2 EXISTING CONDITIONS

2.1 Overview of Service Provided

2.1.1 Introduction

The Maryland Transit Administration is the largest public transportation provider in the State of Maryland. The agency operates local bus service in Baltimore and its suburbs (referred to in this report as Core Bus Service[1]), a Light Rail (LR) and Heavy Rail system (Metro) centered on Baltimore, paratransit, statewide commuter bus, and a commuter rail system. This report focuses primarily on MTA's "core system" consisting of core bus, Light Rail, and Metro Subway service.

The purpose of this report is to document the existing condition of the core system. The existing condition information will help inform the Maryland Transit Administration's *Bus Network Improvement Project* (BNIP), a major component of MTA's *Transit Modernization Program (TMP)*. The BNIP will serve to determine how MTA's core system can better serve its market while making the most effective use of its resources.

2.1.2 The System at a Glance

The MTA forms a critical piece of the Baltimore region's transportation system. Every weekday approximately 370,000 trips are taken on MTA buses, Light Rail, and trains.[2] The vast majority of these trips are taken within the core service areas of the City of Baltimore and Baltimore County.

Excluding the commuter bus and train services, the Maryland Transit Administration operates three kinds of services: Core Bus, Light Rail, and Metro Subway. Core Bus forms the backbone of MTA's transit network and serves over 68 million trips a year. The MTA operates three kinds of bus services: local buses, neighborhood circulators, and QuickBus, a system of limited stop buses along major corridors. Core Bus service can be further sub-divided into the following categories:

- Radial Routes: Lines radiating from Downtown Baltimore;
- Crosstown Routes: Lines that directly connect activity centers outside Downtown Baltimore;
- Express Routes: Limited or non-stop peak period service between suburban areas and Downtown;
- Feeder Routes: Lines that connect outlying areas to the Metro Subway and Light Rail;
- Circulator Routes: Lines that operate in a specific service area on a one-way loop; and

[1] "Core Bus" is used instead of "Local Bus" to emphasize that there are gradations of service offered that are not local bus but have some express elements to them. This will be further expanded upon in later study components where new services are recommended.

[2] NTD Report, 2011 (Most recent year of data available).

- QuickBus Routes: Lines that are overlaid on local routes with limited stops.

Table 2.1.1 summarizes the MTA Core Bus services, while **Figures 2.1.1, 2.1.2** and **2.1.3** show various perspectives on the MTA Core Bus Service across the system and in Central Baltimore, and **Figure 2.1.4** details the Metro Subway and Light Rail routes.

In addition to bus service, the MTA operates Light Rail and Heavy Rail lines (Metro Subway). Baltimore's Metro opened in 1983 and was originally conceived as a multi-line system, of which one line was built that operates between Johns Hopkins Hospital, just east of Downtown, and Owings Mills in the city's northwestern suburbs. In 1992 the Metro was joined by a Light Rail line that operates North-South from Hunt Valley to Glen Burnie and Baltimore-Washington International (BWI) Thurgood Marshall Airport. The Light Rail operates in multiple service patterns, as seen in **Figure 2.1.4**.

Table 2.1.1 – Core Bus Service Routes

Radial			
1	Sinai Hospital / Mondawmin Metro Station to Fort McHenry	**23**	Rolling Road / Wildwood to Fox Ridge
3	Sheppard Pratt Hospital to Inner Harbor	**27**	Reisterstown Plaza Metro Station to Port Convington
5	Cedonia / Federal Street to Mondawmin Metro Station	**30**	Edmondson Village to City Hall / Hopkins Bayview
7	Mondawmin Metro Station to Canton	**35**	White Marsh Mall to UMBC / Blind Industries
8	Lutherville LR Stop to University Hospital	**36**	Northern Parkway and York Road to Riverview / Monroe Street
10	Rolling Road/Paradise Avenue to Dundalk / Bullneck Road	**53**	Old Court Metro Station to Mondawmin Metro Station
11	Towson Town Center to Canton	**54**	Randallstown / Milford Mill Metro Station to Penn-North Metro Station
15	Security Square / Westview to Overlea / Perry Hall	**61**	Lake Avenue to Inner Harbor
18	Glen and Key Avenues to Velvet Valley / Copper Ridge / Scotts Hill / Owings Mills Center	**64**	Curtis Bay / Energy Parkway to North Avenue
19	Carney / Goucher and Taylor to State Center Metro Station	**91**	Sinai Hospital to City Hall
20	Security Square Mall to CCBC Dundalk / Marine Terminal		
Crosstown			
4	CCBC Essex to Turner Station	**38**	North Bend Loop to Cold Spring Lane and Grandview
13	Walbrook Junction to Canton / Fell's Point	**44**	Security Square Mall to Rosedale Industrial Park
16	Mondawmin Metro Station to Brooklyn Homes	**51**	Rogers Avenue Metro Station to Patapsco LR Stop
21	Mondawmin Metro Station to Fell's Point	**55**	Fox Ridge to Towson Town Center
22	Mondawmin Metro Station to Bayview Medical Center	**77**	Old Court Metro Station to Patapsco LR Stop
33	Rogers Avenue Metro Station to Moravia	**99**	Old Court Metro Station to BWI Thurgood Marshall Airport
Feeder			
9	International Circle to Lutherville LR Stop	**56**	Glyndon to Owings Mills Town Center
12	Stella Maris to Kirk and Bartlett	**57**	Security Square Mall to Rogers Avenue Metro Station
14	Patapsco LR Stop to Annapolis / Jumpers Hole	**58**	White Marsh to Reisterstown Plaza Metro Station
17	Patapsco LR Stop to Parkway Center	**59**	Owings Mills Town Center / Redland Court to Reisterstown Plaza Metro Station
24	Whispering Woods to Moravia Park	**60**	Stevenson University to Reisterstown Plaza Metro Station
52	Milford Mill Road to Mondawmin Metro Station		

Express			
03X	Cromwell Bridge Road to Inner Harbor	**64X**	North Avenue to Riviera Beach
05X	Cedonia to Downtown Baltimore	**104**	Cromwell Bridge Road to Johns Hopkins Hospital
10X	US Route 40 and Rolling Road to Light Street	**120**	White Marsh Park & Ride to Johns Hopkins Hospital
15X	Perry Hall to Paca Street	**150**	Columbia to Downtown Baltimore
19X	Carney / Goucher and Taylor to State Center Metro Station	**160**	Whispering Woods / Fox Ridge to Johns Hopkins Hospital
Circulator			
29	Cherry Hill LR Stop to Cherry Hill	**97**	Mondawmin Metro Station to Mondawmin Metro Station
50	Erdman and Belair to Erdman and Belair	**98**	Woodberry LR Stop to Woodberry LR Stop
QuickBus			
40	Security Boulevard at CMS to Middle River	**47**	Walbrook Junction to Overlea Loop
46	Paradise Avenue Loop to Cedonia Loop	**48**	Towson Town Center to University of Maryland Transit Center

Figure 2.1.1 – System Map

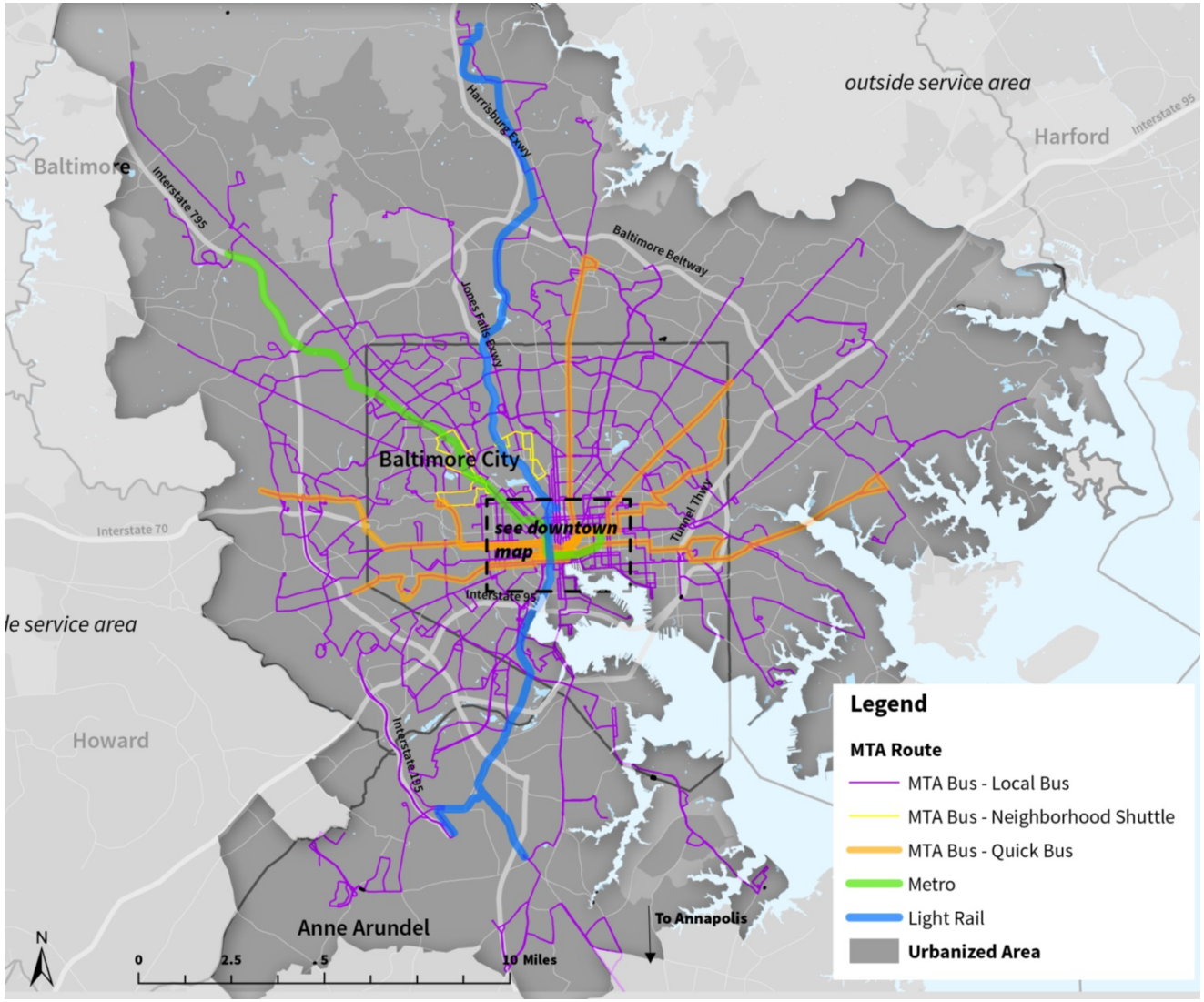


Figure 2.1.2 – System Map (Central Baltimore)

