

Using Value-by-Alpha Maps to Visualize CTPP/ACS Bus Commute Estimate Reliability

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Transportation Mapping & Analysis Session

Today's Discussion

- CTPP and ACS Data Overview
- Estimate Reliability, Sampling Error and MOE, and Coefficient of Variation
- CTPP Flow Data and Bus Commute by Census Tract
- Creating Value-by-Alpha Maps Using ArcMap

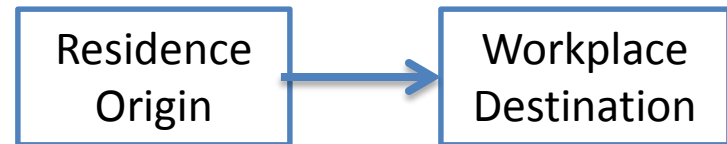
CTPP Data

- Census Transportation Planning Products Data Tabulations (CTPP)
- American Association of State Highway and Transportation Officials (AASHTO)-sponsored and funded by state DOTs and MPOs
- “Designed to help transportation analysts and planners understand where people are commuting to and from, and how they get there.”

CTPP Data

- Data Organization

- Part 1: Residence Tabulations
- Part 2: Workplace Tabulations
- **Part 3: Commuting Flow to Work**



- Commute data with more detailed crosstabs of critical transportation data than standard ACS

- **Means of transportation**
- Number of occupants per vehicle
- Travel time to work and time leaving home
- Demographic information: income, age, presence of children, minority status

ACS Data and 5 Year Estimates

- American Community Survey
 - Previous CTPP data tabulations based on decennial Census long form but that survey replaced by American Community Survey (ACS)
 - Sample of HH, 1 in 40 HH surveyed monthly over 12 months, accumulated and pooled/reported for 1, 3, and 5 year periods (not point in time)
- 5 year estimates
 - Late 2013 first CTPP data based on 5-year ACS data
 - Available from state to neighborhood (census tracts, block groups and blocks, <20k population)
 - 1 in 8 households surveyed over 5 year period (as compared to about 1 in 6 that received the census long form in the 2000 census).
 - Trade-off: low reliability for small areas

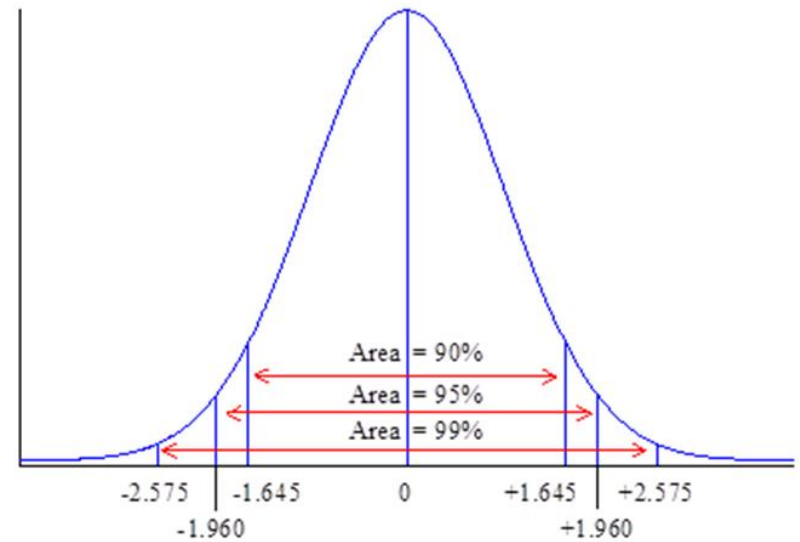
Why does this matter? Data users want to know the statistical reliability and usability of estimates

Estimate Reliability and Sampling Error

- Sampling error/standard error(SE):
The uncertainty or variability associated with an estimate that is based on data gathered from a sample of the population rather than the full population
- 90% confidence level for all published ACS estimates
- Margin of Error (MOE): Measure of the precision of an estimate (+/-) at a given level of confidence

$$\text{MOE} = \text{SE} * 1.645$$

Read: A data user can be 90 percent certain that the sample estimate and the population value differ by no more than the value of the MOE



Coefficient of Variation (CV)

- The relative amount of sampling error associated with a sample estimate
- Ratio of the standard error of the estimate to the estimate: $CV = SE / \text{Estimate} * 100\%$

$$MOE = SE * 1.645$$

$$CV = \frac{\left(\frac{MOE}{1.645} \right)}{ESTIMATE} \times 100$$



Things that May Affect the Estimates from the American Community Survey

Updated February 2013

Accessing CTPP Data

<http://ctpp.transportation.org/Pages/5-Year-Data.aspx>

The screenshot shows the AASHTO website's CTPP section. The header includes the AASHTO logo and navigation links like 'About AASHTO', 'Bookstore', 'Software', 'Meetings', 'Committees', 'Programs', 'Newsroom', and 'Resources'. The main banner reads 'Census Transportation Planning Products'. The '5-Year Data' page contains the following text:

AASHTO > CTPP > 5-Year Data

The CTPP data product based on 2006 – 2010 5-year American Community Survey (ACS) Data is designed to help transportation analysts and planners understand where people are commuting to and from, and how they get there. The information is organized by where workers live, where they work, and by the flow between those places.

