APPENDIX E.

ANALYSIS OF POTENTIAL MULTIMODAL CENTERS IN VIRGINIA

The following describes the methodology used for analyzing Potential Multimodal Centers in Virginia. This work was done as part of a contract with the Office of Intermodal Planning and Investment to study statewide accessibility in 2011. The results of that study were also used in the development of the Multimodal System Design Guidelines by classifying the activity density of each of the 319 centers in that study according to the Multimodal Center types (P-1 to P-6) used in the Multimodal System Design Guidelines.

A Potential Multimodal Center, as defined in this study, is a local concentration of population and/or employment. Potential Multimodal Centers throughout Virginia range from the downtowns of large cities to small town centers to concentrations of suburban employment or population. The geography used for testing in this study for Potential Multimodal Centers was a 1-mile wide (diameter) circle. Defining a statewide dataset of activity centers required a flexible methodology and multiple iterations of edits to refine what would become the final set of 319 one-mile diameter activity centers. Rather than only including the centers with the highest concentrations of population and jobs in the Commonwealth, it was decided to distribute the centers geographically and include all counties in the State, numerous villages, small towns and large cities, in order to span the full range of rural, suburban, and urban contexts in Virginia. What they share in common is a relative concentration of people and jobs, compared with their surrounding areas, suggesting their historic
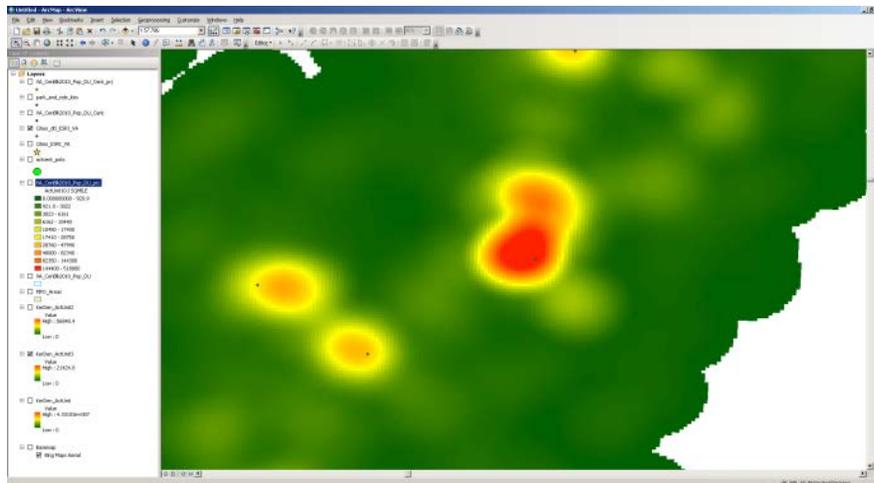
 significance relative to their surrounding area or surrounding region.

To define activity centers, the first thing that was needed was an understanding of the spatial distribution of activity in the Commonwealth. For the purpose of this study, the definition of activity was the sum of population and jobs in an area. This was analyzed in several ways.

- First, ArcGIS was used to calculate the kernel density of jobs and population across the state. This resulted in a continuous surface of job or population density, interpolated from Census block centroids. From this, high activity values can be shown by themselves, making these "hotspots" readily apparent (see the "heat map" of activity density below).

- A cross check on this method of analyzing activity density was to use the density of the Census blocks themselves, color-coded to represent the level of density in each block. An industry-standard way to describe the density of a built environment is by use of a "Transect," which categorizes the spectrum of density from very rural (T1) to very urban (T6).

- A final way to verify activity centers was through the use of aerial imagery. Aerial imagery was overlaid with the previously described activity 'heat maps' to verify and confirm the specific center of density in each activity center.

