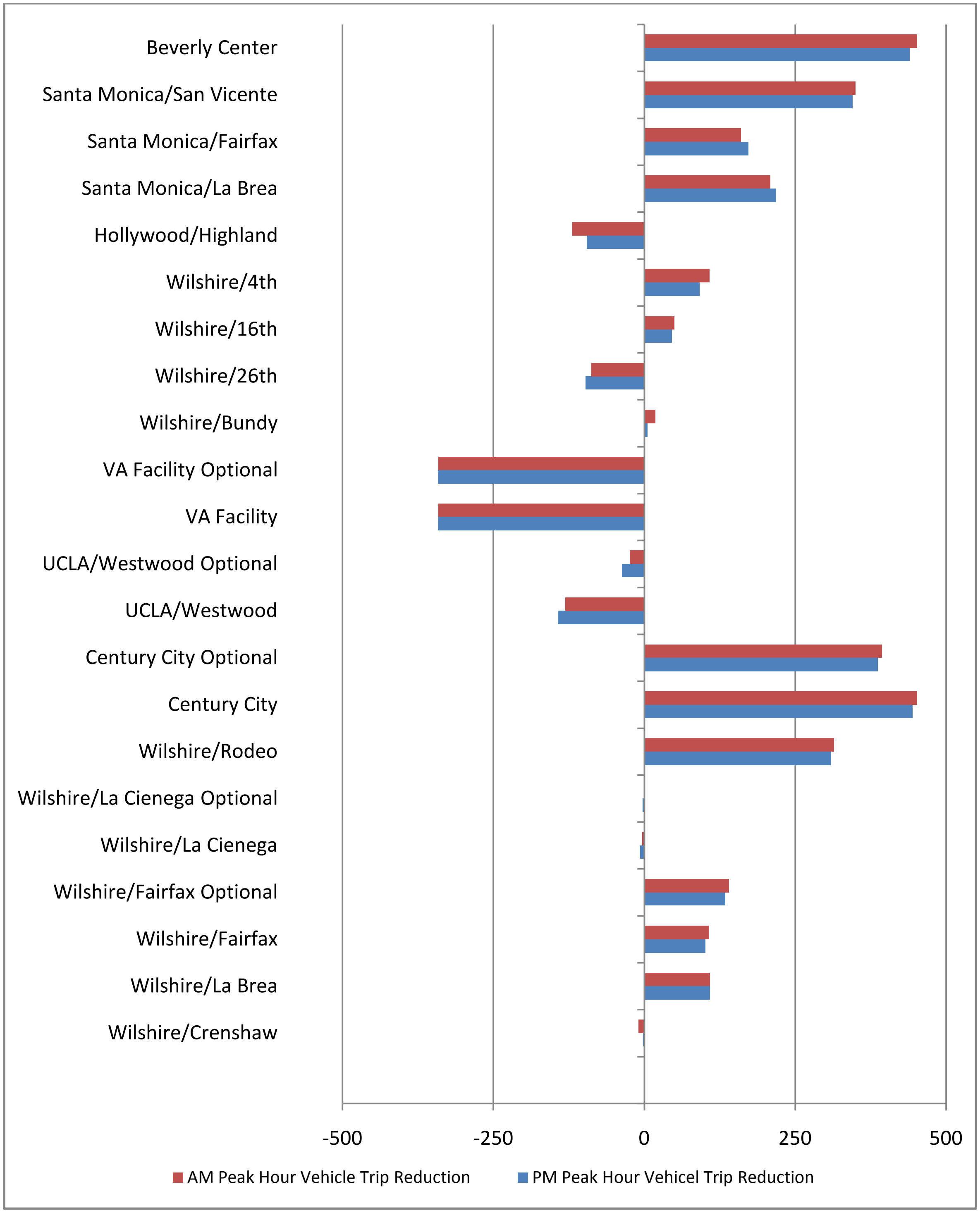

Figure 3-3: AM and PM Peak Hour Estimated Additional Vehicle Trip Reductions

4.0 SMART GROWTH PROJECT EVALUATION

Combining the 4Ds analysis and Direct Ridership Modeling for the Westside Subway Extension highlights the project's smart growth benefits in terms of vehicle trip reductions not typically captured in regional travel demand models.