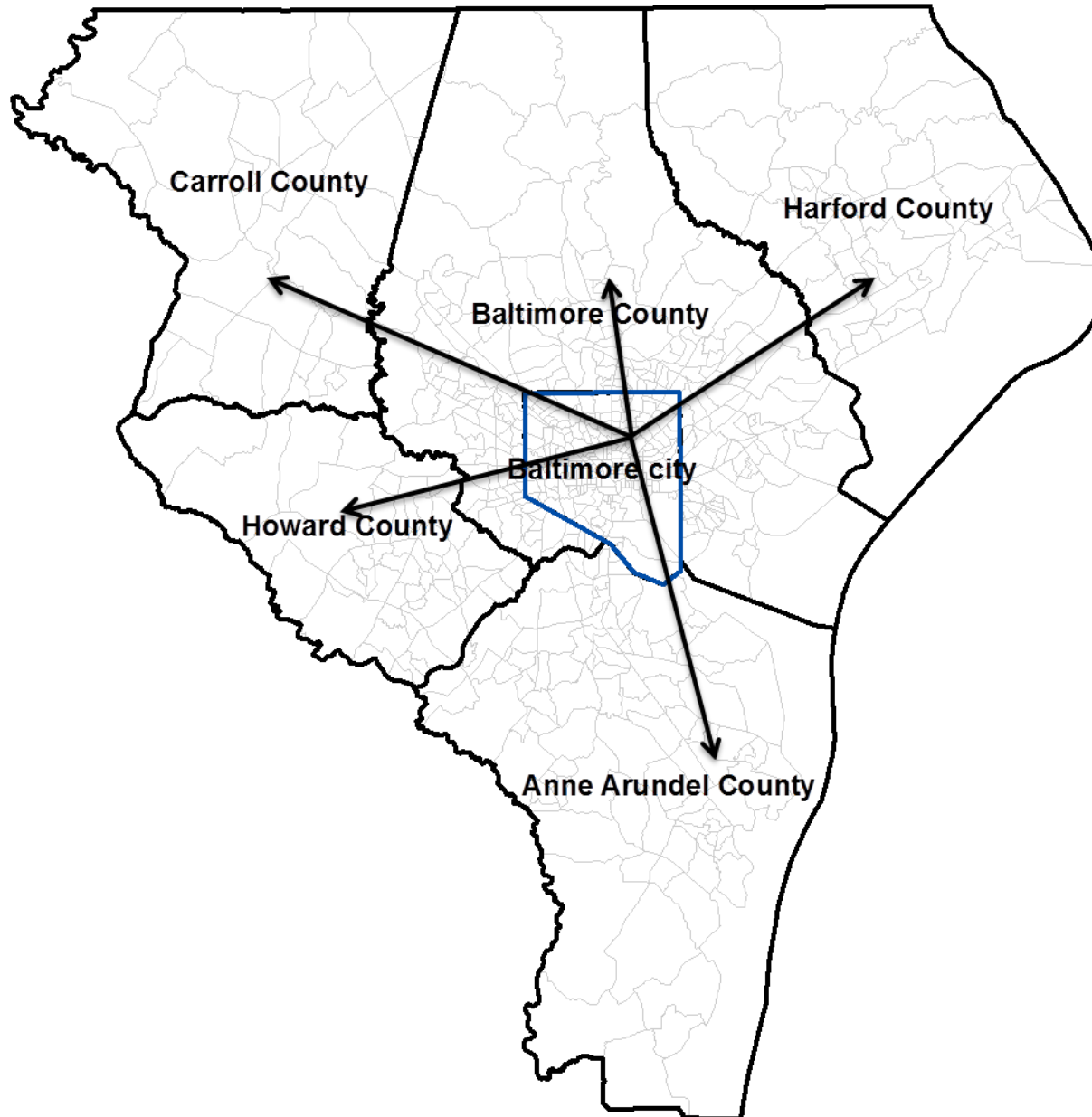
The link below will take you to the CTPP data product based on 2006 – 2010 5-year ACS Data. The CTPP Data Access Software is a powerful tool that allows users to access 250 gigs of data provided to CTPP by the Census Bureau. The Data set consists of about 200 residence based tables, 110 place based tables and 39 flow tables (home to work) for over 325,000 geographies.

Three buttons are visible: 'take me to the data', 'take me to the software tutorial', and 'take me to the movies'. A yellow circle highlights the 'take me to the data' button.

Clicking "take me to the movies" above will take you to the YouTube page where the following tutorials are available:
CTPP Software: open and rearrange a data table

<http://data5.ctpp.transportation.org/ctpp/Browse/browsetables.aspx>

- **State-County-Tract -> State-County-Tract**



File Home Insert Page Layout Formulas Data Review View Developer Add-Ins JMP Acrol SAS Team

Clipboard Font Alignment Number Styles Cells Editing

Calibri 11

General

Insert Delete Format

R22

fx

	A	D	H	I	K	L	N
1	RESIDENCE	WORKPLACE	total	totmoe	bus	busmoe	
2	Census Tract 1001, Baltimore city	Census Tract 1001, Baltimore city,	10	17			
3	Census Tract 1102, Baltimore city	Census Tract 1001, Baltimore city,	85	107			
4	Census Tract 1301, Baltimore city	Census Tract 1001, Baltimore city,	10	19	10	19	
5	Census Tract 1308.04, Baltimore	Census Tract 1001, Baltimore city,	15	26			
6	Census Tract 2001, Baltimore city	Census Tract 1001, Baltimore city,	20	29	20	29	
7	Census Tract 2008, Baltimore city	Census Tract 1001, Baltimore city,	15	28			
8	Census Tract 2602.02, Baltimore	Census Tract 1001, Baltimore city,	10	20			
9	Census Tract 2603.01, Baltimore	Census Tract 1001, Baltimore city,	10	23			
10	Census Tract 2609, Baltimore city	Census Tract 1001, Baltimore city,	4	16			
11	Census Tract 2701.02, Baltimore	Census Tract 1001, Baltimore city,	10	18			
12	Census Tract 2719, Baltimore city	Census Tract 1001, Baltimore city,	20	39			
13	Census Tract 702, Baltimore city,	Census Tract 1001, Baltimore city,	15	22	15	22	
14	Census Tract 909, Baltimore city,	Census Tract 1001, Baltimore city,	15	27			
15	Census Tract 101, Baltimore city,	Census Tract 1002, Baltimore city,	35	57			
16	Census Tract 1202.02, Baltimore	Census Tract 1002, Baltimore city,	15	25			
17	Census Tract 1511, Baltimore city	Census Tract 1002, Baltimore city,	30	47			
18	Census Tract 1512, Baltimore city	Census Tract 1002, Baltimore city,	20	31			
19	Census Tract 2201, Baltimore city	Census Tract 1002, Baltimore city,	25	47			
20	Census Tract 2604.01, Baltimore	Census Tract 1002, Baltimore city,	35	54			
21	Census Tract 2701.02, Baltimore	Census Tract 1002, Baltimore city,	10	28	10	28	
22	Census Tract 2702, Baltimore city	Census Tract 1002, Baltimore city,	15	23			
23	Census Tract 2703.02, Baltimore	Census Tract 1002, Baltimore city,	10	18			
24	Census Tract 2704.01, Baltimore	Census Tract 1002, Baltimore city,	10	20			
25	Census Tract 2704.02, Baltimore	Census Tract 1002, Baltimore city,	45	60			
26	Census Tract 2705.02, Baltimore	Census Tract 1002, Baltimore city,	25	26			
27	Census Tract 2706, Baltimore city	Census Tract 1002, Baltimore city,	20	37			
28	Census Tract 2707.01, Baltimore	Census Tract 1002, Baltimore city,	10	15			

