

# Appendix D: Estimation of Land Use-Driven Sources of Funding

**Appendix D summarizes the methods by which the real estate tax base and parking space estimates used to calculate value capture and parking fee revenues were projected.**

## **Residential and Commercial Development along Proposed Streetcar Transit Corridors in the District of Columbia**

Projected residential and commercial development was analyzed along the proposed streetcar transit corridors in the District of Columbia. The methodology addressed three components of the projected development:

- **Baseline development value** – The value of the residential and commercial development projected to occur in the baseline scenario was estimated for each streetcar transit line. That value was used to determine the total revenue that could be generated from sources such as a benefit assessment tax.
- **Induced development value** – The value of the estimated increase in development that would be attributable to transit investment was estimated for each streetcar transit line. That value was used to determine the total revenue that could be generated from sources such as tax increment financing.
- **Numbers of parking spaces** – The number of parking spaces associated with development in the baseline scenario and with the increased development attributable to investment in streetcar transit is estimated. Those estimates were used to determine the revenue that would be generated from a parking tax.

It is important to note that the estimations listed above exclude low-density residential development. Because it is unlikely that any benefits assessment tax, tax increment financing, or parking tax would be applied to relatively low-density housing, it was decided to omit all low-density residential development from this analysis. Therefore, only residential development classified as medium- or high-density was considered when estimating development values and numbers of parking spaces. Low density residential development was defined as buildings with less

than 8 units. Medium density residential density includes buildings with 8-12 units on high density includes buildings with more than 12 units.

It is also important to note that all estimates reported in this memorandum include only the portions of each streetcar corridor (and associated buffer area) that are within the District of Columbia.

The analysis applied in this report is based on a prior analysis conducted for the October 2005 District of Columbia Transit Alternatives Analysis. This appendix first describes how the 2005 analysis was developed and what assumptions were made to apply the prior results to this study.

## **Proposed Streetcar Corridors**

The streetcar element of the 2010 System Plan will be implemented in three phases. The phases and segments are mapped in Figure D-1. The premium transit alignments included in the 2005 DC Transit Alternatives Analysis study, which differ from the corridors included in this study, are summarized in Figure D-2.

## **Estimating the Value of Residential and Commercial Development in 2005 DC Transit Alternatives Analysis Baseline Scenario**

In order to estimate the value of residential and commercial development in the baseline scenario, employment and household projections were obtained from the Metropolitan Washington Council of Governments (MWCOG).<sup>1</sup> Those forecasts were obtained for all transportation analysis zones (TAZs) along the premium transit alignments included in the October 2005 District of Columbia Transit Alternatives Analysis final report, which are summarized in Figure D-2. For each of these zones, data were obtained from 2000 to 2030 in five year increments and interim years were interpolated.

<sup>1</sup>Data from MWCOG Round 6.3 Cooperative Forecasts were used in this analysis.