After using this methodology for identifying potential activity centers, the next step was to compare it to Census data on major cities and Census Designated Places (CDP - both of which were layers available from the US Census) as starting points for identifying activity centers. Centroids were created from the CDP layer, as it was originally a polygon layer describing the CDP boundaries. These layers included a total of 452 points, some of which were located in centers of activity density, although most were not. The locations of these points were manually adjusted so that they were brought in alignment with the clusters of activity density. There were several criteria used for relocating these points:

- Maximize activity density (place the centroid so that it captures the maximum amount of activity units)

- If possible, place the point on a major street or intersection

- Do not move the centroid out of its boundary (either CDP or municipal boundary)

This methodology provided an initial set of candidate activity centers. Centers were also located in activity rich areas, like major commercial districts, universities, and Metro Rail stations in northern Virginia. Basic metrics for this first set of candidate activity centers were calculated to aid in the selection process, which was necessary due to the overrepresentation of activity-poor areas. This was particularly evident among the CDPs, an analysis of which showed that just because they are designated as a "place" does not mean that they are a center of activity.

As noted above, there were many small towns initially considered as potential activity centers due to their designation as CDPs. However, CDPs accounted for about 89 percent of the centers tagged for deletion in this round. During the deletion process, the geographic representation of the activity centers was paramount. If a center was the only one in a county or large area, it was kept as part of the activity center set. Also during this stage, centers were thinned out where there was excessive overlap. This was especially the case along some Metro Rail transit corridors as shown in the two images below – the one on the left before the deletion process and the one on the right after the deletion process.

Other centers were added or moved based on further analysis of aerial imagery, especially to identify suburban activity centers, where identifying distinct central locations can be difficult.

Data Used

The following is a listing of primary data sources used in this analysis:

- **Population.** US Census Blocks [1], with SF1 Summary data for population.
- **Employmen**t. US Census LED On the Map Tool[2], obtained statewide employment at the Census Block level for 2010, downloaded in March 2012.

A Summary table of the activity density by Multimodal Center type is shown on the following pages.

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1 U.S. Census Bureau 2010 TIGER/Line® Shapefiles. http://www.census.gov/cgi-bin/geo/shapefiles2010/main
2 U.S. Census Bureau. 2012. OnTheMap Application. Longitudinal-Employer Household Dynamics Program. http://onthemap.ces.census.gov/

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Tysons West	55,013	109.7	P6
Richmond	54,640	108.9	P6
Richmond South of River	54,640	108.9	P6
Rosslyn	44,791	89.3	P6
Backlick & Edsall	42,426	84.6	P6
Ballston - MU	42,372	84.5	P6
Norfolk	37,772	82.3	P6
Pentagon City/Crystal City	37,475	74.7	P6
Alexandria	27,176	54.2	P5
Reston Parkway	26,412	52.6	P5
Reston South Lakes	26,412	52.6	P5
Reston Lake Anne	26,412	52.6	P5
Clarendon	20,012	39.9	P5
Bailey's Crossroads	19,673	39.2	P5
Alexandria West	19,045	38.0	P5
University of Virginia	17,763	35.4	P5
Hampton	14,787	33.9	P5
Lake Monticello	16,134	33.3	P4
Tysons East	16,692	33.3	P4
Merrifield	16,645	33.2	P4
Herndon-Monroe	16,434	32.8	P4
Chantilly	16,297	32.5	P4
Richmond West	16,291	32.5	P4
Charlottesville	16,134	32.2	P4
Roanoke	15,953	31.8	P4
Van Dorn Street	15,319	30.5	P4
Chesterfield Court House	15,311	30.5	P4
Fair Oaks East	15,147	30.2	P4
Fair Oaks South	15,147	30.2	P4
Fairfax	15,043	30.0	P4
George Mason University	15,043	30.0	P4
Idylwood	14,313	28.5	P4
Lincolnia	14,224	28.4	P4
Fan District	13,408	26.7	P4
King St/Eisenhower Ave	13,326	26.6	P4
Staples Mill Rd	13,095	26.1	P4
Lynnhaven	13,085	26.1	P4
Hybla Valley	12,728	25.4	P4
Falls Church	12,715	25.3	P4
Alexandria Old Town North	11,587	25.3	P4
istopher Newport University	12,589	25.1	P4