ESRITtoT

Ready



80%

Manipulating Data to Calculate CV

- Appendix 3
- Margin of Error for Aggregated Count Data

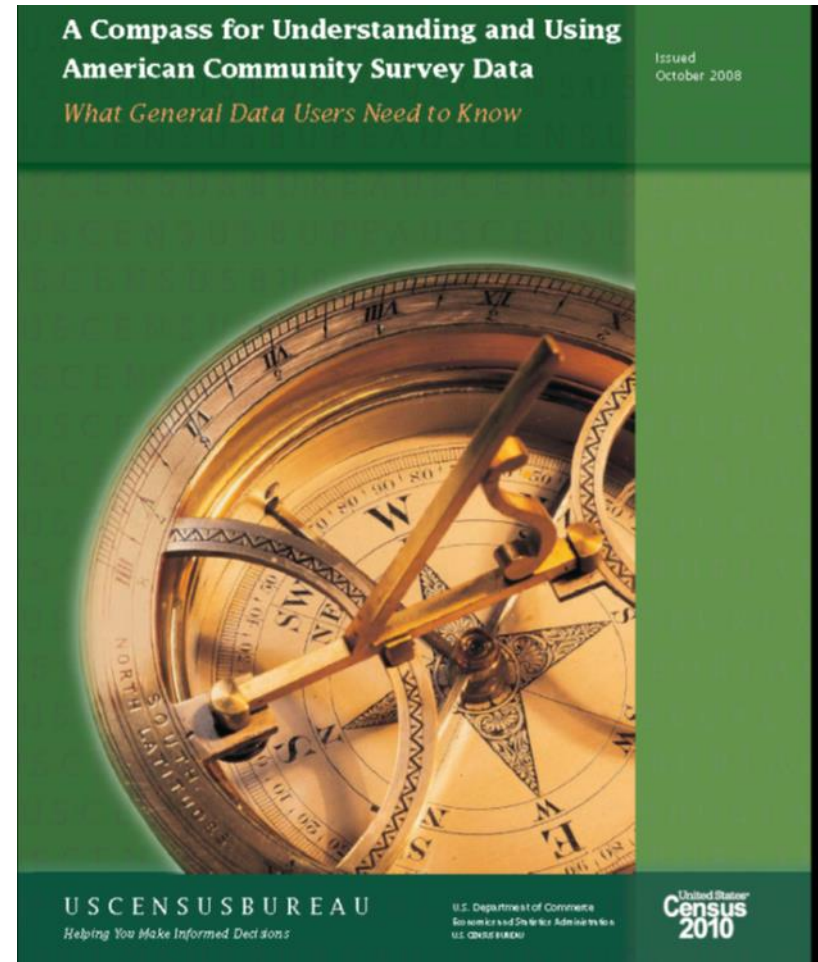
$$MOE_{agg} = \pm \sqrt{\sum_c MOE_c^2}$$

- Margin of Error for a Proportion

$$MOE_p = \frac{\pm \sqrt{MOE_{num}^2 - (\hat{p}^2 * MOE_{den}^2)}}{\hat{X}_{den}}$$

- Coefficient of Variation

$$CV = \frac{\left(\frac{MOE}{1.645}\right)}{ESTIMATE} \times 100$$



WORKPLACE	SumOftotal	SumOfotmoesq	totsqrtmoe	SumOfbus	SumOfbusmoesq	bussqrtmoe	proportion	propmoe	propcoeffvar
Census Tract 1001, Baltimore city, Maryland	239	18643	136.54	45	1686	41.06	0.19	0.13	0.43

Value-by-Alpha Maps

- Bivariate choropleth maps are used to visualize two measures at the same time.
- Value-by-alpha maps are a type of bivariate choropleth map
- The **intensity of color** will represent the reported estimate of bus commuters and the **transparency** of the layer will represent a measure of the reliability of the estimate, the CV.

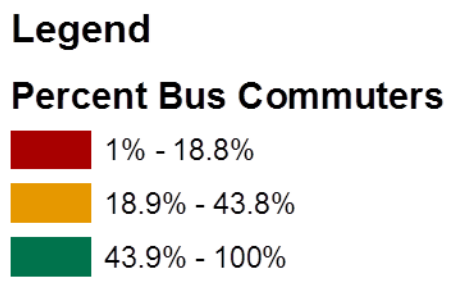
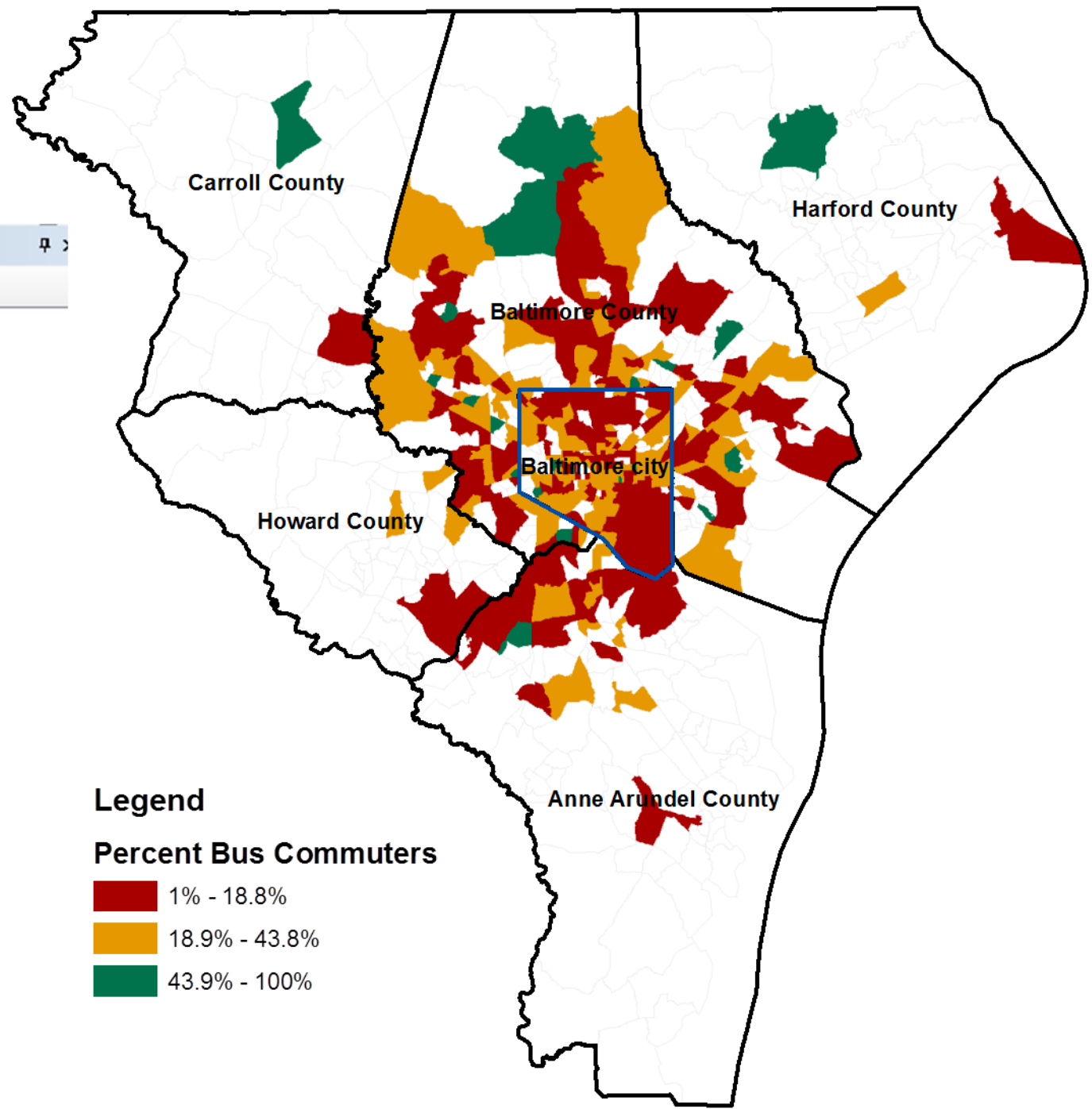
VBA in ArcMap