Figure D-1: DC Streetcar Corridors by Phase and Segment

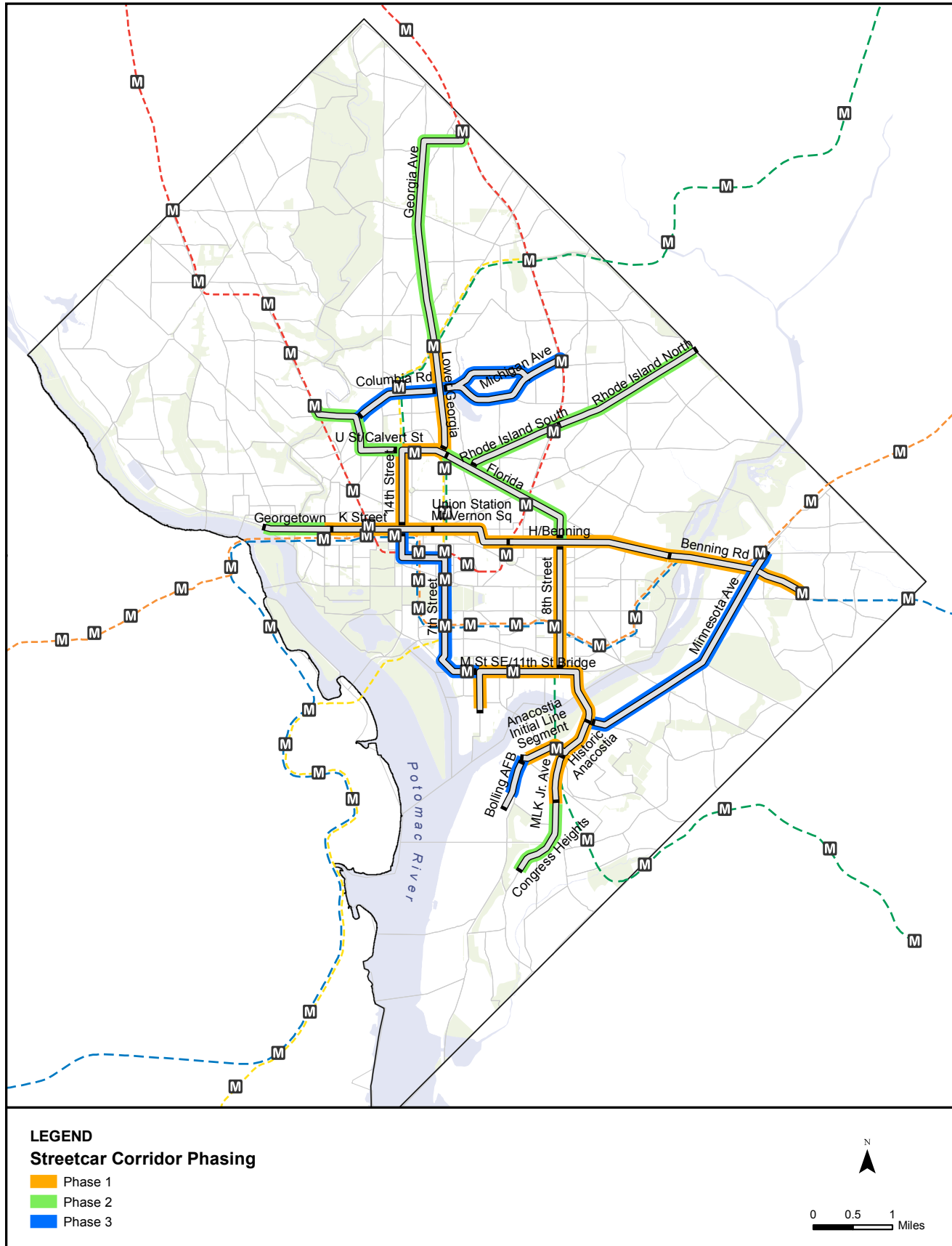
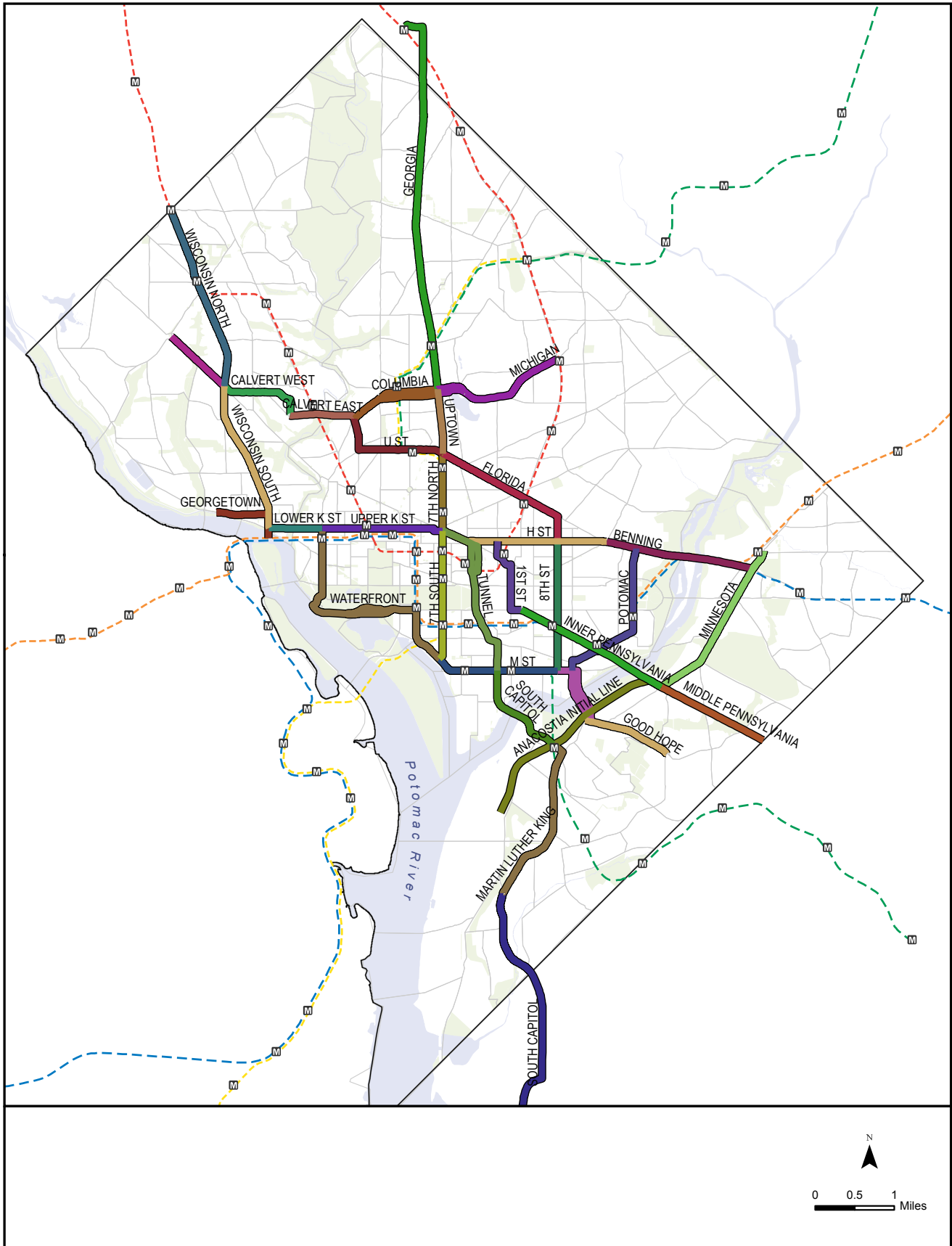