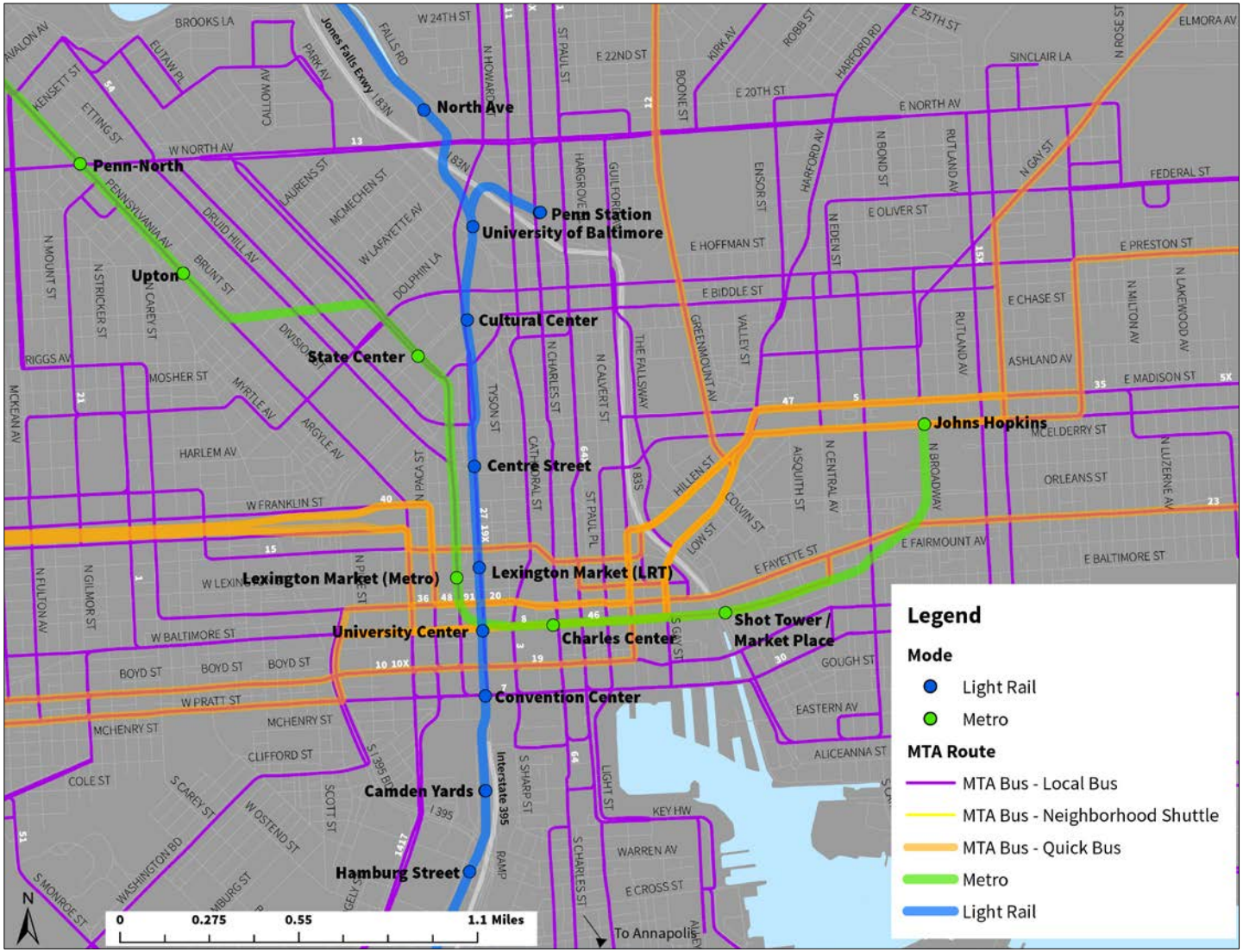
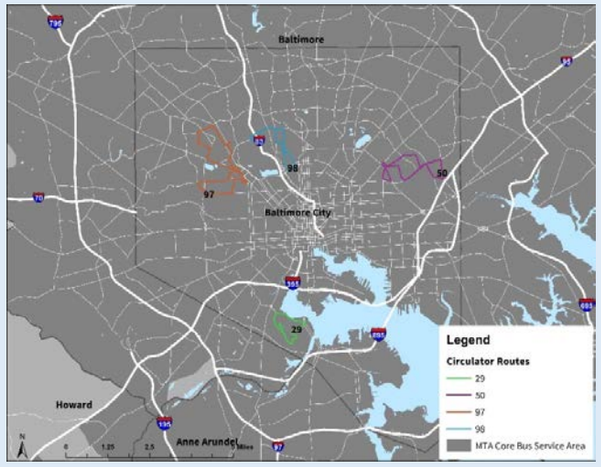
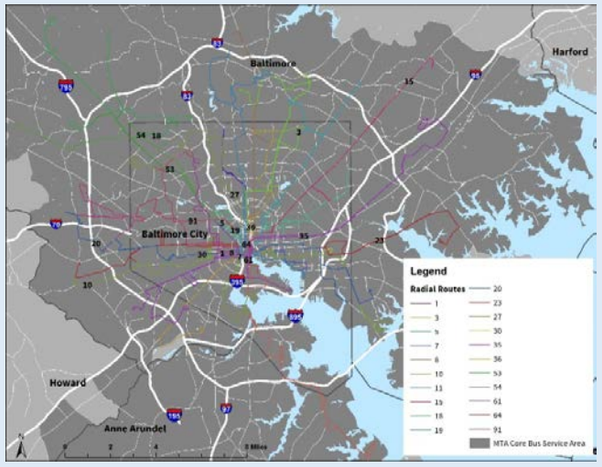


Figure 2.1.3 – MTA Core Bus Services by Type of Service

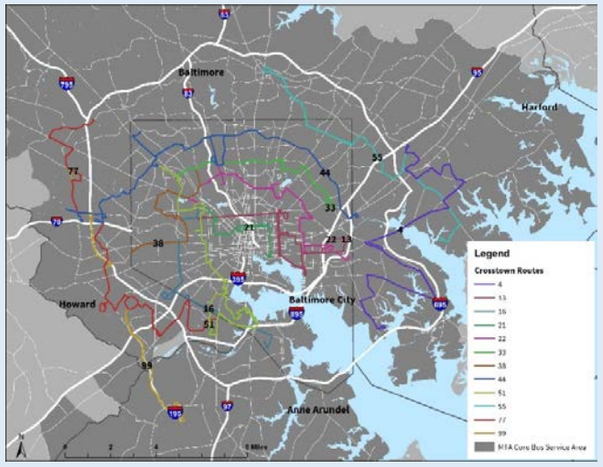
Circulator



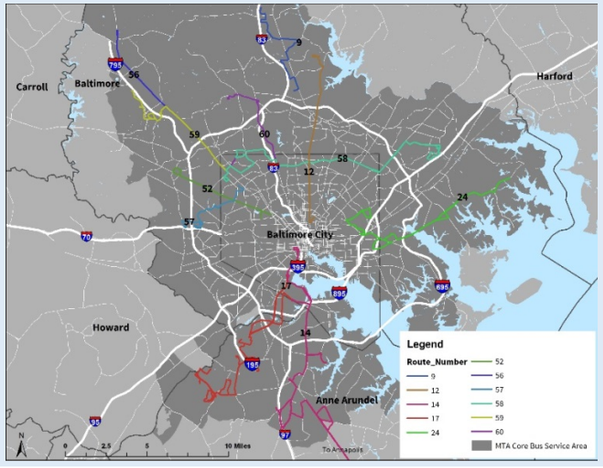
Radial



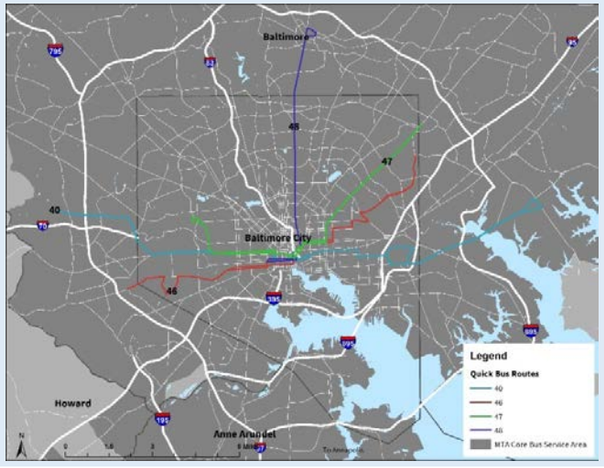
Crosstown



Feeder



QuickBus



Express

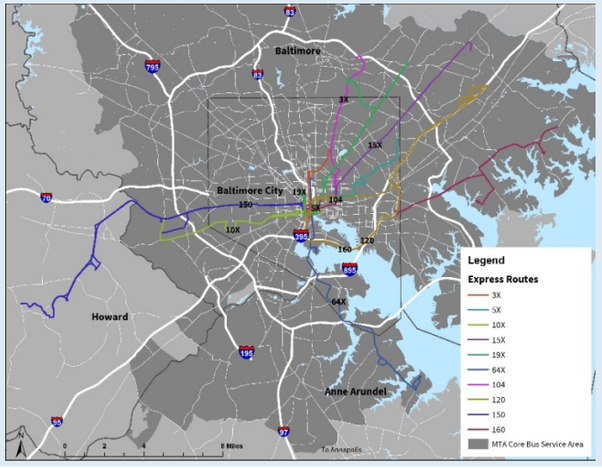


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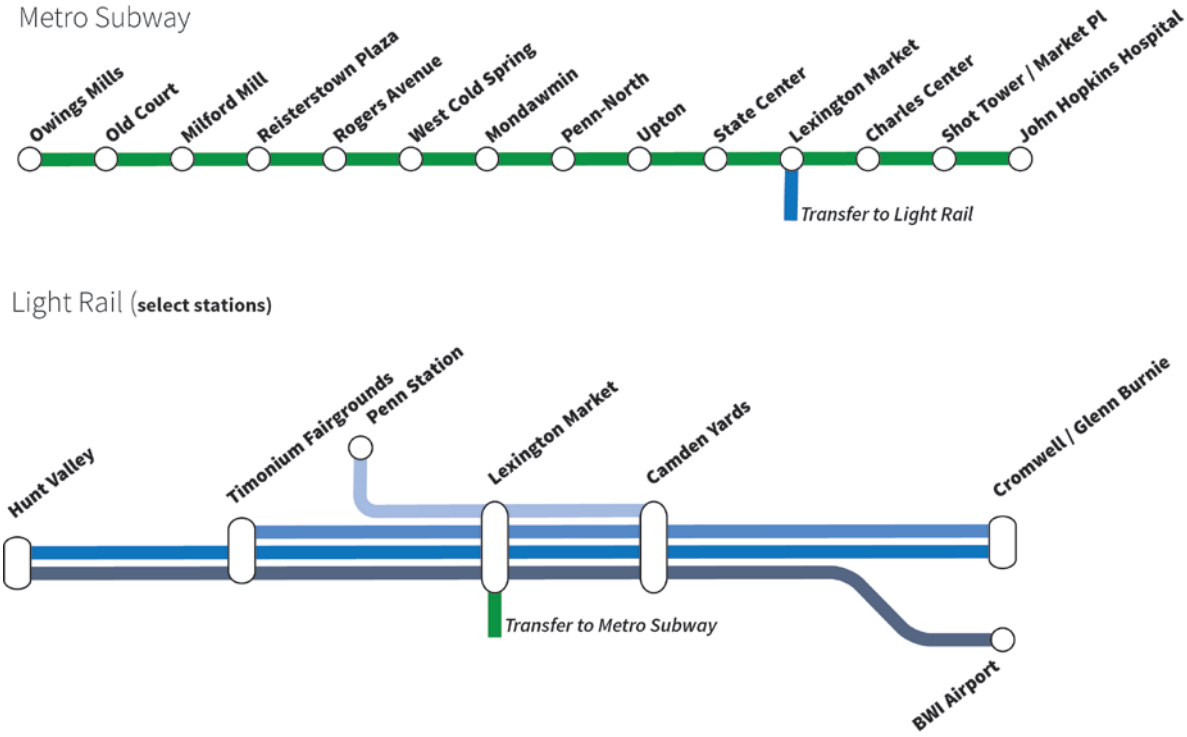
Figure 2.1.2 – Metro Subway and Light Rail Alignments



2.2 Existing and Future Land Use and Demographics

2.2.1 Existing Demographics

2.2.1.1 Population Density

Current population density was calculated for the MTA service area using 2010 Census population totals by census tract. Population density for tracts within the MTA service area range from a low of only 4 people per square mile for the tract containing BWI Thurgood Marshall Airport to a high of nearly 87,000 people per square mile for a tract just east of Downtown Baltimore, adjacent to I-83. Generally, tracts closer to Downtown Baltimore and along the Metro in northwest Baltimore City have higher population densities, while tracts in northern Baltimore County have lower population densities. In order to be viable for transit service, densities in excess of 12,000 people per square mile are typically necessary and it is these areas that also have the highest need for transit service; those tracts with the highest densities all currently have some level of Core Bus service. **Figures 2.2.1** and **2.2.2** illustrate population density within the MTA service area.

Figure 2.2.1 – Population Density (People per Square Mile)