- **Map a layer of the estimate of interest (percent Baltimore City commuters traveling by bus) and adjust choropleth classifications and color scheme.**
- Make copies of the estimate layer based on the number of reliability classifications in the analysis.
- Use definition query to select tracts that fall within the specified reliability range and adjust the transparency of the reliability layers so that more reliable estimates are more visible.

Table Of Contents



- Layers
- Geographies
- Percent Bus Commuters
- Percent Bus Commuters
 - Percent
 - 1% - 18.8%
 - 18.9% - 43.8%
 - 43.9% - 100%
- Region Tracts
- Percent Bus Commuters by CV



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Mapping Coefficient of Variation

- A small CV (less than 15%) indicates that the sampling error is small relative to the estimate and the estimate is more reliable.
- A CV greater than 40% generally signifies an unreliable estimate.

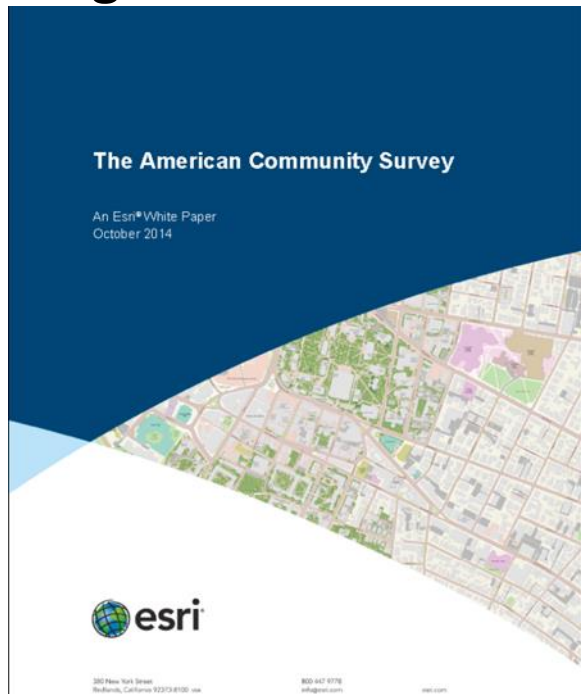


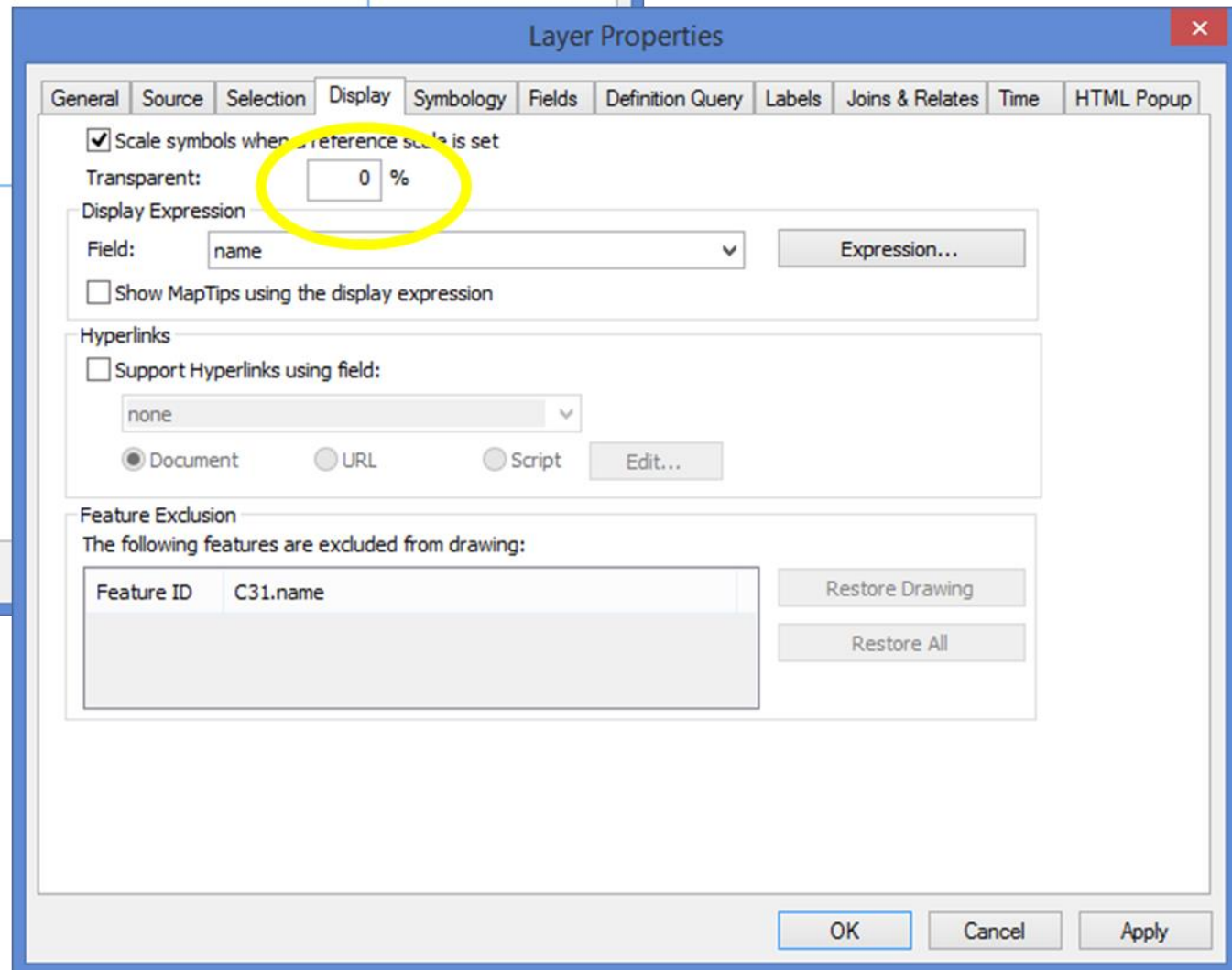
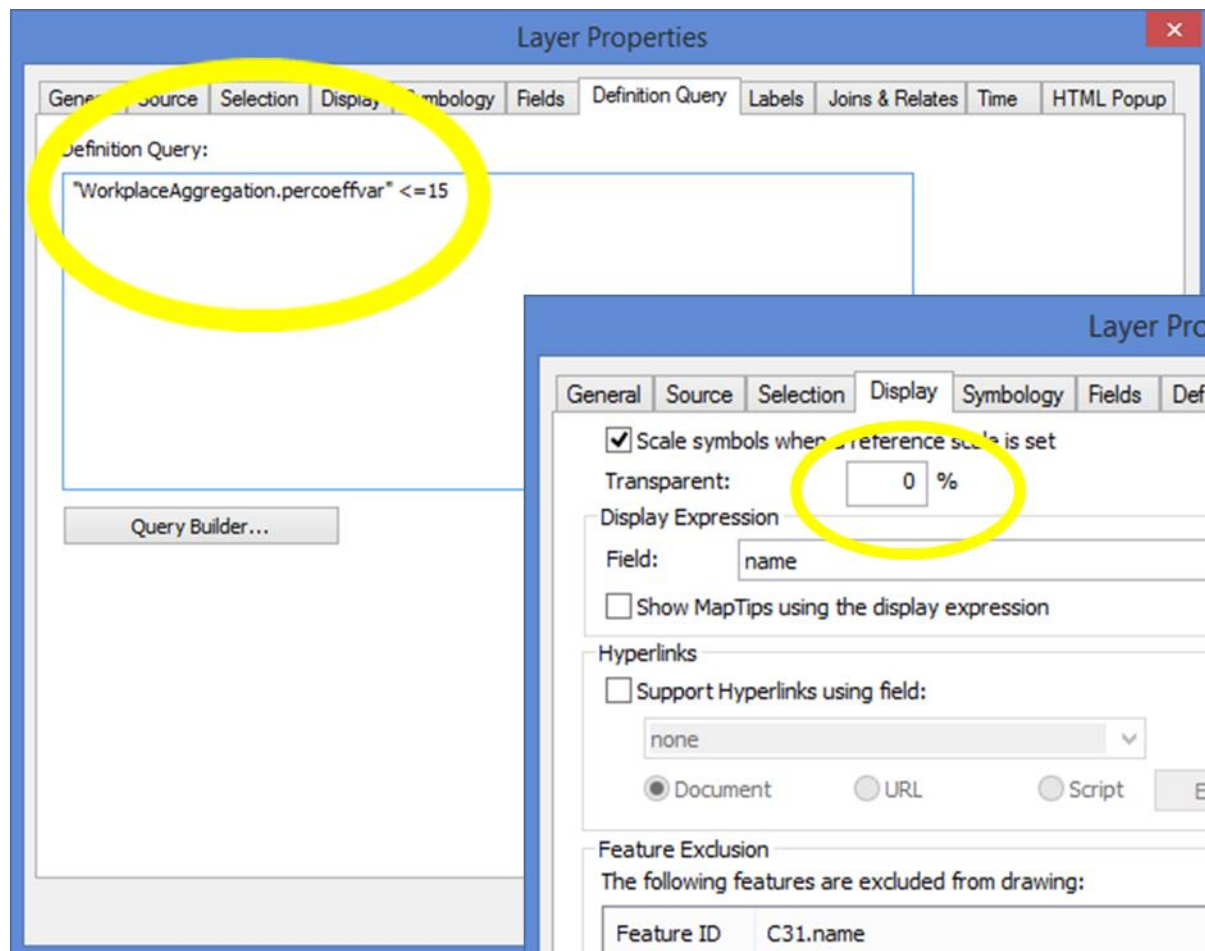
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Layers