Figure D-2: 2005 DC Transit Alternatives Analysis Premium Transit Corridors by Segment



Because TAZs are irregularly shaped, TAZ-level data was adjusted to reflect households and employment that is within one quarter mile of a proposed streetcar line. That adjustment was conducted by calculating a unique factor for households and employment for each TAZ. For households, that factor was calculated by dividing the total area of land used for medium- and high-density housing within one quarter mile of a streetcar transit line by the total area of land used for residential purposes in the entire TAZ. For employment, that factor was calculated by dividing the total area of land used for commercial purposes within one quarter mile of a streetcar line by the total area of land used for commercial purposes in the entire TAZ<sup>2</sup>.

After calculating factors for each TAZ for both residential and commercial development, housing units and employment for each TAZ from the MWCOG forecast were multiplied by those factors to arrive at an estimate of multi-unit households and employment in each TAZ that were within one quarter mile of a streetcar line. Residential and commercial development values were estimated based upon those adjusted household and employment figures.

To estimate the value of residential development, the number of households was multiplied by an assumed value per household. That value was calculated by determining the average housing unit value in the District of Columbia for each of the years between 2005 and 2030. The average housing unit value was estimated to be \$342,395 in 2005 and was assumed to increase at an inflation adjusted rate of 3.7 percent<sup>3</sup>. The average housing unit value for selected years is displayed in Table D-1.

**Table D-1: Estimated Average Housing Unit and Commercial Development Value in the District of Columbia**

Year	Average Housing Unit Value	Average Commercial Development Value Per Square Foot
2015	\$492,736	\$574.27
2025	\$591,095	\$688.08
2025	\$709,089	\$824.46
2030	\$850,637	\$987.86

Source: Delta Associates, Census Bureau, and AECOM

<sup>2</sup>Land use that was considered commercial in this analysis included the following classifications: low-, medium-, and high-density commercial, production and technical employment, institutional, federal, and local public facilities. Land use data were obtained from the DCDC Office of Planning.

<sup>3</sup>The average housing value in the District of Columbia, using Delta Associates sales data and Census Bureau housing stock distribution, was estimated to be \$342,395 in 2005. The compound annual growth rate in housing prices in the Washington, D.C. Metro Area was obtained by analyzing data from the Office of Federal Housing Enterprise Oversight. That rate, adjusted for inflation, was 3.7 percent for the 1975 to 2005 period.

<sup>4</sup>The area per employee for office, retail, and other employment was calculated by comparing the floor area of new development with employment growth that occurred in the Washington, DC region between 1990 and 2000. Those figures were obtained from MWCOG's Commercial Construction Indicators, 2003. Area per employee for industrial space was obtained from Metro-Seattle's 1999 Employment Density Study. Examples of other employment include workers in gymnasiums, churches, construction yards, and hospitals.

<sup>5</sup>The value of commercial development per square foot in 2005 was based on Delta Associates' recent transactions data. The inflation adjusted compound annual growth rate in Class A office building sales from 1997 to 2004 in the District of Columbia, which was 3.7%, was used as a proxy for appreciation rates of commercial property.