Figure 4-1 illustrates the combined trip reductions that would be indicated for the project if smart growth tools were used to better capture the effects of built environment variables. The top of each bar in the figure represents the total vehicle trips predicted by the Metro Regional Travel Demand Model (Base Year, 2035 Bo Build, and Alternative 5) while the potential vehicle trip reductions from the 4Ds process are shown in red and the DRM model are shown in green.

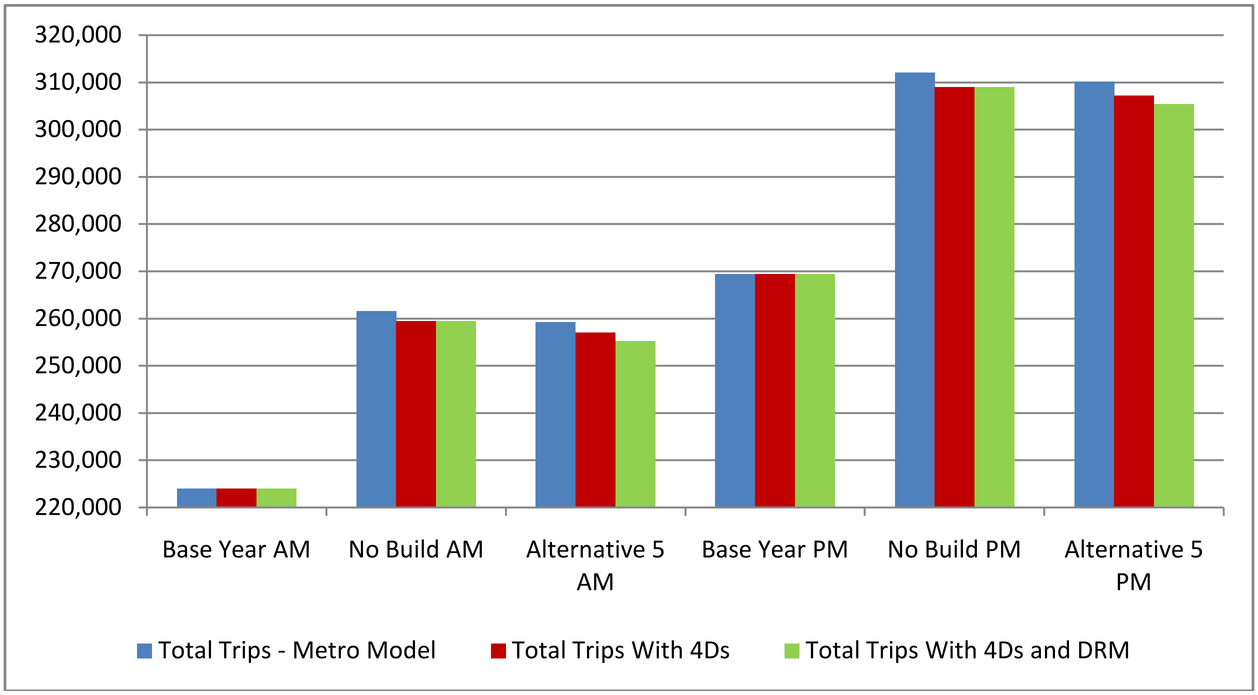

Figure 4-1: Study Area Vehicle Trips with 4Ds and DRM Reductions

Employing smart growth tools indicates that the Build Alternatives could have more pronounced congestion relief benefits than analyzed in the Traffic Impact Analysis that relies on the Metro Regional Travel Demand Model outputs as the basis for the traffic forecasting analysis. As Figure 4-1 illustrates, the peak hour benefits are substantial enough that new development could occur in a station-area and result in no net new vehicle trips. The trip reduction when compared to the Metro Regional Travel Demand Model also implies reduced parking demand in the station areas due to the strong trip attractors that exist within a ½ mile walking distance. This analysis helps validate the beneficial impact of the subway and promotes its ability to act as a catalyst for new development without worsening traffic conditions. The reduction in parking demand at trip attractors points to the possibility of station-area parking districts with lowered minimum parking requirements.

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