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- Percent Bus Commuters by CV
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 - 43.9% - 100%
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Percent
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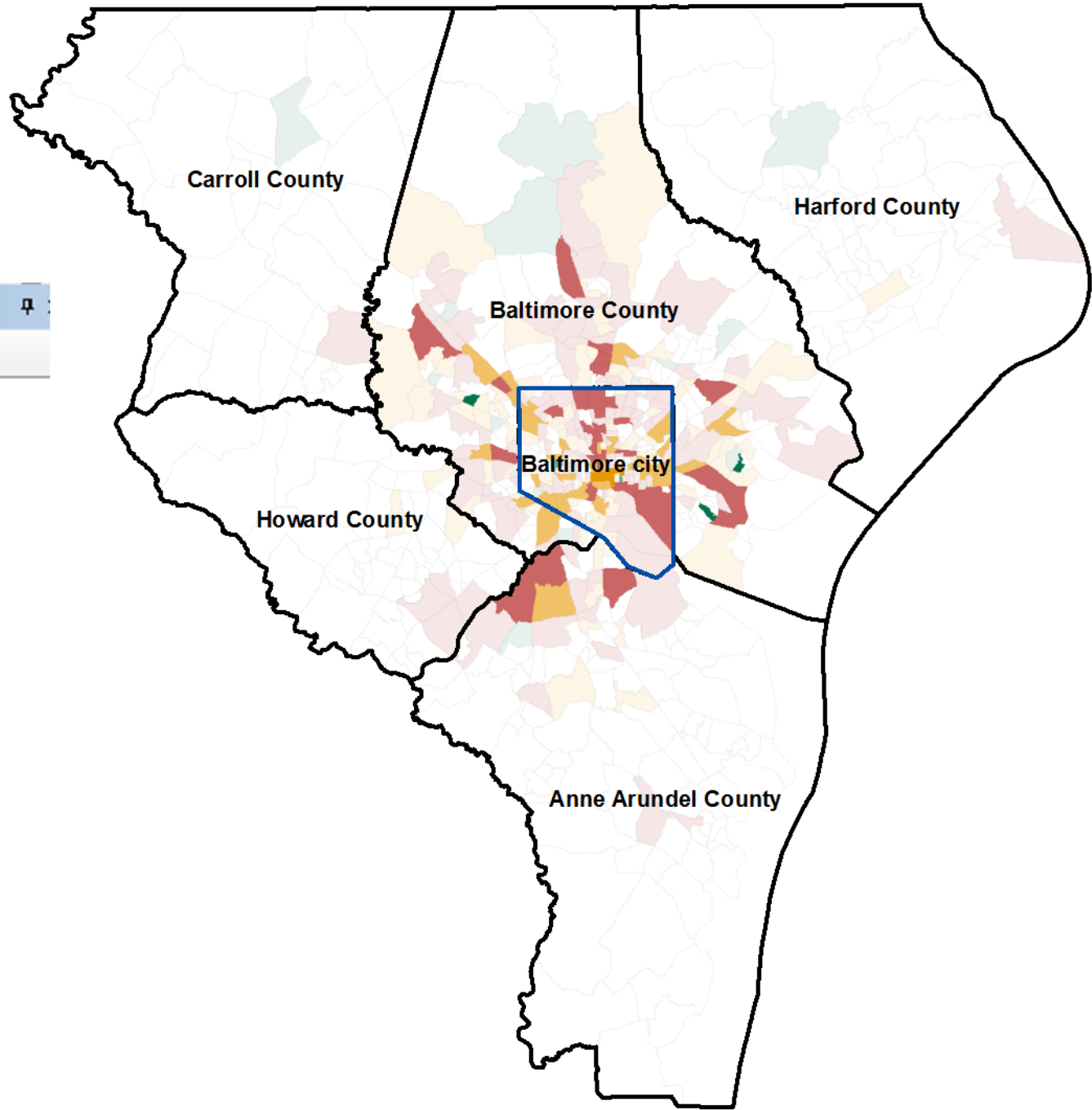


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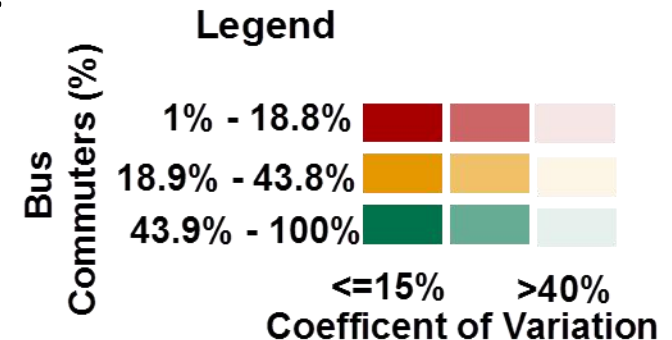
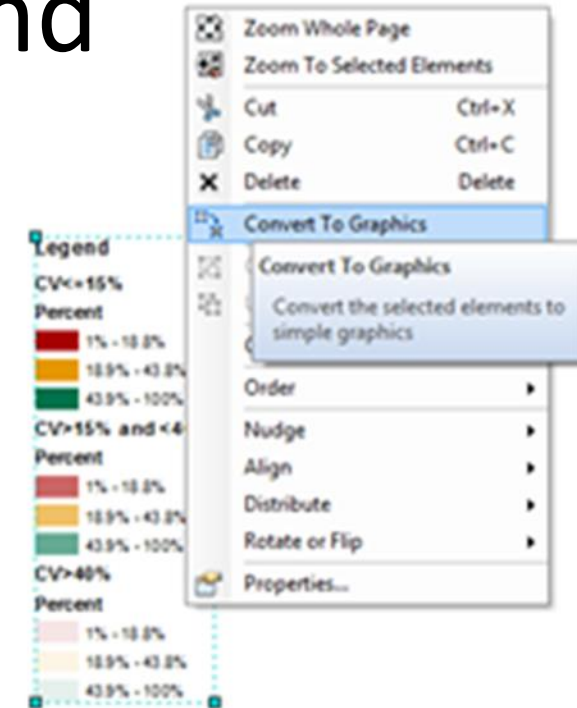


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Making the Legend

- Convert legend to graphics and then ungroup to arrange symbology
- Final legend is a bivariate scheme showing the estimate of bus commuter percentage going top to bottom, and the CV transparency dimension running from left to right



Bus
Commuters (%)