For commercial development, the employment projected to occur in the baseline scenario was first translated into floor area using the following assumptions regarding area per employee:

- Office employees: 300 square feet per employee
- Retail employees: 400 square feet per employee
- Industrial employees: 900 square feet per employee
- Other employees: 1,000 square feet per employee<sup>4</sup>

Then, the estimated commercial area was multiplied by development value per square foot to determine the total commercial development value in the baseline scenario. The commercial value per square foot was assumed to be \$400 in 2005 and was increased at a rate of 3.7 percent annually<sup>5</sup>. The average commercial development value per square foot for selected years is displayed in Table D-1.

Table D-2 illustrates the calculations used to determine the residential and commercial development by TAZ. The table uses TAZ 131 data from the Georgia Avenue segment as an example. TAZ 131 is located just west of the Petworth Metro Station.

The total value of residential and commercial development in the baseline scenario for each segment in the proposed 2005 transit network was calculated for each TAZ and aggregated by premium transit corridor. Table D-3 displays the estimated values for selected years.

## Estimating the Value of Increased Development Attributable to Streetcar transit in the 2005 DC Transit Alternatives Analysis

For the 2005 study AECOM interviewed a number of real estate developers active in the District of Columbia. Recent projects by these developers included large-scale commercial development, mixed-use, and residential condominium and apartment complexes. Based on the interview findings, the study assumed that, in general,

residential and commercial development volumes would be 25 percent higher within one quarter mile of streetcar lines. However, the developers also indicated certain areas of the District that would not likely experience any increased development in response to investment in streetcar transit. Therefore, when calculating the value of increased development attributable to streetcar transit, the incremental increases in development volume of 25 percent for the streetcar alternative were only applied to selected TAZs.

**Table D-2: An example of the Calculations to Determine Baseline Residential Development Value Using TAZ 131**

Row Number	Household Calculations		Source/Formula
1	Total Households in 2015	1,702	MWCOG
<b>Factor for Adjustment to 1/4 mile</b>			
2	Total Residential Area within 1/4 Mile of Transit Line (Sq. Ft.)*	266,580	DC Office of Planning
3	Total Residential Area within Entire TAZ (Sq. Ft.)	3,022,014	DC Office of Planning
4	Household Factor	8.8%	Row 3 / Row 4
<b>Adjusted Households</b>			
5	Adjusted Households in 2015	150	Row 1 <sup>1</sup> X Row 4
<b>Housing Value</b>			
6	Assumed Value per Unit	\$492,736	AECOM <sup>2</sup>
<b>Total Residential Development Value</b>			
7	Total Residential Value in 2015	\$73,978,478	Row 5 <sup>1</sup> X Row 6
<b>Employment in 2015</b>			
8	Industrial	140	MWCOG
9	Retail	187	MWCOG
10	Office	249	MWCOG
11	Other	239	MWCOG
12	Total	815	MWCOG
<b>Factor for Adjustment to 1/4 mile</b>			
13	Total Commercial Area within 1/4 Mile of Transit Line (Sq. Ft.)	1,438,172	DC Office of Planning
14	Total Commercial Area within Entire TAZ (Sq. Ft.)	1,488,430	DC Office of Planning
15	Employment Factor	96.6%	Row 13 / Row 14
<b>Adjusted Employment in 2015</b>			
16	Industrial	135	Row 8 <sup>2</sup> X Row 15
17	Retail	181	Row 9 <sup>2</sup> X Row 15
18	Office	241	Row 10 <sup>2</sup> X Row 15
19	Other	231	Row 11 <sup>2</sup> X Row 15
20	Total	788	Row 12 <sup>2</sup> X Row 15
<b>Assumed Area per Employee (Sq. Ft.)</b>			
21	Industrial	900	AECOM <sup>3</sup>
22	Retail	400	AECOM <sup>4</sup>
23	Office	300	AECOM <sup>4</sup>
24	Other	1,000	AECOM <sup>4</sup>
<b>Estimated Total Commercial Area (Sq. Ft.)</b>			
25	Industrial	121,749	Row 16 <sup>3</sup> X Row 21
26	Retail	72,276	Row 17 <sup>3</sup> X Row 22
27	Office	72,180	Row 18 <sup>3</sup> X Row 23
28	Other	230,937	Row 19 <sup>3</sup> X Row 24
<b>Assumed Commercial Value per Square Foot</b>			
29	Commercial Value per Square foot in 2015	\$574.27	AECOM <sup>5</sup>
<b>Total Commercial Development Value</b>			
30	Industrial	\$69,916,555	Row 25 <sup>3</sup> X Row 29
31	Retail	\$41,506,019	Row 26 <sup>3</sup> X Row 29
32	Office	\$41,450,529	Row 27 <sup>3</sup> X Row 29
33	Other	\$132,619,498	Row 28 <sup>3</sup> X Row 29
34	Total Commercial Development Value in 2015	<b>\$285,492,602</b>	Sum of Rows 30 to 34

Notes:

<sup>1</sup>Area includes land use associated with high- and medium-density only.