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Fair Oaks	12,578	25.1	P4
Chesapeake Great Bridge	12,559	25.0	P4
Columbia Pike	12,492	24.9	P4
Portsmouth Downtown	12,320	24.6	P4
Shirlington	12,145	24.2	P4
Lake Barcroft	11,727	23.4	P4
Alexandria North	11,587	23.1	P4
Manassas	11,542	23.0	P4
Bull Run	11,488	22.9	P4
Virginia Beach Town Center	11,322	22.6	P4
Seven Corners	10,719	21.4	P4
McLean	10,639	21.2	P4
Cox Rd & Nuckols Rd	10,616	21.2	P4
Wiehle Avenue	10,473	20.9	P4
Williamsburg	10,016	20.0	P4
Winchester	10,005	19.9	P4
Annandale	9,622	19.2	P4
Norfolk North Downtown	9,519	19.0	P4
Old Dominion University	9,519	19.0	P4
Chippenham	9,499	18.9	P4
Diamond Springs & Wesleyan	9,414	18.8	P4
Jefferson	9,204	18.3	P4
Harrisonburg	9,101	18.1	P4
James Madison University	9,101	18.1	P4
Vienna/Fairfax - GMU	9,072	18.1	P4
Centreville	9,019	18.0	P4
Newport News	8,983	17.9	P4
Route 28	8,641	17.2	P4
Chantilly East	8,615	17.2	P4
Virginia Beach Greenwich	8,607	17.1	P4
Thomas Corner	8,607	17.1	P4
Laurel	8,325	16.6	P4
Radford University	8,250	16.4	P4
Chesapeake Greenbriar	8,251	16.4	P4
Mount Vernon	7,993	15.9	P4
Farmville	7,873	15.7	P4
Warrenton	7,817	15.6	P4
Franconia	7,811	15.6	P4
Danville	7,767	15.5	P4
Burke	7,740	15.4	P4
Lynchburg	7,678	15.4	P4
Sherwood Forest	7,689	15.3	P4
Marumsco Woods	7,677	15.3	P4
Leesburg	7,671	15.3	P4

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Leesburg Fort Evans	7,671	15.3	P4
Loch Lomond	7,441	14.8	P4
Portsmouth West	7,412	14.8	P4
Broad Street & Pemberton	7,366	14.7	P4
Fredericksburg	7,362	14.7	P4
Springfield	7,361	14.7	P4
S Sterling Blvd	7,350	14.7	P4
Acredale	7,300	14.5	P4
Blacksburg	7,252	14.5	P4
West Gate	7,242	14.4	P4
Newington	7,177	14.3	P4
Manassas Park	7,152	14.3	P4
Suffolk	7,087	14.1	P4
Peninsula Town Center	7,077	14.1	P4
Port of Newport News	6,917	14.0	P4
Bristol	6,961	13.9	P4
Newport News Shipyard	6,917	13.8	P4
Level Green	6,903	13.8	P4
Sudley	6,846	13.6	P3
Staunton	6,713	13.4	P3
Occoquan	6,659	13.3	P3
Vienna	6,609	13.2	P3
Groveton	6,551	13.1	P3
Ashburn	6,461	12.9	P3
Midlothian	6,430	12.8	P3
Hodges Manor	6,299	12.5	P3
Salem	6,251	12.5	P3
Lexington	6,236	12.4	P3
Tuckahoe	6,190	12.3	P3
Christiansburg	6,161	12.3	P3
Woodbridge	6,120	12.2	P3
Virginia Beach	6,038	12.0	P3
Quantico Station	5,517	12.0	P3
West Springfield	6,009	12.0	P3
Cascades	5,944	11.8	P3
Dulles Town Center	5,944	11.8	P3
Lake Ridge	5,697	11.4	P3
Gayton Centre	5,683	11.3	P3
Ashburn Farm & Claiborne	5,643	11.2	P3
Broad Street & 64	5,594	11.2	P3
University of Richmond	5,594	11.2	P3
Dumbarton	5,594	11.2	P3
Dumfries	5,517	11.0	P3
North Springfield	5,406	10.8	P3