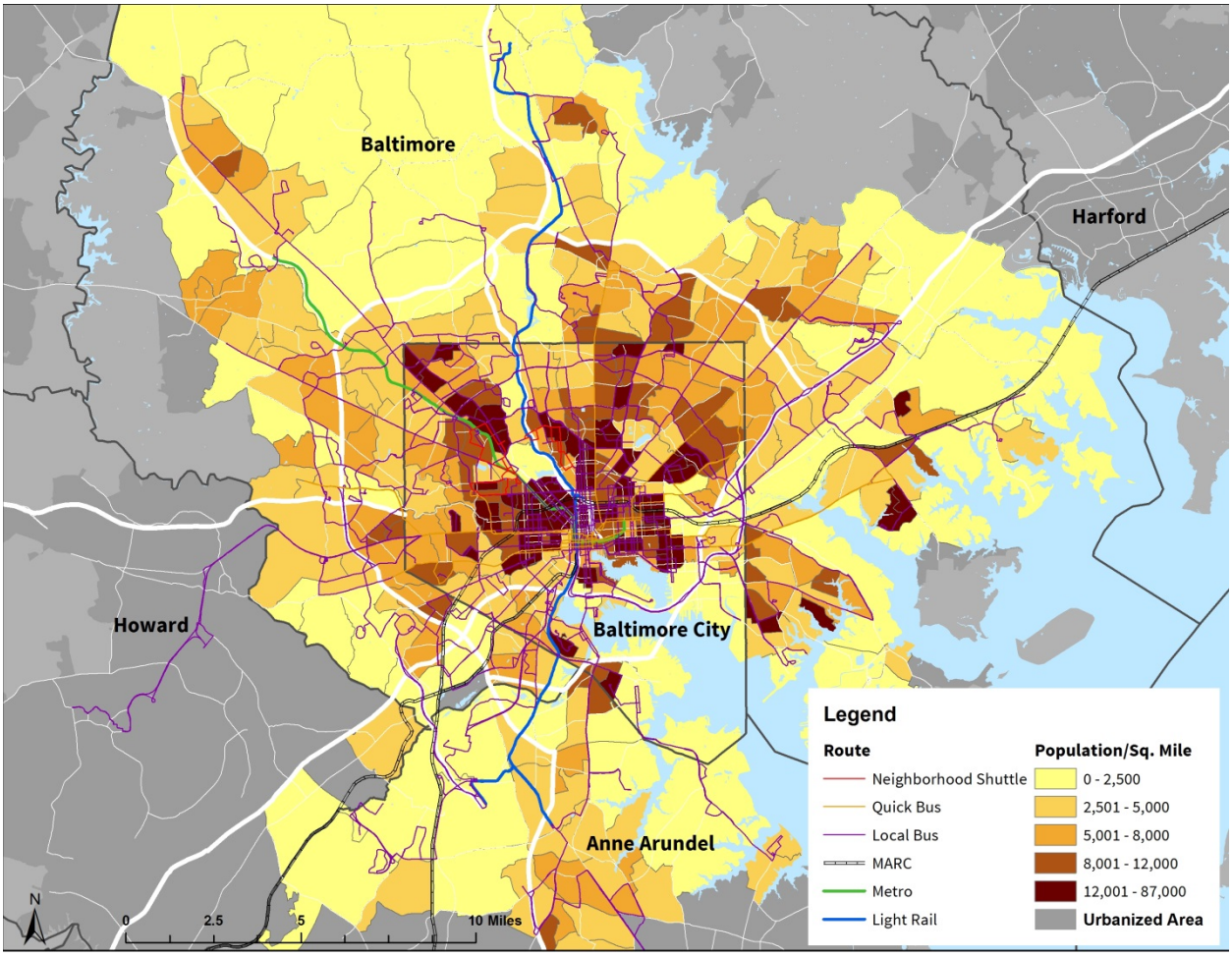
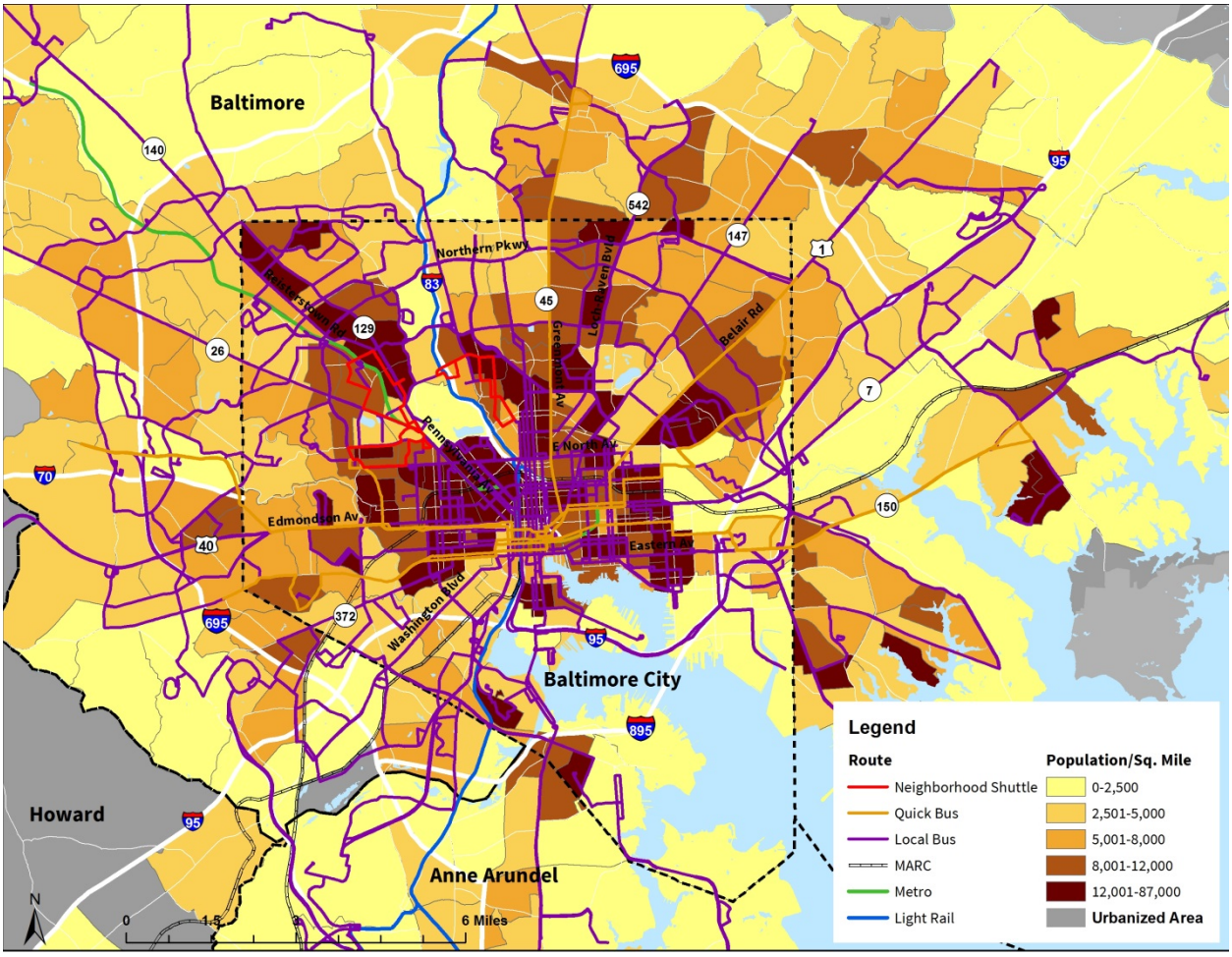


Figure 2.2.2 – Population Density (People per Square Mile) Within Baltimore Beltway



2.2.1.2 Low-Income Households

Low-income household information for the MTA service area was compiled by census tract using 2007-2011 American Community Survey (ACS) data to find the percentage of households with incomes less than $20,000. This percentage ranges from less than 1 percent in several Baltimore County tracts north of the City of Baltimore to 60-65 percent in several tracts in East Baltimore near Downtown and in the Cherry Hill neighborhood of South Baltimore. The two census tracts containing the University of Maryland-Baltimore County and Towson University also display a high percentage of low-income households; note that, this is not an accurate portrayal of low-income households but rather reflective of the large student population. Generally, tracts within the City of Baltimore have a higher percentage of low-income households, while those in Baltimore County and Anne Arundel County have lower percentages. The majority of high low-income tracts within the City of Baltimore corresponded well with the existence of some level of Core Bus routes, as well as the Metro and Light Rail alignments. **Figures 2.2.3** and **2.2.4** illustrate low-income household census tracts within the MTA service area.

Figure 2.2.3 – Low-Income Households

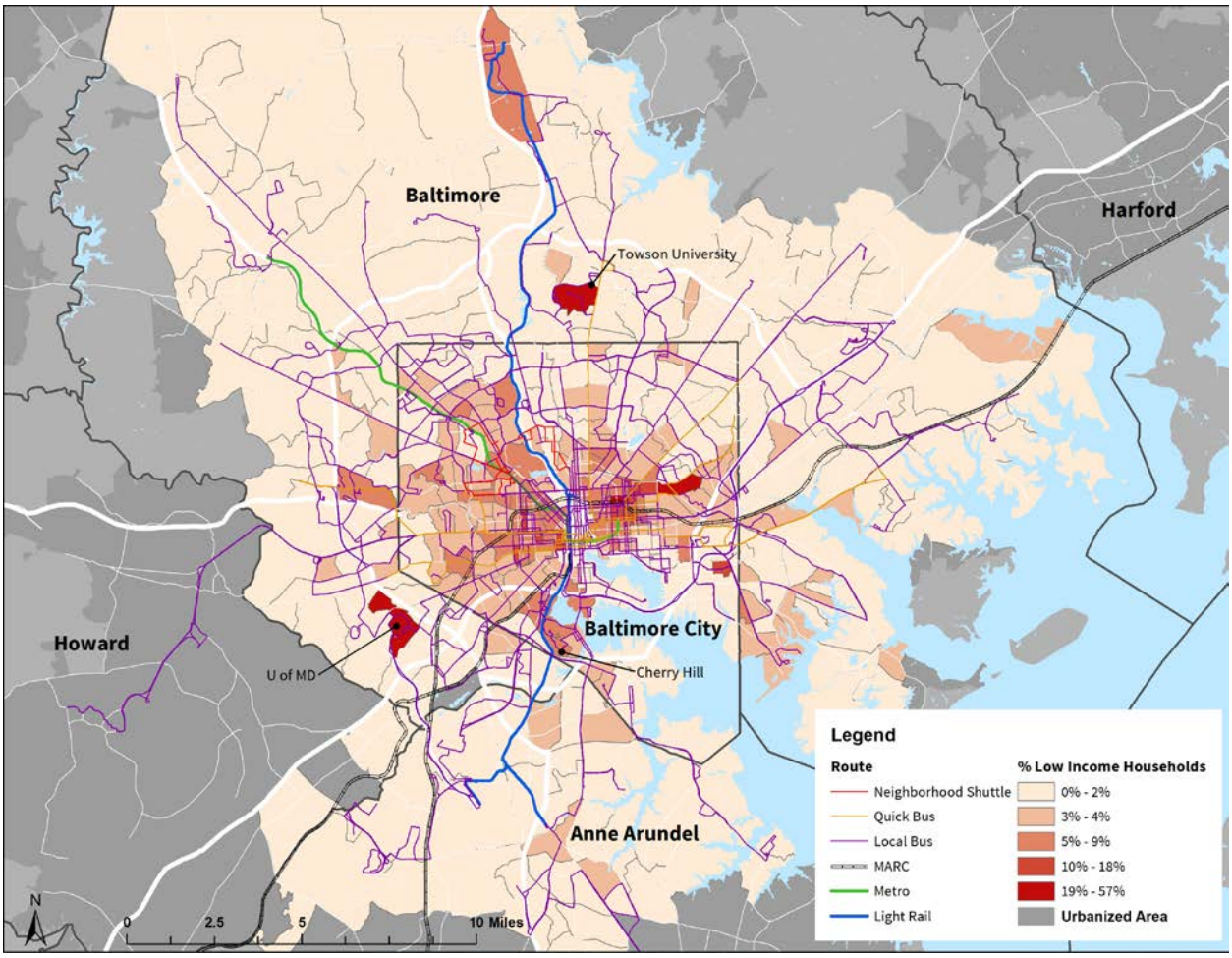
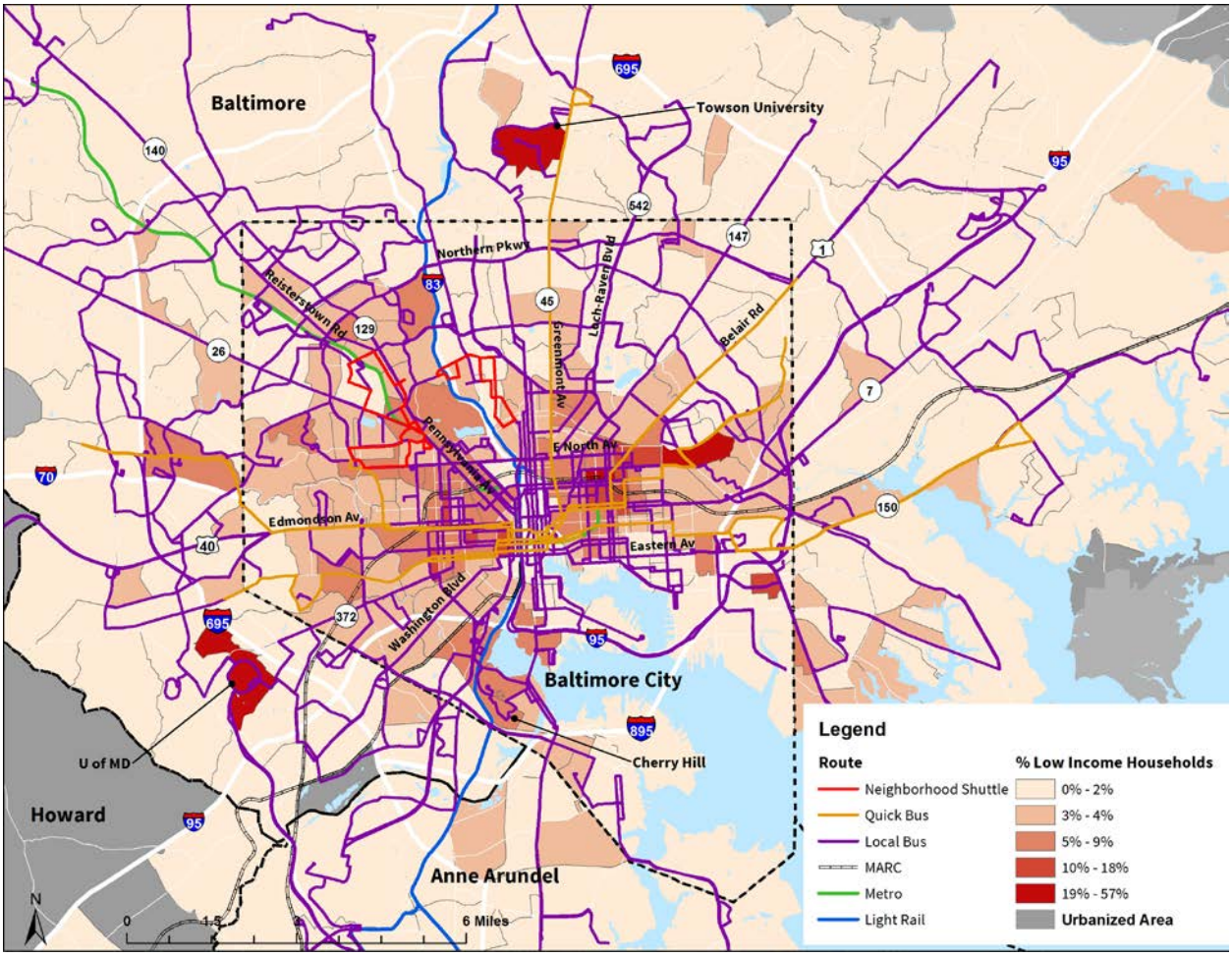


Figure 2.2.4 – Low-Income Households (Within Baltimore Beltway)



2.2.1.3 Zero-Car Households

Information on households that do not own or have access to a vehicle was compiled by census tract using 2007-2011 ACS vehicle ownership data. Overall, the boundaries of the City of Baltimore correspond closely with the extent of the area with high percentages of zero-car households. The percentage of zero-car households ranges from less than 1 percent in several tracts in Baltimore, Howard and Anne Arundel counties to greater than 75 percent in several tracts in the East Baltimore and Cherry Hill neighborhoods of the City of Baltimore. Generally, tracts adjacent to Downtown Baltimore and in southeast Baltimore have a much higher percentage of zero-car households, while those in Baltimore County, Anne Arundel County and Howard County had lower percentages. The tracts with higher percentages corresponded well with Core Bus routes and the Metro alignment. **Figures 2.2.5** and **2.2.6** illustrate the percentage of zero-car households by census tract for the MTA service area.