<sup>2</sup>Sources also include Delta Associates and Census Bureau.

<sup>3</sup>Source also includes Metro-Seattle's 1999 Employment Density Study.

<sup>4</sup>Sources also include MWCOG's Commercial Construction Indicators, 2003.

<sup>5</sup>Sources also include MWCOG and Delta Associates.

Figure D-3 displays the areas that were considered eligible for increased development.

Using the information obtained from the survey, the total residential and commercial development attributable to investment in streetcar transit was calculated for each TAZ for the streetcar alternative. Those figures were calculated by first determining the residential and commercial development that was expected to occur from 2015 to 2030 in the baseline scenario and multiplying those figures by a 25 percent increment for streetcar alternatives in all TAZs considered eligible for increased development. That resulted in the total residential and commercial development that would be attributable to streetcar transit for the entire 2015 to 2030 period. Those figures were then multiplied by an assumed value to determine the total development value attributable to streetcar transit. Table D-4 displays the estimated cumulative value of residential and commercial development attributable to streetcar transit for the streetcar alternatives.

### Estimating the Number of Parking Spaces in the Baseline Scenario and the Increase in Parking that is Attributable to Streetcar Transit in the 2005 DC Transit Alternatives Analysis

The baseline number of parking spaces was determined for both residential and commercial development, based on residential and commercial development volumes and District of Columbia municipal parking regulations. Table D-5 summarizes assumptions regarding the parking regulations that were applied in this analysis.

The total number of parking spaces associated with the residential and commercial development within one quarter mile of the streetcar lines was calculated by multiplying the assumed residential and commercial development in the baseline scenario by the appropriate parking assumptions reported in Table D-5. Those figures, which were calculated for each TAZ and aggregated by corridor, are displayed for selected years in Table D-6.

Calculating the increase in parking attributable to streetcar transit was similarly conducted by multiplying the assumed residential and commercial development attributable to streetcar transit by the parking assumptions displayed in Table D-5. Those figures were calculated for the streetcar alternative and are displayed in Table D-7.

### Applying results of the 2005 DC Transit Alternatives Analysis

Some segments and corridors studied in the 2005 DC Transit Alternatives Analysis differ from the segments now proposed in the 2010 System Plan. In lieu of a new study of the projected residential and commercial development in the proposed streetcar corridors, the 2005 study findings were applied to the 2010 recommended network. Projected baseline and streetcar alternative real estate values and parking spaces were estimated for each segment of the proposed 2010 streetcar network by applying projected values for the equivalent 2005 segments, pro-rating to adjust for any changes in segment length. Segments that were not included in the 2005 study that have since been added to the proposed network applied the projected real estate values and parking spaces from a 2005 proxy segment deemed to be similar in nature and development