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Bloxoms Corner	5,407	10.8	P3
Front Royal	5,358	10.7	P3
Woodfield & Laurelwood	5,298	10.6	P3
Petersburg	5,272	10.5	P3
Fort Belvoir	5,244	10.5	P3
Lorton	5,244	10.5	P3
Hopewell	4,946	10.4	P3
and Rd & Independence Blvd	5,187	10.3	P3
Bedford	5,175	10.3	P3
Herndon	5,133	10.2	P3
Waynesboro	5,074	10.1	P3
Cave Spring	5,068	10.1	P3
Marion	5,060	10.1	P3
East Falls Church	5,019	10.0	P3
Dale City	4,999	10.0	P3
Spring Knoll Plaza	4,981	9.9	P3
Radford	4,859	9.7	P3
Ettrick	4,828	9.6	P3
Ashland	4,812	9.6	P3
Yorkshire	4,665	9.3	P3
Haymarket	4,613	9.2	P3
Vinton	4,583	9.1	P3
Five Mile Fork	4,574	9.1	P3
Culpeper	4,559	9.1	P3
Belle Haven	4,558	9.1	P3
Montrose	4,402	8.8	P3
Loxley Gardens	4,398	8.8	P3
Industrial Complex	4,393	8.8	P3
Galax	4,316	8.6	P3
Oakton	4,268	8.5	P3
Wise	4,196	8.4	P3
Colonial Heights	4,132	8.2	P3
Purcellville	4,125	8.2	P3
Round Hill	4,125	8.2	P3
Smithfield	3,720	8.2	P3
Martinsville	4,074	8.1	P3
Aquia Harbour	4,070	8.1	P3
Mechanicsville	4,065	8.1	P3
Grundy	3,995	8.0	P3
Berryville	3,956	7.9	P3
Highland Springs	3,952	7.9	P3
Emporia	3,954	7.9	P3
Linton Hall	3,926	7.8	P3

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Pulaski	3,880	7.7	P3
Dunn Loring	3,825	7.6	P3
Rose Hill Dr	3,824	7.6	P3
Richlands	3,825	7.6	P3
Woodstock	3,776	7.5	P3
Lakeside	3,768	7.5	P3
Norton	3,741	7.5	P3
Short Pump	3,679	7.3	P3
Elkton	3,515	7.0	P3
Stephens City	3,510	7.0	P3
Hollymead	3,427	6.8	P3
Albemarle Square	3,427	6.8	P3
Clintwood	3,362	6.7	P3
Abingdon	3,356	6.7	P3
East Highland Park	3,345	6.7	P3
Covington	3,331	6.6	P3
Gloucester Courthouse	3,203	6.4	P2
Glen Allen	3,126	6.2	P2
Fort Hunt	3,121	6.2	P2
Route 772	3,043	6.1	P2
Wytheville	2,996	6.0	P2
West Falls Church -VT/UVA	2,968	5.9	P2
Jonesville	2,947	5.9	P2
Timberville	2,920	5.8	P2
Bridgewater	2,859	5.7	P2
Franklin	2,859	5.7	P2
Bensley	2,841	5.7	P2
Wyndham	2,824	5.6	P2
Broadway	2,705	5.4	P2
Bon Air	2,671	5.3	P2
Hillsville	2,643	5.3	P2
Buena Vista	2,589	5.2	P2
Montclair	2,417	5.0	P2
Bealeton	2,457	4.9	P2
Gate City	2,433	4.8	P2
Orange	2,428	4.8	P2
Appomattox	2,421	4.8	P2
Roanoke Mall	2,389	4.8	P2
Hollins	2,389	4.8	P2
Fort Lee	2,370	4.7	P2
Luray	2,362	4.7	P2
Sandston	2,342	4.7	P2
Monticello Marketplace	2,300	4.6	P2
Clifton Forge	2,238	4.5	P2