Figure 2.2.5 – Zero-Car Households

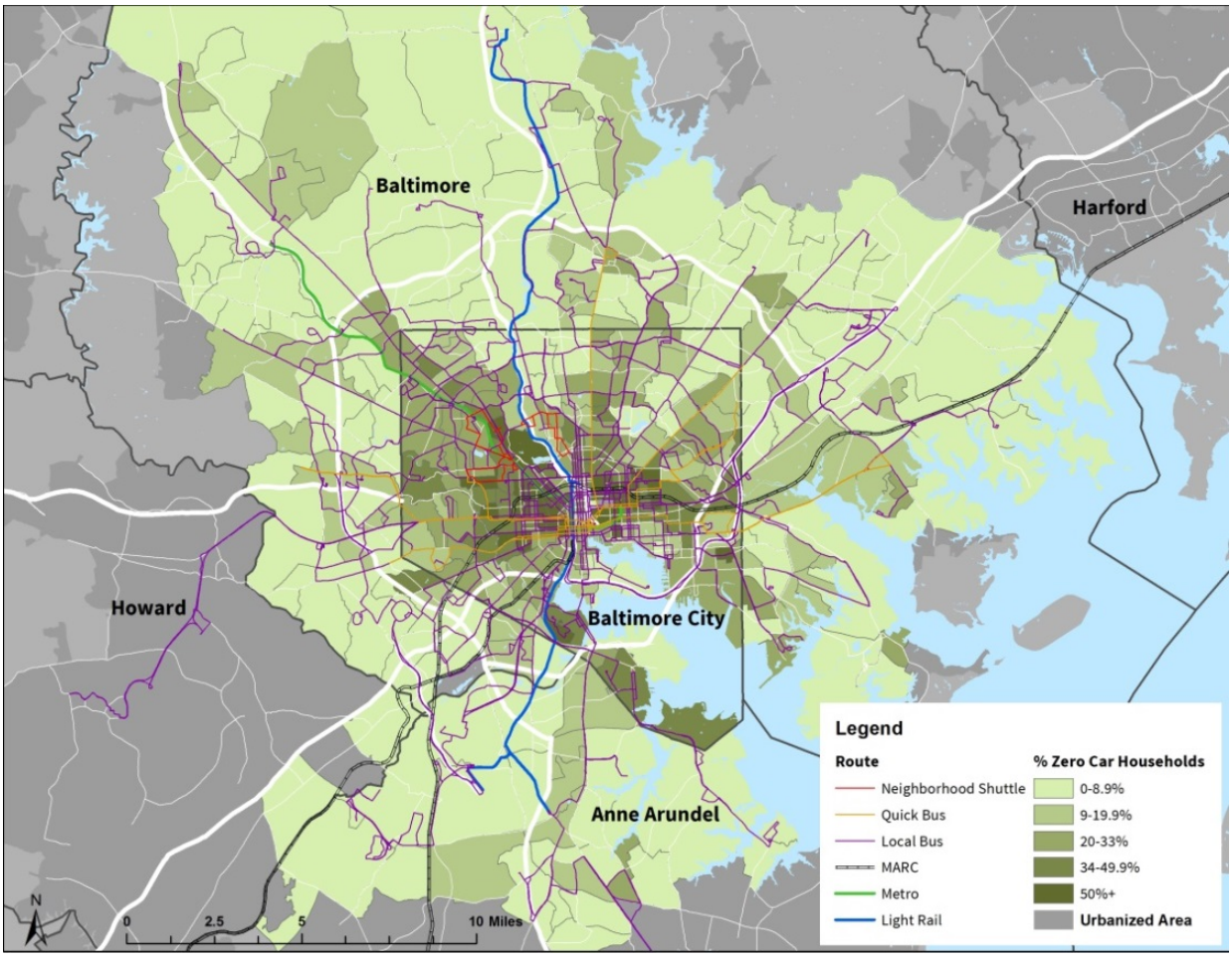
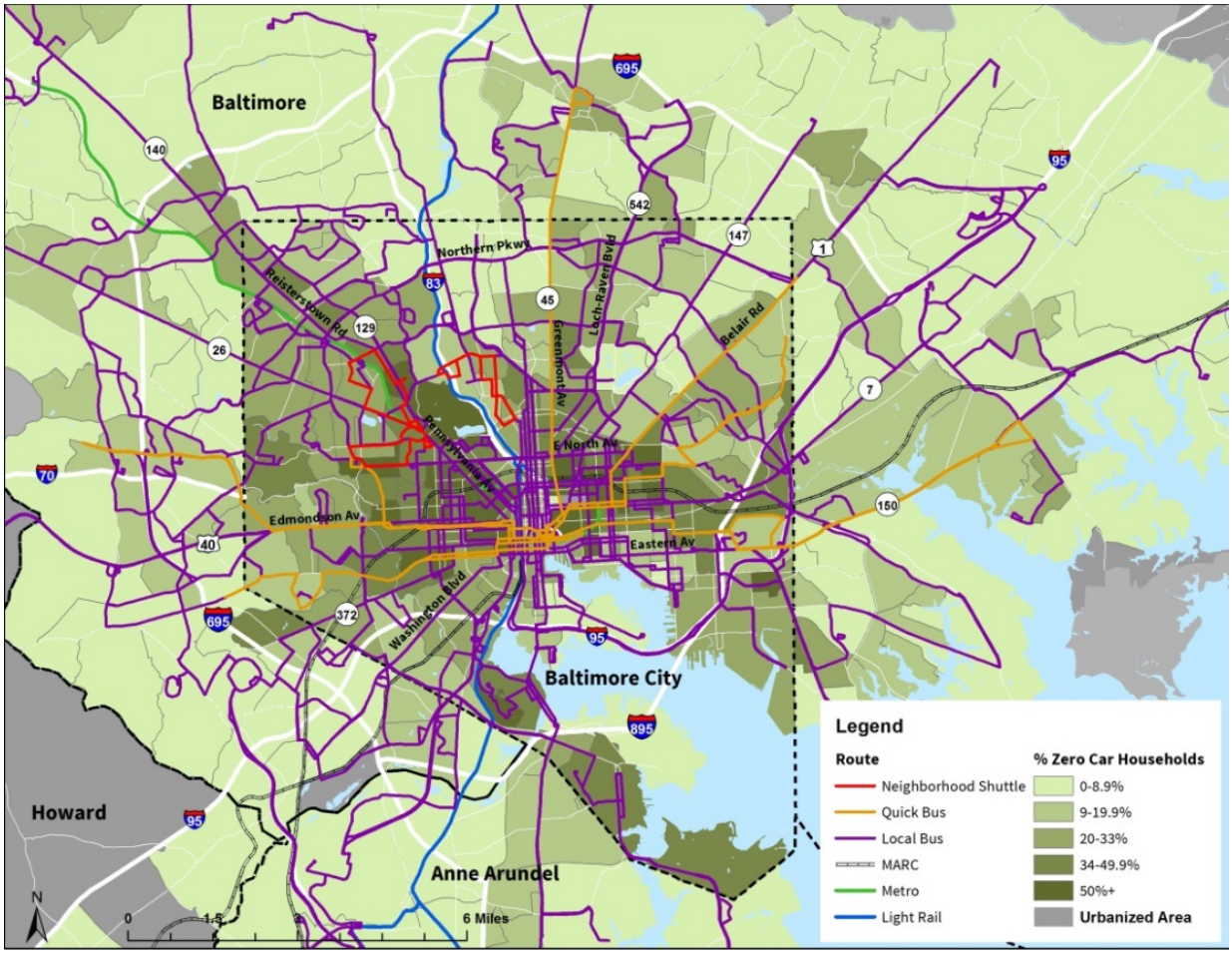


Figure 2.2.6 – Zero-Car Households (Within Baltimore Beltway)



2.2.1.4 Age

Population by age information for the MTA service area was compiled by census tract using 2007-2011 ACS data. Populations 65 and over and under the age of 18 have a higher need for public transportation due to their lower levels of vehicle ownership. Concentrations of populations 65 and over were generally found outside of Baltimore City in Baltimore County and Anne Arundel County in areas with limited transit routes. The percentage of the population age 65 and over was nearly 58 percent in Catonsville near the MD-372/I-695 interchange and nearly 46 percent in the Cross Keys neighborhood of Baltimore City. Elsewhere in Baltimore County, western Towson near MD-139 and the Oregon Ridge Park, Loch Raven Reservoir and Pikesville areas all had high percentages of population age 65 and over. In Anne Arundel County, there were high concentrations near BWI Thurgood Marshall Airport. Cross Keys, Pikesville and BWI areas all have access to MTA rail service; however the location of housing within ¼ mile of stations is limited. **Figures 2.2.7** and **2.2.8** illustrate the percentage of the population age 65 and over by census tract for the MTA service area.