Legend

1% - 18.8%



18.9% - 43.8%

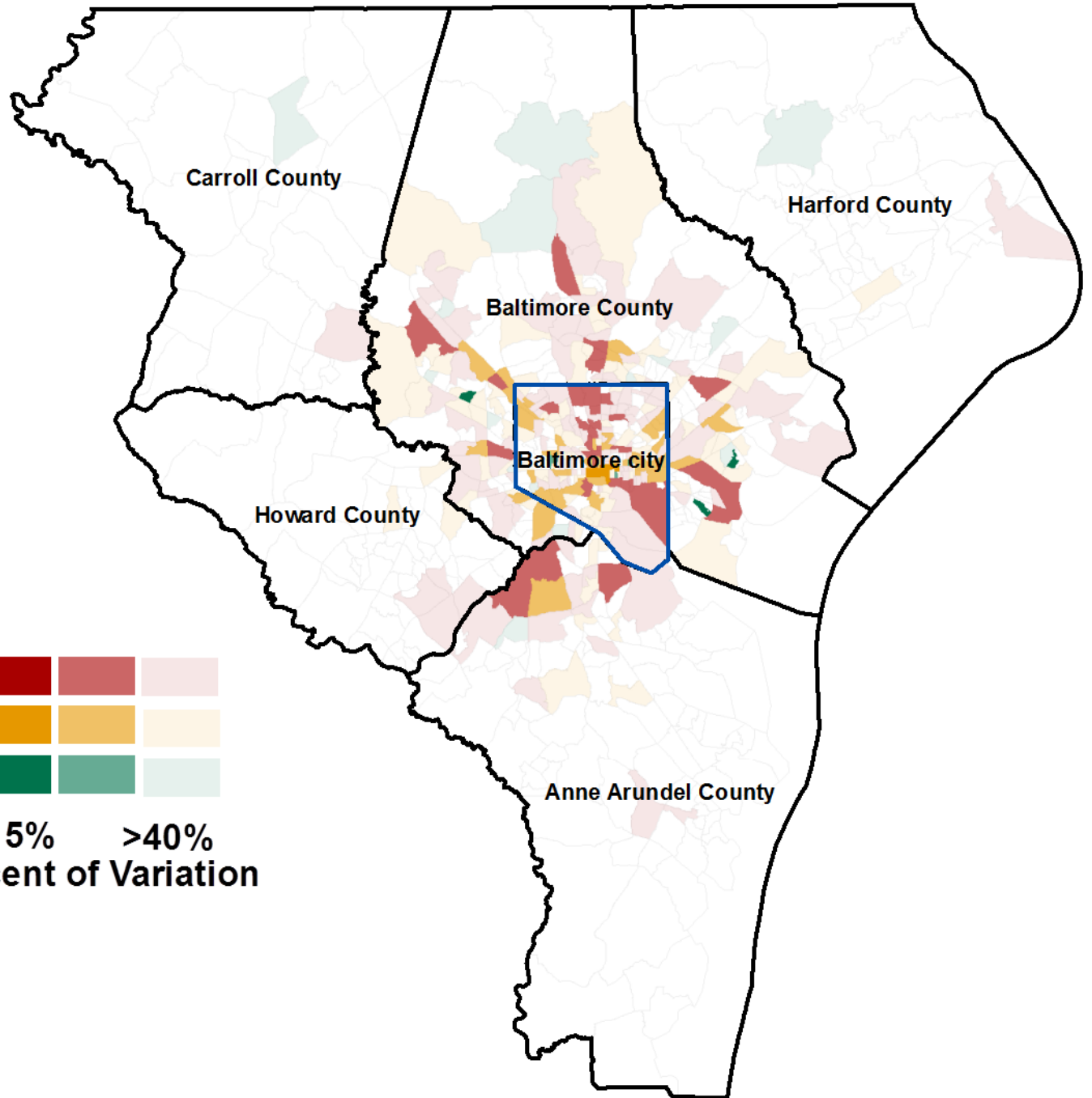


43.9% - 100%



<=15% >40%

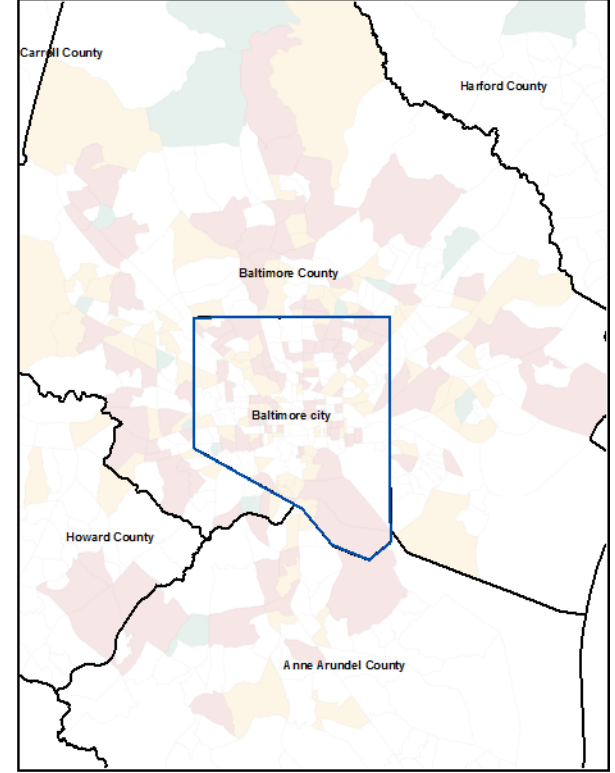
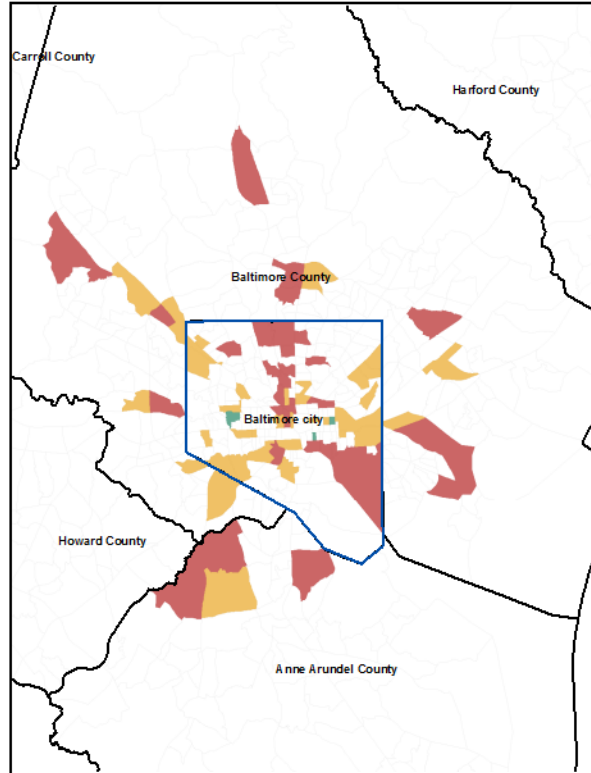
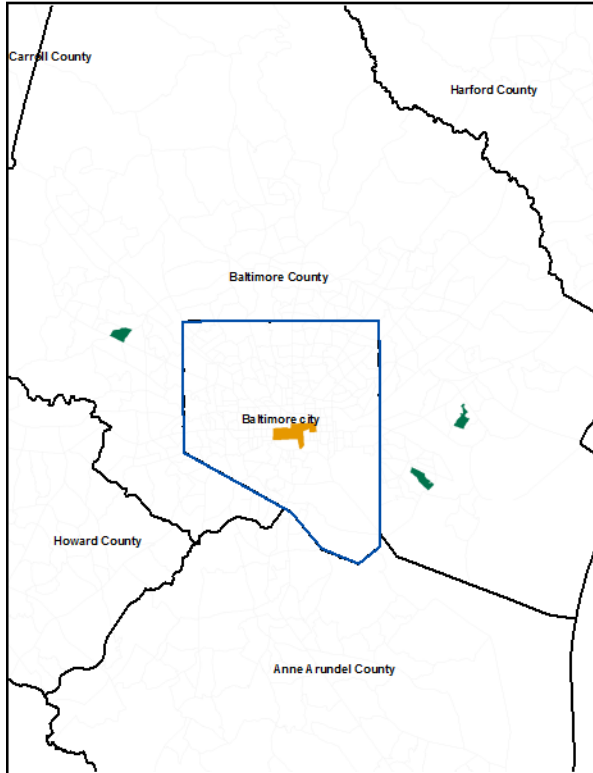
Coefficient of Variation