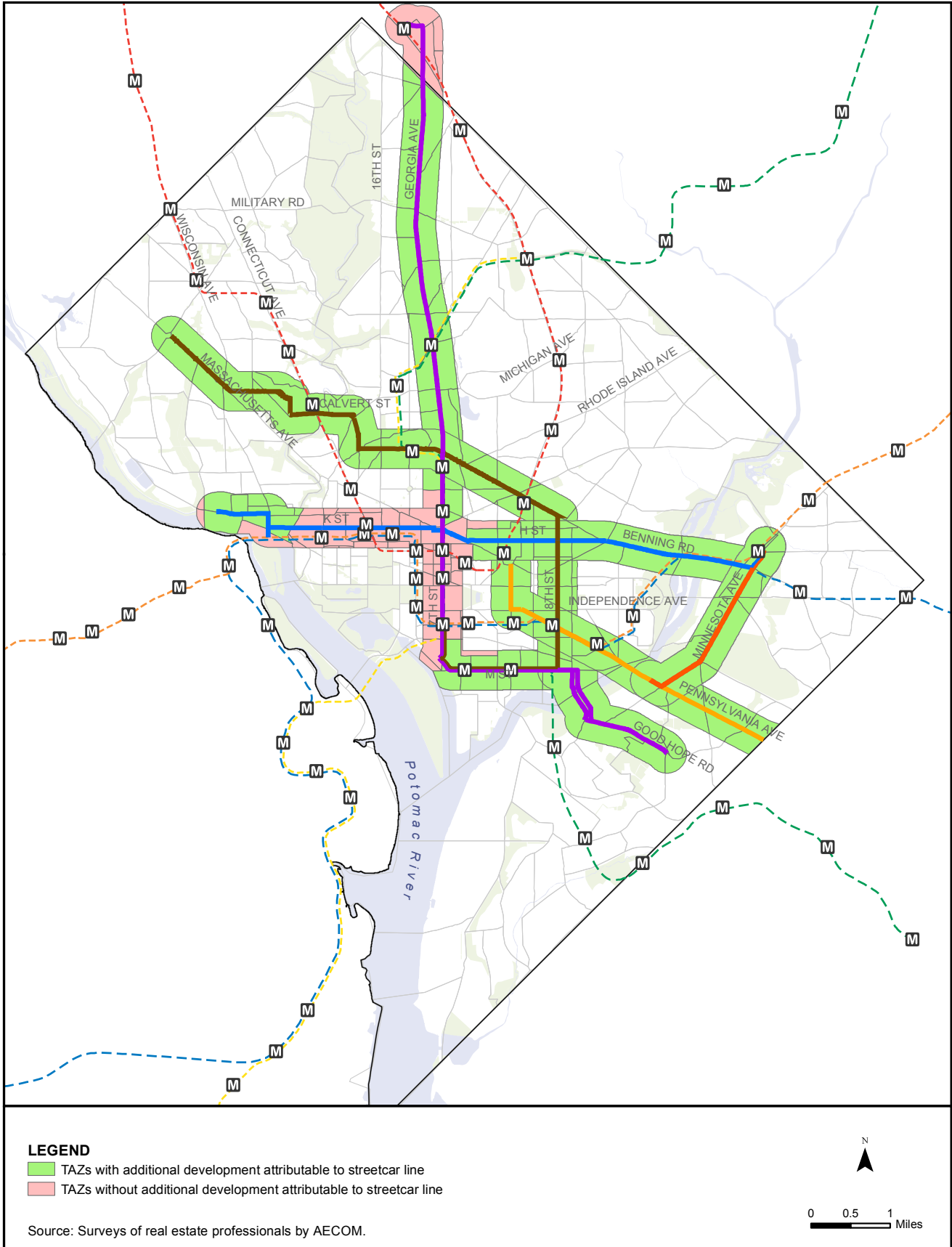
**Table D-3: Residential and Commercial Development Value along Streetcar Corridors in the 2005 DC Transit Alternatives Analysis Baseline Scenario**

Corridor	2015	2020	2025	2030
<b>Baseline Residential Development Value</b>				
Silver Spring to Skyland	\$7,252,236,663	\$8,791,804,072	\$10,658,804,987	\$12,786,506,698
Anacostia Streetcar Extension	\$179,791,467	\$219,765,015	\$268,714,682	\$322,355,281
American Univ. to L'Enfant Plaza	\$7,975,966,981	\$9,708,992,218	\$11,818,966,699	\$14,178,258,918
Georgetown to Minnesota Ave	\$5,701,431,294	\$6,917,722,817	\$8,395,215,822	\$10,071,061,763
Union Station to Forestville	\$125,049,779	\$152,482,586	\$185,884,669	\$222,990,811
<b>Total*</b>	<b>\$12,717,419,261</b>	<b>\$16,162,939,973</b>	<b>\$19,649,984,938</b>	<b>\$23,635,281,952</b>
<b>Baseline Commercial Development Value</b>				
Silver Spring to Skyland	\$49,806,036,051	\$63,553,297,770	\$81,525,748,659	\$97,683,638,798
Anacostia Streetcar Extension	\$1,609,726,859	\$1,977,549,707	\$2,369,487,610	\$2,839,105,137
American Univ. to L'Enfant Plza	\$36,697,298,331	\$46,218,657,642	\$58,919,715,636	\$70,597,232,347
Georgetown to Minnesota Ave	\$74,453,909,487	\$92,365,825,220	\$113,694,939,259	\$136,228,560,455
Union Station to Forestville	\$9,054,867,690	\$11,321,207,911	\$13,895,689,020	\$16,649,727,103
<b>Total*</b>	<b>\$128,967,161,292</b>	<b>\$161,123,996,379</b>	<b>\$200,471,457,804</b>	<b>\$241,983,629,978</b>

\* The total development value does not equal the sum of the values for the individual streetcar lines, because some development areas were included in more than one corridor where streetcar lines intersected. The total also assumes that the Georgetown to Minnesota Ave Metro Station line includes the Lower K Street alternative.

Source: MWCOG, Delta Associates, and AECOM.