Figure 2.2.7 – Percentage of Population Age 65 and Over

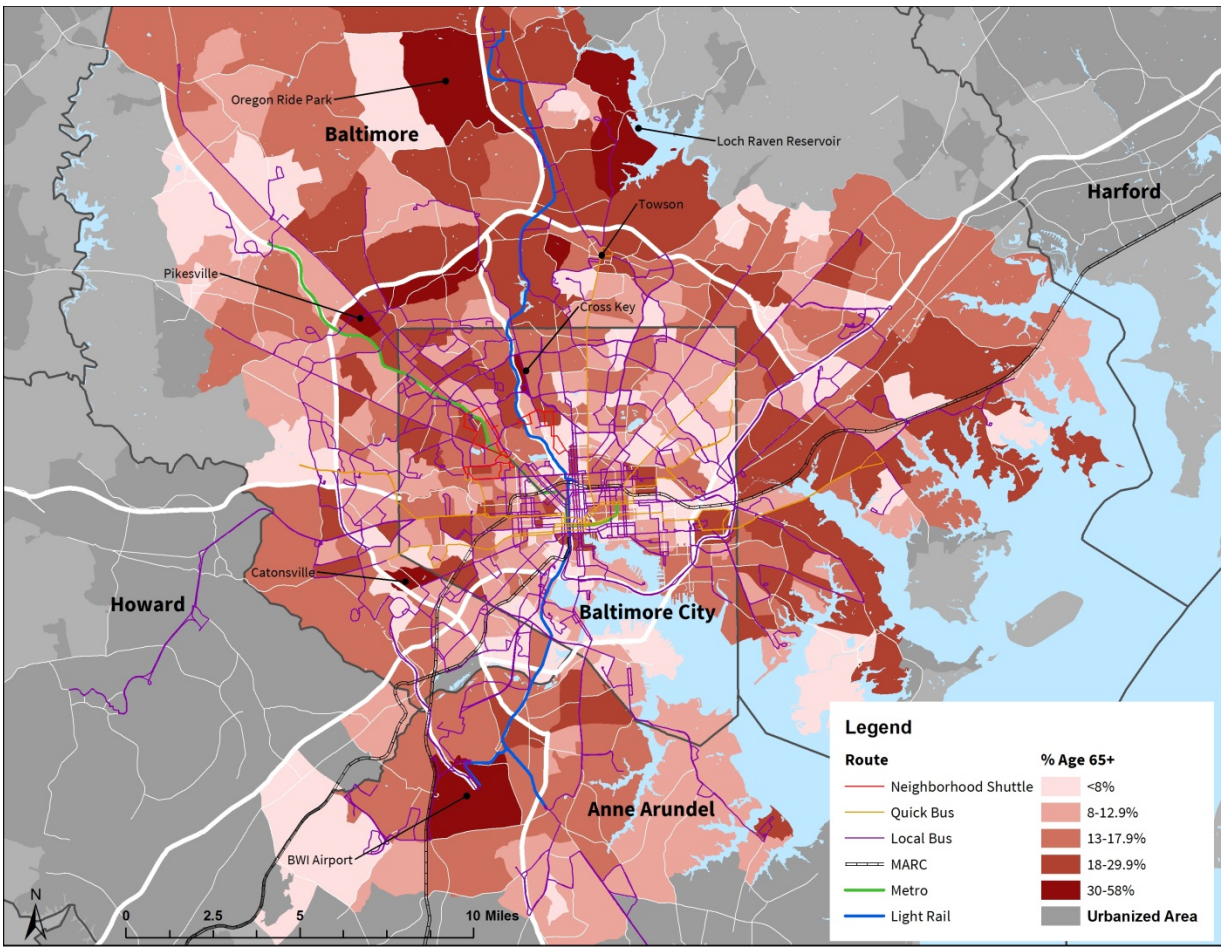
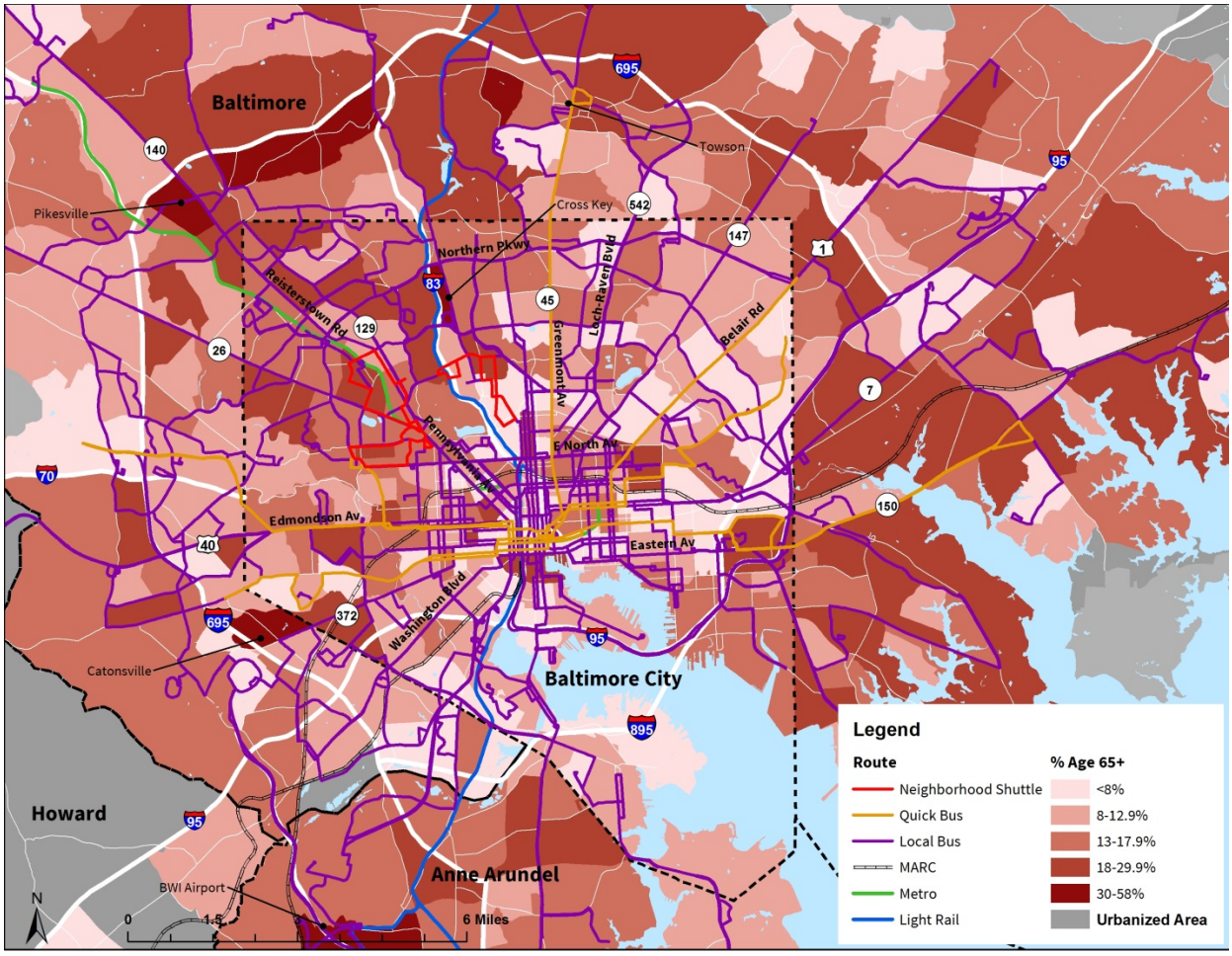


Figure 2.2.8 – Percentage of Population Age 65 and Over (Within Baltimore Beltway)



Concentrations of populations under the age of 18 were generally found within Baltimore City or within Baltimore County to the west of Baltimore City. In Baltimore City, the Druid Heights, Upton, West Hills and Cherry Hill neighborhoods had the highest percentages, while in Baltimore County the Baltimore Highlands, Windsor Mill, Woodlawn and Howard Park neighborhoods had the highest percentages. The Cherry Hill and Upton neighborhoods of Baltimore City had the highest overall percentages, between 45 percent and 50 percent. Overall, areas with high percentages of youths were situated in areas with several existing MTA Core Bus routes and/or rail routes. **Figures 2.2.9** and **2.2.10** illustrate the percentage of the population under the age of 18 by census tract for the MTA core service area.

Figure 2.2.9 – Percentage of the Population under the Age of 18

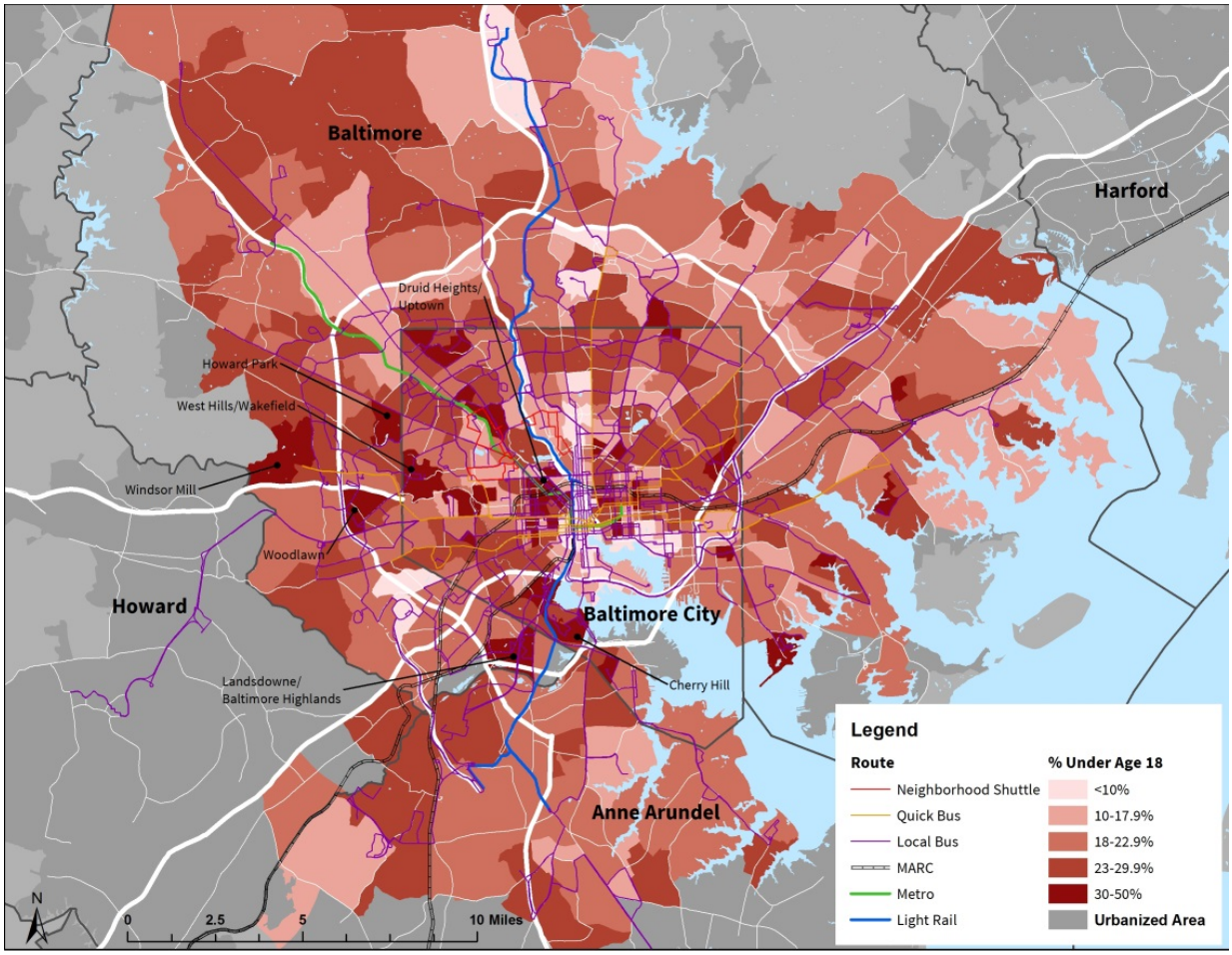
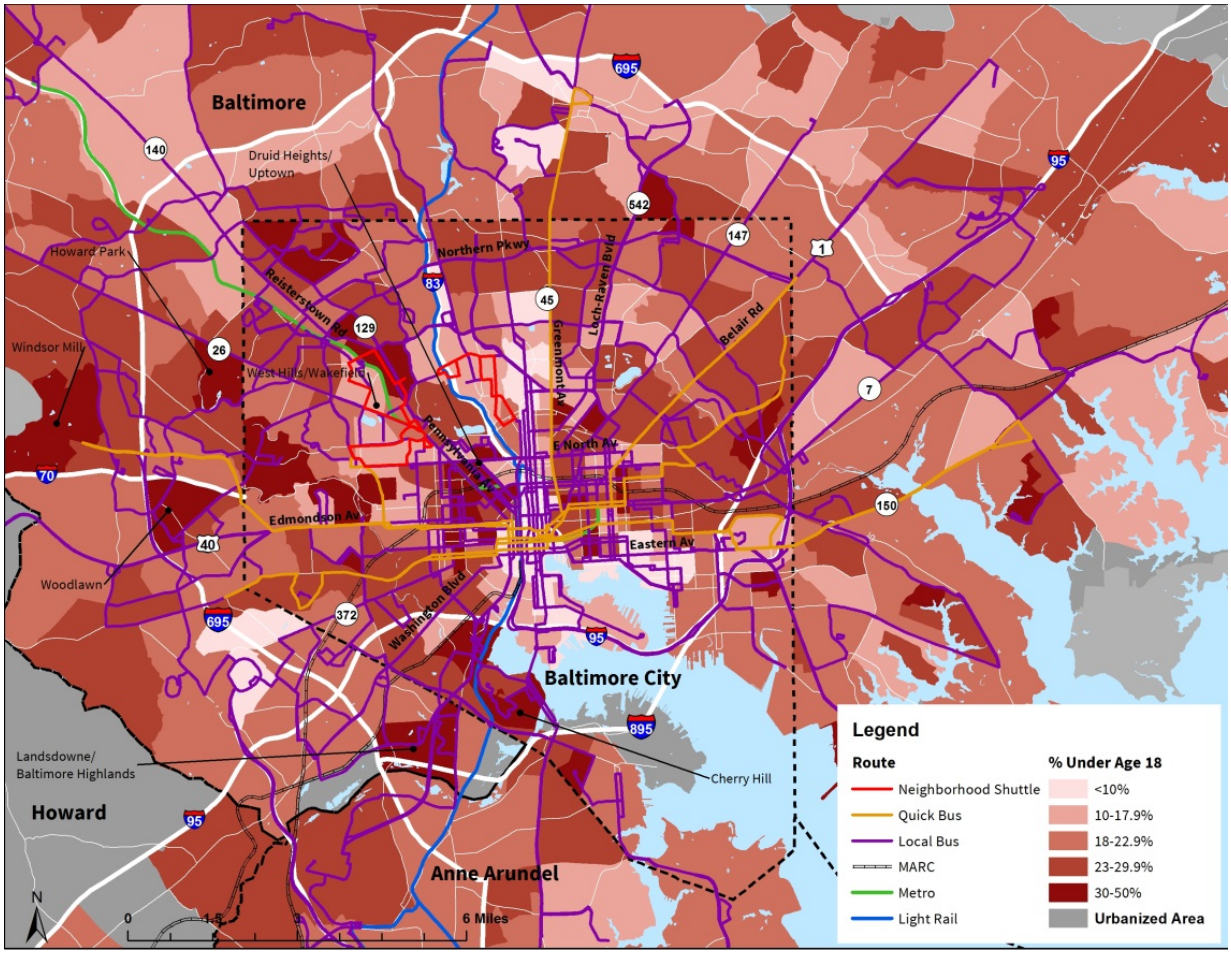


Figure 2.2.10 – Percentage of the Population under the Age of 18 (Within Baltimore Beltway)



2.2.2 Employment Density

Employment density by census tract was compiled using 2011 Census Local Employment Dynamics (LED) data. Employment density was not as centralized as population density, with several high employment density census tracts located outside of the City of Baltimore in Baltimore County and Anne Arundel County. Overall, tracts with the highest employment densities were in Downtown Baltimore, Towson, Pikesville, the Southdale area of Glen Burnie and near the BWI Business Park. All of these high employment density census tracts are served by Local Bus routes, the Metro or the Light Rail, though in the case of the Metro and Light Rail, many actual employment locations are a considerable distance away from actual stations. Those high employment density census tracts closest to Downtown Baltimore have the most transit service (in terms of number of routes), often served by multiple MTA modes. **Figures 2.2.11** and **2.2.12** illustrate employment density in the MTA Core service area.