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Lebanon	2,219	4.4	P2
Halifax	2,217	4.4	P2
Lawrenceville	2,183	4.3	P2
Strasburg	2,176	4.3	P2
South Hill	2,159	4.3	P2
Stuart	2,120	4.2	P2
Verona	2,100	4.2	P2
Bluefield	2,069	4.1	P2
Grafton Village	2,063	4.1	P2
Falmouth	2,063	4.1	P2
South Boston	2,057	4.1	P2
Shenandoah	1,973	3.9	P2
Grottoes	1,956	3.9	P2
Mantua	1,948	3.9	P2
Fishersville	1,947	3.9	P2
Timberlake	1,942	3.9	P2
Gloucester Point	1,896	3.9	P2
Accomac	1,914	3.8	P2
Colonial Beach	1,827	3.8	P2
Tappahannock	1,522	3.7	P2
Dublin	1,803	3.6	P2
Chase City	1,797	3.6	P2
Chamberlayne	1,752	3.5	P2
Big Stone Gap	1,726	3.4	P2
Gordonsville	1,701	3.4	P2
Bowling Green	1,698	3.4	P2
Glasgow	1,688	3.4	P2
Waverly	1,679	3.3	P2
Blackstone	1,673	3.3	P2
Madison Heights	1,671	3.3	P2
Lovettsville	1,662	3.3	P2
Chester	1,652	3.3	P2
Coeburn	1,607	3.2	P2
Crewe	1,572	3.1	P2
Cloverdale	1,570	3.1	P2
Mount Crawford	1,553	3.1	P2
Marshall	1,505	3.0	P2
Altavista	1,491	3.0	P2
Floyd	1,474	2.9	P2
West Point	1,215	2.9	P2
Kilmarnock	1,452	2.9	P2
Amherst	1,397	2.8	P2
Tazewell	1,382	2.8	P2
Chatham	1,376	2.7	P2

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Pearisburg	1,320	2.6	P2
Narrows	1,320	2.6	P2
Gretna	1,318	2.6	P2
Dahlgren	1,148	2.5	P2
Exmore	1,265	2.5	P2
Chincoteague	1,240	2.5	P2
Collinsville	1,235	2.5	P2
Pennington Gap	1,233	2.5	P2
Goochland	1,193	2.4	P2
Woodlawn	1,166	2.3	P2
Louisa	1,164	2.3	P2
Clarksville	991	2.3	P2
Brookwoods Golf Club	1,122	2.2	P2
Victoria	1,112	2.2	P2
New Castle	1,111	2.2	P2
Elliston-Lafayette	1,088	2.2	P2
Cape Charles	948	2.1	P2
Spotsylvania Courthouse	1,036	2.1	P2
Poquoson	1,000	2.0	P1
Madison	980	2.0	P1
Kenbridge	959	1.9	P1
Warsaw	952	1.9	P1
Fincastle	947	1.9	P1
Independence	945	1.9	P1
Powhatan	934	1.9	P1
Boykins	910	1.8	P1
Stanardsville	905	1.8	P1
Crozet	903	1.8	P1
Ferrum College	885	1.8	P1
Rocky Mount	885	1.8	P1
Courtland	881	1.8	P1
Amelia Court House	792	1.6	P1
Urbanna	654	1.5	P1
Yorktown	621	1.4	P1
Keysville	623	1.2	P1
Rustburg	579	1.2	P1
Jarratt	562	1.1	P1
Washington	512	1.0	P1
Scottsville	486	1.0	P1
Surry	475	0.9	P1
McKenney	474	0.9	P1
Mineral	468	0.9	P1
Buchanan	464	0.9	P1
Rose Hill	455	0.9	P1

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Lovingston	452	0.9	P1
Dryden	447	0.9	P1
Ivor	436	0.9	P1
Bland	382	0.8	P1
Forest	369	0.7	P1
Reedville	328	0.7	P1
Port Royal	273	0.7	P1
Monterey	241	0.5	P1
Mathews	236	0.5	P1
Dillwyn	233	0.5	P1
Dendron	193	0.4	P1
Warm Springs	99	0.2	P1
Cumberland	97	0.2	P1
Charles City	63	0.1	P1
King and Queen Courthouse	3	0.0	P1

MULTIMODAL CENTER INTENSITY			
Center Type	Activity Density (Jobs + people/acre)	Gross Development FAR (residenial + non-residential)	Net Development FAR (residenial + non-residential)
P1 Rural or Village Center	2.13 or less	0.03 or less	0.05 or less
P2 Small Town or Suburban Center	2.13 to 6.63	0.03 to 0.10	0.05 to 0.15
P3 Medium Town or Suburban Cente	6.63 to 13.75	0.10 to 0.21	0.15 to 0.3
P4 Large Town or Suburban Center	13.75 to 33.75	0.21 to 0.5	0.3 to 0.8
P5 Urban Center	33.75 to 70.0	0.5 to 1.0	0.8 to 1.6
P6 Urban Core	70.0 or more	1.0 or more	1.6 or more