Figure D-3: TAZs Expected to Experience Increased Development in the 2005 DC Transit Alternatives Analysis



**Table D-4: Cumulative Value of Development Attributable to Streetcar Investment in the 2005 DC Transit Alternatives Analysis Streetcar Alternative**

	2015	2020	2025	2030
<b>Value of Residential Development Attributable to Streetcar Transit</b>				
Silver Spring to Skyland	\$76,360,153	\$110,490,485	\$155,510,082	\$186,552,874
Anacostia Streetcar Extension	\$753,759	\$1,888,661	\$3,490,363	\$4,187,106
American Univ. to L'Enfant Plaza	\$75,587,363	\$119,003,784	\$177,323,339	\$212,720,476
Georgetown to Minnesota Ave.	\$7,585,753	\$17,377,269	\$31,117,376	\$37,329,001
Union Station to Forestville	\$1,096,459	\$1,910,874	\$3,006,746	\$3,606,950
<b>Total*</b>	<b>\$87,109,648</b>	<b>\$145,085,669</b>	<b>\$223,679,542</b>	<b>\$268,330,264</b>
<b>Value of Commercial Development Attributable to Streetcar Transit</b>				
Silver Spring to Skyland	\$142,161,350	\$635,800,883	\$1,409,099,340	\$1,688,373,959
Anacostia Streetcar Extension	\$1,516,851	\$13,580,586	\$16,272,173	\$19,497,215
American Univ. to L'Enfant Plaza	\$140,640,431	\$710,598,747	\$1,705,197,986	\$2,043,157,492
Georgetown to Minnesota Ave.	\$69,640,343	\$470,072,339	\$802,495,721	\$961,545,321
Union Station to Forestville	\$13,220,736	\$133,338,917	\$244,080,033	\$292,455,159
<b>Total*</b>	<b>\$245,087,720</b>	<b>\$1,435,729,714</b>	<b>\$2,975,250,246</b>	<b>\$3,564,926,114</b>

\* The total development value does not equal the sum of the values for the individual streetcar lines, because some development areas were included in more than one corridor where streetcar lines intersected. The total also assumes that the Georgetown to Minnesota Ave Metro Station line includes the Lower K Street alternative.  
Source: MWCOG, Delta Associates, and AECOM.

**Table D-5: Summary of Parking Assumptions Applied in Analysis**

Development Type	Proxy Category in Parking Regulations	Assumed Parking Provision	Note
Residential	Average of 4 residential categories	1 space per 2.5 units	Required provision ranges from 1 space per unit to one space per 4 units. Analysis assumes 1 space per 2.5 units.
Industrial	Manufacturing, Industrial, and Wholesale	1 space per 1,000 sf.	Extracted directly from municipal parking regulations.
Retail	Retail or Service Except Gas	1 space per 750 sf.	Analysis assumes area was in C-1, C-2-A, C-3-A, C-M-1, or M district.
Office	General Office	1 space per 650 sf.	Analysis assumes area was in C-1, C-2-A, or C-3-A district.
Other	Warehouse	1 space per 3,000 sf.	Because "Other employment" includes a wide variety of employment, an appropriate proxy was unavailable. Warehouse regulations were selected as a conservative estimate.

Source: DC Office of Documents and Administrative Issuances and AECOM.

**Table D-6: Residential and Commercial Parking Spaces along Streetcar transit Corridors in the 2005 DC Transit Alternatives Analysis Baseline Scenario**

	2015	2020	2025	2030
<b>Baseline Residential Parking Spaces</b>				
Silver Spring to Skyland	5,887	5,949	6,013	6,013
Anacostia Streetcar Extension	146	149	152	152
American Univ. to L'Enfant Plaza	6,475	6,570	6,667	6,667
Georgetown to Minnesota Ave.	4,628	4,681	4,736	4,736
Union Station to Forestville	102	103	105	105
<b>Total*</b>	<b>11,003</b>	<b>11,149</b>	<b>11,298</b>	<b>11,298</b>
<b>Baseline Commercial Parking Spaces</b>				
Silver Spring to Skyland	88,853	94,927	102,096	102,096
Anacostia Streetcar Extension	1,774	1,807	1,807	1,807
American Univ. to L'Enfant Plaza	58,089	60,999	65,175	65,175
Georgetown to Minnesota Ave.	133,474	138,062	142,154	142,154
Union Station to Forestville	13,405	13,958	14,380	14,380
<b>Total*</b>	<b>227,319</b>	<b>236,328</b>	<b>246,076</b>	<b>246,076</b>

\* The total development value does not equal the sum of the values for the individual streetcar lines, because some development areas were included in more than one corridor where streetcar lines intersected. The total also assumes that the Georgetown to Minnesota Ave Metro Station line includes the Lower K Street alternative.