Figure 2.2.11 – 2011 Employment Density

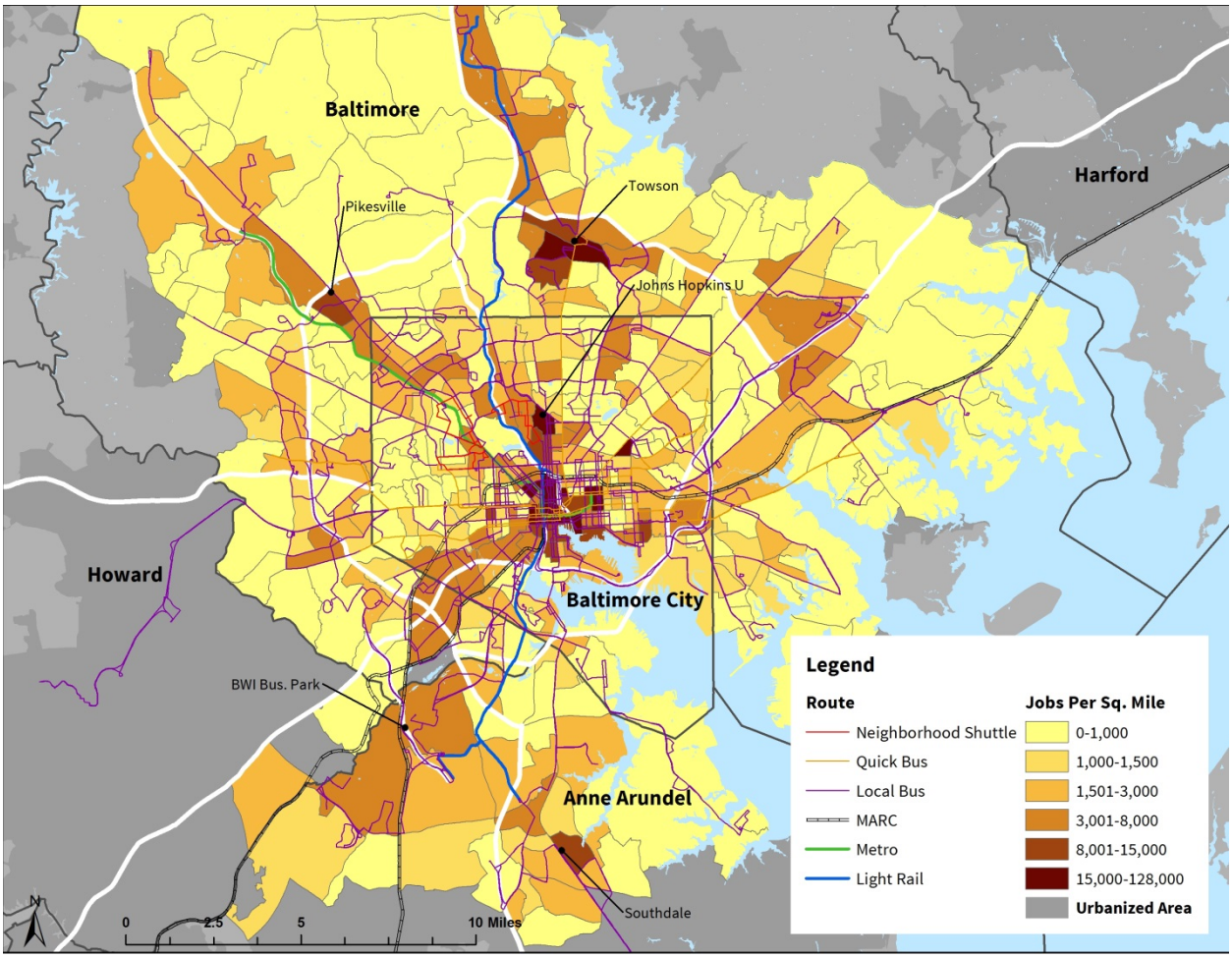
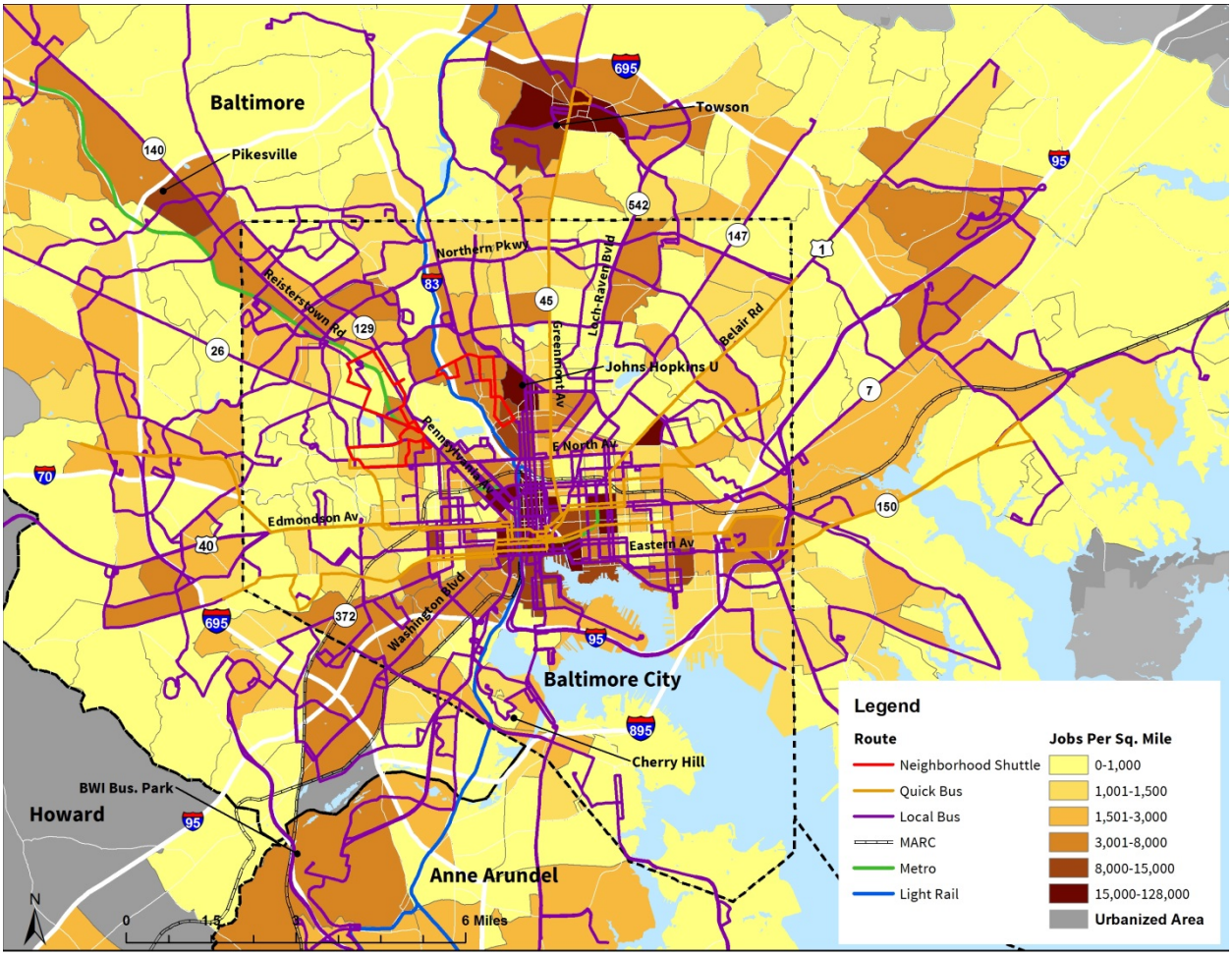


Figure 2.2.12 – 2011 Employment Density (Within Baltimore Beltway)



2.2.3 *Transit Propensity*

In order to identify those areas where transit demand is highest, demographic data from the ACS was compiled into a transit propensity index for each census tract within the MTA Core Bus service area. Inputs into this index fell into the categories of population, age, households, income, vehicle ownership, labor force size and commute mode. Overall, 33 different metrics were analyzed, including reviews of the data in the aggregate, by density and as a percentage of the total population. Rates such as the percentage of senior citizens of the total population and density of senior citizens are useful in understanding the composition of each census tract, while the aggregate measures, such as the total senior citizen population, indicate the absolute potential for travel in general and transit trip making in particular. **Table 2.2.1** summarizes all of the different metrics involved in generating this index. All densities listed are per square mile.

Table 2.2.1 – Transit Propensity Index Methodology

Category	Measurement
Population	• Total Population • Population Density
Age	• Total Seniors (65+) • Senior Density • Seniors percent of Population • Total Youth (<18) • Youth Density • Youths percent of Population
Households	• Total Households • Household Density
Income	• Median Household Income • Total Households in Poverty • Percent Households in Poverty • Households in Poverty Density • Total Households between Poverty and Median Income • Percent Households between Poverty and Median Income • Households between Poverty and Median Income Density
Vehicle Ownership	• Total Zero-Car Households • Percent Zero-Car Households • Zero-Car Household Density • Total One-Car Households • Percent One-Car Households • One-Car Household Density
Labor Force	• Labor Force Size • Labor Force Density • Employed Persons • Employed Person Density • Percent Employed
Commute Mode	• Total Commuters • Commuter Density • Total Transit Commuters • Percent Transit Commuters • Transit Commuter Density

For all variables with the exception of Median Household Income, higher values are indicative of greater need and likelihood of transit use. For example, a census tract with a higher senior citizen density or a high number of zero-car households exhibits a greater mobility need and a propensity for transit use. In this analysis, a standardized score has been used to combine the different variables. With this approach for each variable, the block group with the lowest value is assigned a score of zero, while the block group with the highest value is assigned a value

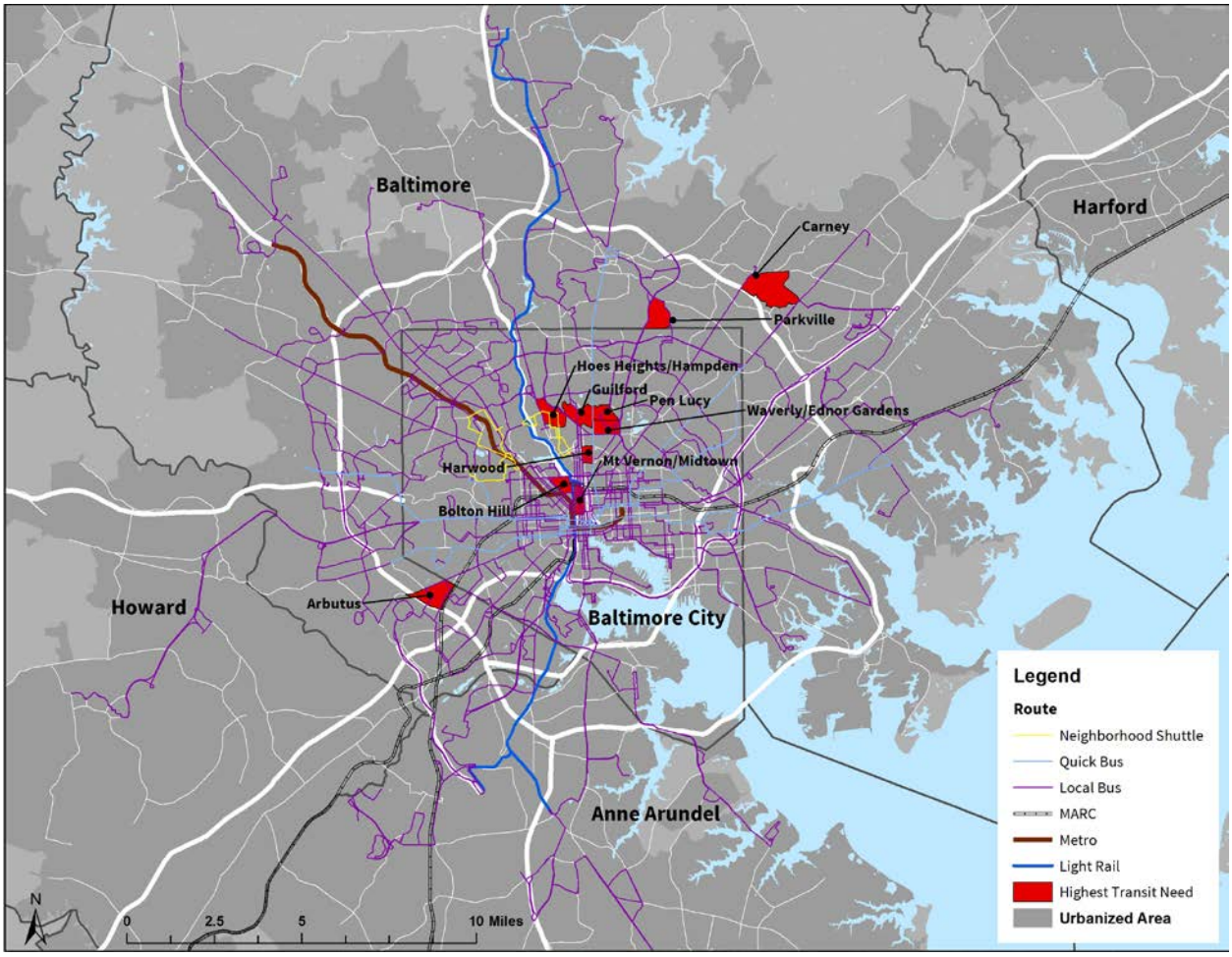
of 100. The other areas are computed by interpolating between maximum and minimum values. These scores can then be added for the 33 variables, where the highest possible score would be 3,300.