CV<=15%

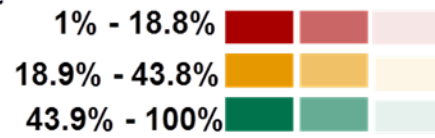
CV>15% and <=40%

CV>40%

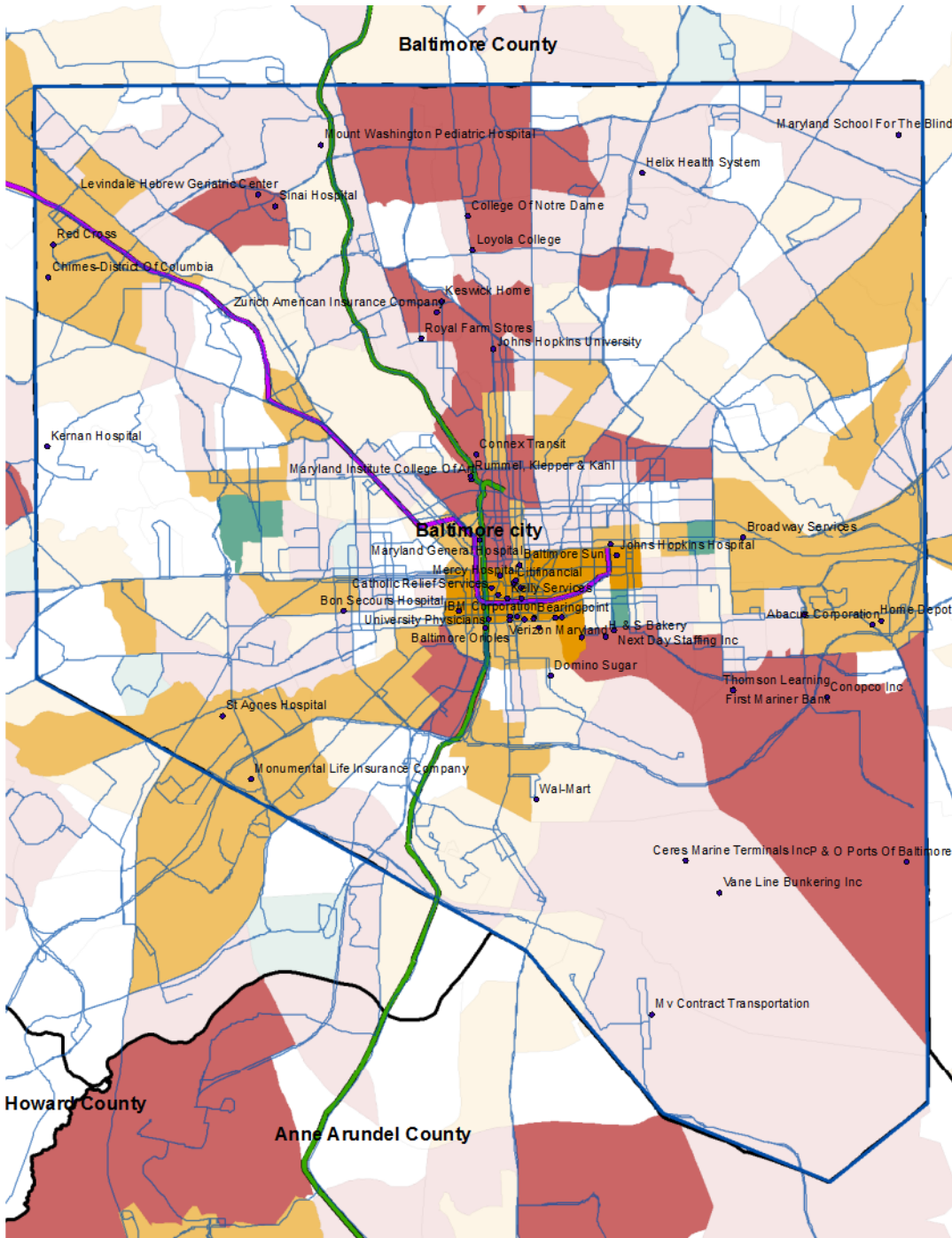


Legend

**Bus
Commuters (%)**

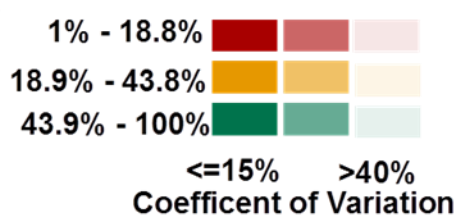


<=15% >40%
Coefficient of Variation



Bus Commuters (%)

Legend



Legend

- Major Employers
- Bus Routes

Why Do We Care?

- The Maryland Transit Administration (MTA) recently announced its Baltimore Bus Network Improvement Project (BNIP). The initiative is designed to improve Baltimore City's local bus system and ultimately connect residents to the region and employment opportunities.
- Value-by-alpha maps can be used to determine the usability of estimates of Baltimore City residents who commute to work locally and throughout the region using the bus as their mode of transportation.

Contact

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