Source: MWCOG, DC Office of Documents and Administrative Issuances, and AECOM.



potential to the additional corridor. For example, Rhode Island Avenue has been added to the proposed streetcar network since the 2005 study; the projected values from the 2005 Georgia segment were applied as a proxy.

Projected real estate values have not been adjusted from the 2005 study. As noted in Section 3 above, that study assumed that real estate would grow at an inflation adjusted rate of 3.7 percent, consistent with DC historical experience from 1975 to 2005. Despite the recent economic downturn, DC real estate values since 2005 have grown at an inflation adjusted average annual rate of 8.5 percent<sup>6</sup>,

which is greater than the 3.7 percent assumed in the previous study. However, as a conservative measure, the historical annual average growth rate of 3.7 percent is maintained from 2005 onward.

The total projected baseline and streetcar-induced commercial and residential real estate values and parking spaces applied in the updated analysis are summarized below.

These projections are multiplied by the real estate tax rates and parking fees summarized in the project finance chapter to calculate value capture and parking fee revenue.

**Table D-7: Cumulative Increase in Parking Spaces Attributable to Streetcar Investment in the 2005 DC Transit Alternatives Analysis Streetcar Alternative**

	2015	2020	2025	2030
<b>Residential Parking Spaces Attributable to Streetcar Transit</b>				
Silver Spring to Skyland	66	398	731	1,063
Anacostia Streetcar Extension	2	10	17	25
American Univ. to L'Enfant Plaza	71	429	786	1,143
Georgetown to Minnesota Ave.	51	309	566	824
Union Station to Forestville	1	7	12	18
<b>Total*</b>	<b>78</b>	<b>470</b>	<b>862</b>	<b>1,254</b>
<b>Commercial Parking Spaces Attributable to Streetcar Transit</b>				
Silver Spring to Skyland	349	2,096	3,842	5,589
Anacostia Streetcar Extension	3	20	37	54
American Univ. to L'Enfant Plaza	211	1,263	2,316	3,368
Georgetown to Minnesota Ave.	320	1,919	3,518	5,117
Union Station to Forestville	33	197	362	526
<b>Total*</b>	<b>395</b>	<b>2,369</b>	<b>4,344</b>	<b>6,318</b>

\*The total development value does not equal the sum of the values for the individual streetcar lines, because some development areas were included in more than one corridor where streetcar lines intersected. The total also assumes that the Georgetown to Minnesota Ave Metro Station line includes the Lower K Street alternative.

Source: MWCOG, DC Office of Documents and Administrative Issuances, and AECOM.

**Table D-8: Projected Real Estate Values and Parking Space Provision Applied in 2010 Analysis**

	2015	2020	2025	2030
<b>Real Estate Values (Millions of Dollars)</b>				
Baseline Residential	\$19,665	\$23,677	\$29,008	\$35,849
Residential Attributable to Streetcar	\$0	\$60	\$72	\$89
<b>Total Residential</b>	<b>\$19,665</b>	<b>\$23,737</b>	<b>\$29,080</b>	<b>\$35,938</b>
Baseline Commercial	\$177,532	\$210,995	\$252,079	\$290,933
Commercial Attributable to Streetcar	\$0	\$205	\$232	\$266
<b>Total Commercial</b>	<b>\$177,532</b>	<b>\$211,200</b>	<b>\$252,311</b>	<b>\$291,199</b>
<b>Total</b>	<b>\$197,197</b>	<b>\$234,937</b>	<b>\$281,392</b>	<b>\$327,136</b>
<b>Parking Space Provision (Number of Spaces)</b>				
Baseline Residential	14,900	15,047	15,196	15,196
Residential Attributable to Streetcar	0	29	35	40
<b>Total Residential</b>	<b>14,900</b>	<b>15,076</b>	<b>15,231</b>	<b>15,236</b>
Baseline Commercial	314,480	325,680	338,222	338,222
Commercial Attributable to Streetcar	0	241	253	260
<b>Total Commercial</b>	<b>314,480</b>	<b>325,921</b>	<b>338,475</b>	<b>338,482</b>
<b>Total</b>	<b>329,380</b>	<b>340,997</b>	<b>353,706</b>	<b>353,718</b>

<sup>6</sup> District of Columbia Office of Tax and Revenue, Real Property Tax Assessments, 2005 to 2010, adjusted for inflation by the U.S. Bureau of Labor Statistics Washington-Baltimore region 2005 to 2010 Consumer Price Index for All Urban Consumers.