The overall scoring of the transit propensity metrics ranged from a low of 335 to a high of 3,167. In order to display the results on a map, the scores were geocoded and the index was then broken up into four categories: low, medium, high and very high. An equal number of census tracts were placed into each category to adjust the index to the service area. Overall, neighborhoods in Baltimore City north of Downtown had the highest transit propensity, along with three areas in Baltimore County: Arbutus, Carney and Parkville. **Table 2.2.3** details the ten highest areas of need by census tract, while **Figure 2.2.13** illustrates their locations.

Table 2.2.3 – Top Ten Transit Propensity Scores

Census Tract	Overall Transit Need Score (33 Factors)	Location
24510140100	3,167	Bolton Hill, Baltimore City
24510130700	3,091	Hoes Heights/Hampden, Baltimore City
24510090100	2,979	Pen Lucy, Baltimore City
24510120100	2,967	Guilford, Baltimore City
24510120300	2,914	Harwood, Baltimore City
24005411407	2,886	Carney, Baltimore County
24510110200	2,870	Mt Vernon/Midtown, Baltimore City
24510090300	2,869	Waverly/Ednor Gardens, Baltimore City
24005430900	2,853	Arbutus, Baltimore County
24005491401	2,825	Parkville, Baltimore County

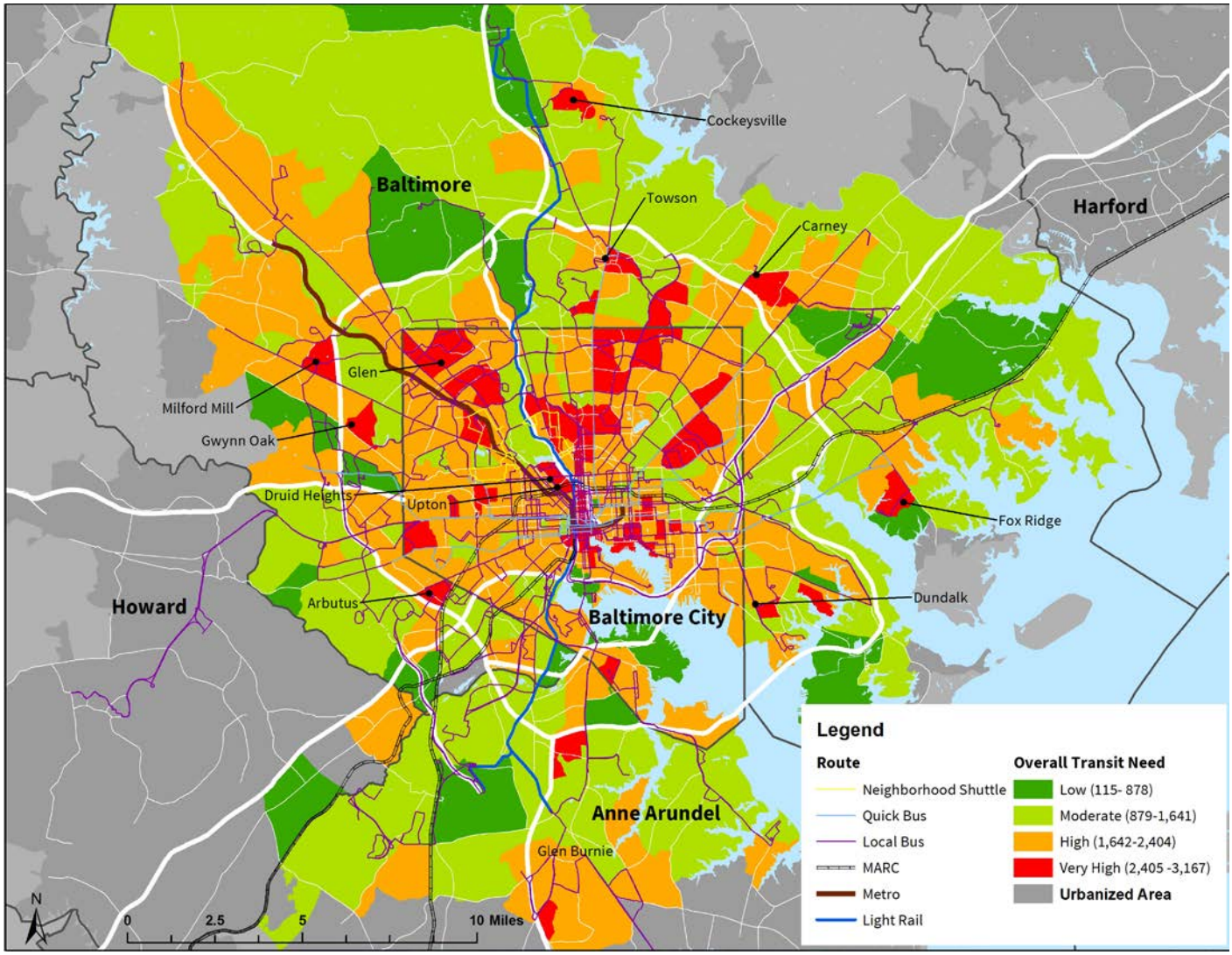
Figure 2.2.13 – Top Ten Transit Propensity Score Census Tracts



Overall, as shown in **Figure 2.2.14**, the majority of census tracts with a very high propensity for transit fell within Baltimore City where population densities are highest and incomes and vehicle ownership is lowest. Outside of those areas with the top ten scores, neighborhoods just west of Downtown (including Upton and Druid Heights) and in northwest Baltimore (Glen) had the highest transit propensities. Several outlying areas in Baltimore County and Anne Arundel County outside of the top ten also had very high transit propensities, including Dundalk, Fox Ridge, Cockeysville, Milford Mill, Gwynn Oak and southern Glen Burnie.

One limitation of the transit propensity analysis is that, particularly outside of Baltimore City, the census tracts are quite large. Therefore, even if a part of the tract would have a high propensity, that gets outweighed by the majority of the tract that does not have a high propensity. Because census tract boundaries usually coincide with the jurisdictional boundary, transit propensity just outside the city line may be understated.

Figure 2.2.14 – Transit Propensity in the MTA Core Bus Service Area



2.2.4 Future Population Density and Employment

Population and employment projections for the year 2020 are based on the Round 7c Cooperative Forecasts from the Baltimore Metropolitan Council (BMC). These projections are made at the Traffic Analysis Zones (TAZs) level for travel demand modeling purposes. TAZs in the BMC district generally represent geographies smaller than census tracts, with exact sizes determined by population and employment density.

2.2.4.1 Future Population Density

In order to highlight areas where population densities are projected to increase, the raw change in population per square mile was calculated. Overall, the MTA service area is projected to increase in population by approximately 387,000 between 2010 and 2020, though this increase is not uniform across the region. Many TAZs are projected

to lose population, while others are expected to gain a significant amount of population. Within the City of Baltimore, much of the northeast and northwest portions of the city are projected to have decreases in population and therefore population density, while neighborhoods closer to Downtown such as West Baltimore and Brewers Hill are expected to increase in density. Given that the MTA system centers on the Downtown, much of the increase in population density will be within TAZs with existing service. Outside of the City of Baltimore projected changes in population density are more uniform, with much of Baltimore County, Anne Arundel County and Howard County projected to have modest increases in population density up to 100 people per square mile. **Figures 2.2.15** and **2.2.16** illustrate projected change in population density between 2010 and 2020.

Figure 2.2.15 – Projected Change in Population Density, 2010-2020

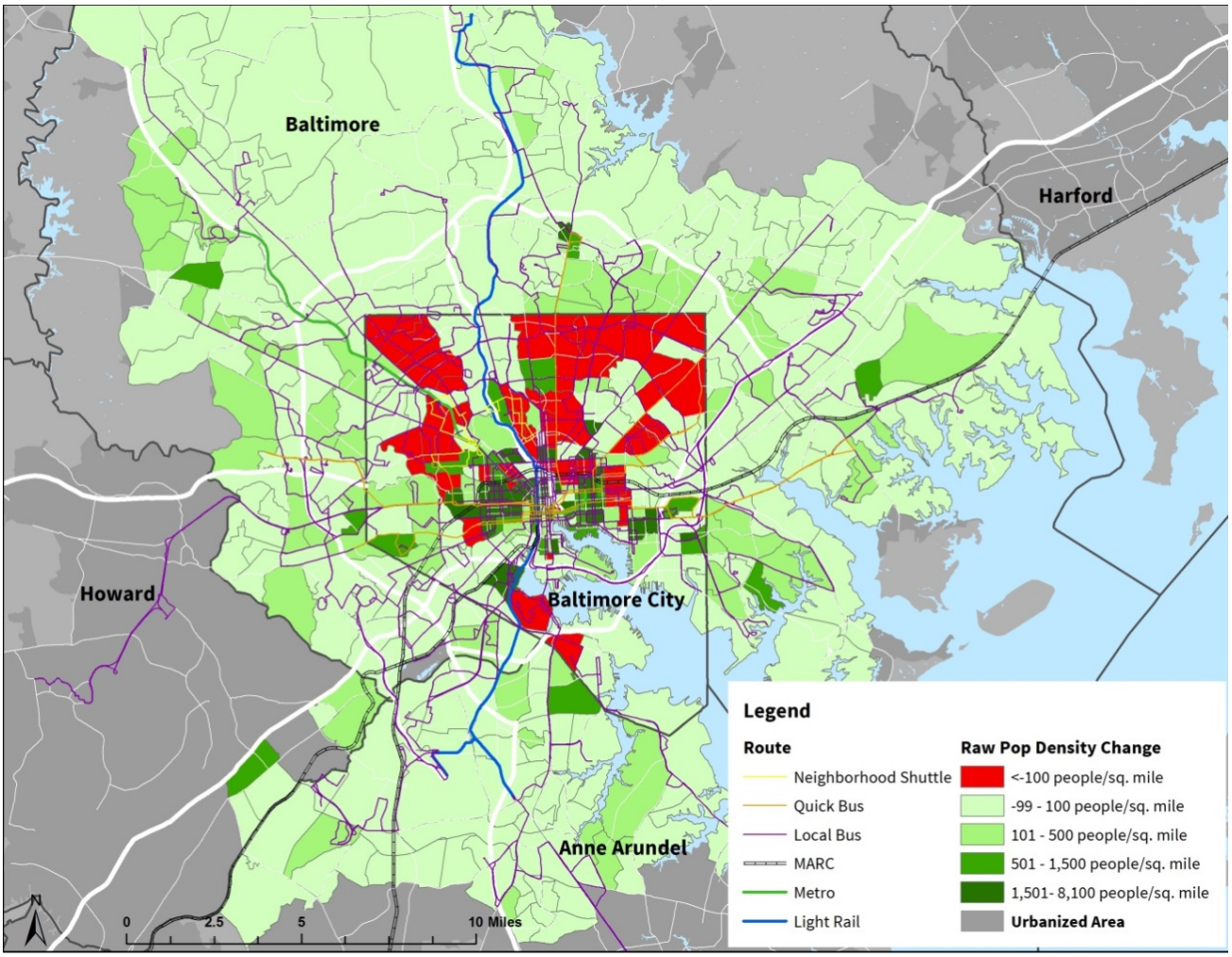
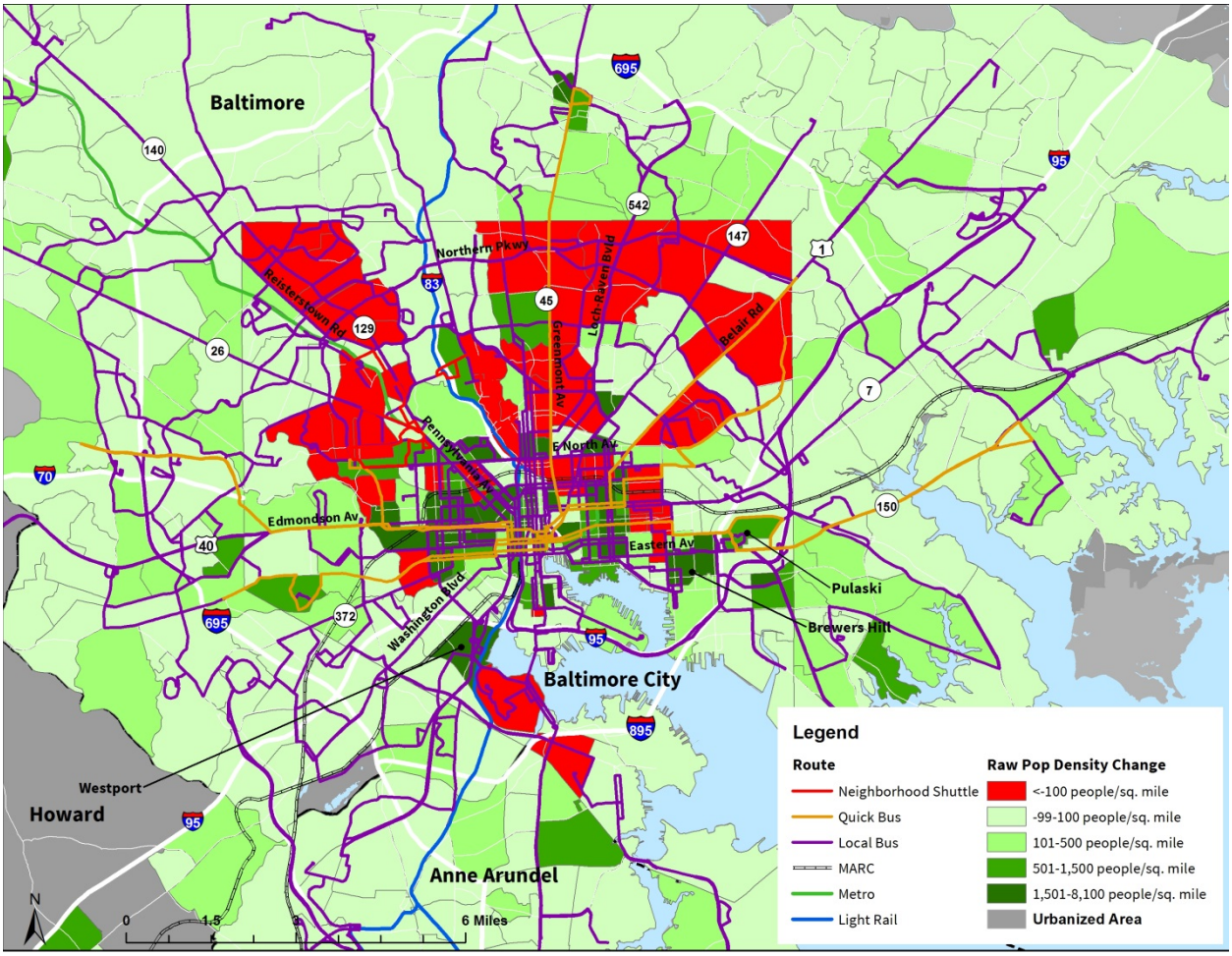


Figure 2.2.16 – Projected Change in Population Density, 2010-2020 (Within Baltimore Beltway)



2.2.4.2 Future Employment

Projected changes in employment were calculated to show high and low employment growth areas in the MTA service area. Overall, the region is expected to add approximately 364,000 jobs between 2010 and 2020, though like population, this growth is not uniform across the region. Significant increases in employment are projected in several outlying TAZs that have limited MTA service in both Baltimore and Anne Arundel Counties. These areas include Reisterstown and Martin Airport in Baltimore County and Curtis Bay and west of BWI Thurgood Marshall Airport in Anne Arundel County. Within the City of Baltimore, employment is projected to decrease or grow little within much of the city outside of Downtown, Fell's Point, Canton, Pulaski, Westport and the Johns Hopkins Hospital area. **Figures 2.2.17** and **2.2.18** illustrate raw increases in employment projected between 2010 and 2020.

Figure 2.2.17 – Projected Change in Employment, 2010-2020

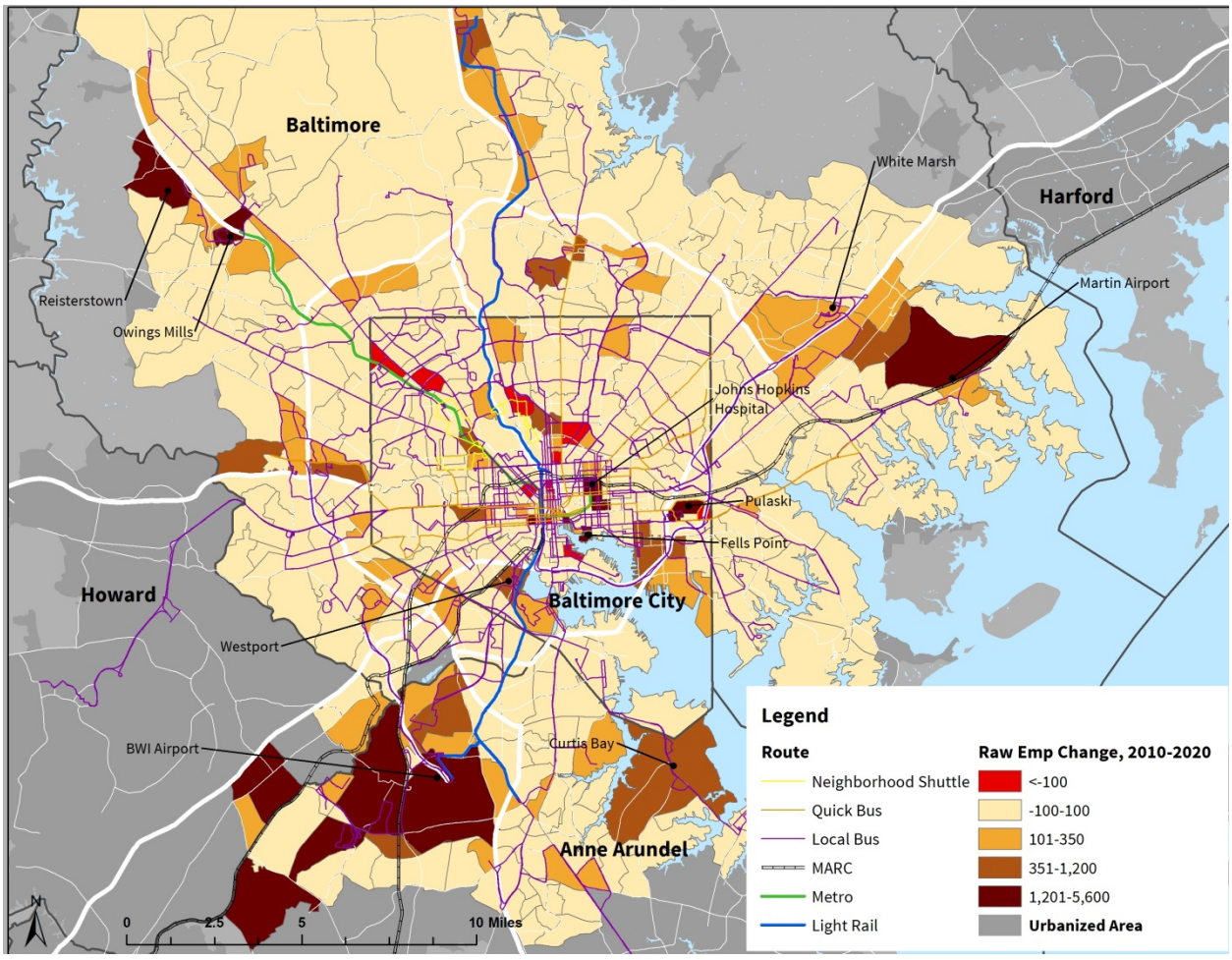
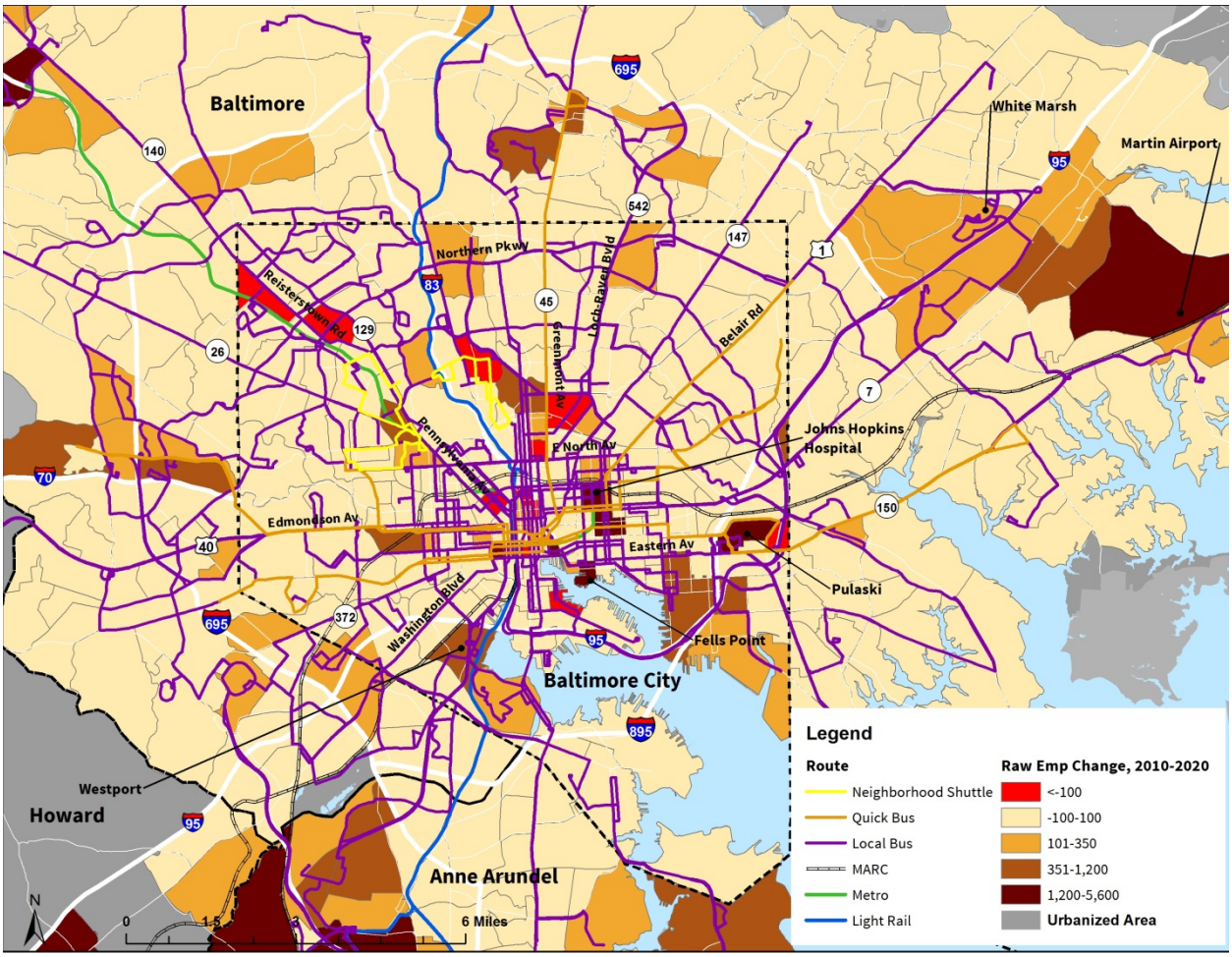


Figure 2.2.18 – Projected Change in Employment, 2010-2020 (Within Baltimore Beltway)



Changes in future employment density between 2010 and 2020 tell a similar story, with large increases projected for several outlying areas and within close proximity to the Baltimore Beltway, including Martin Airport, Reisterstown, Owings Mills, BWI Thurgood Marshall Airport and Towson. Within Baltimore City, large increases in employment density are projected in Fell's Point, Pulaski, Johns Hopkins Hospital, Westport, Cherry Hill, Mondawmin, Johns Hopkins University and Downtown. **Figures 2.2.19** and **2.2.20** illustrate projected increases in employment density between 2010 and 2020 for the Core Bus service area.

Figure 2.2.19 – Projected Change in Employment Density, 2010-2020

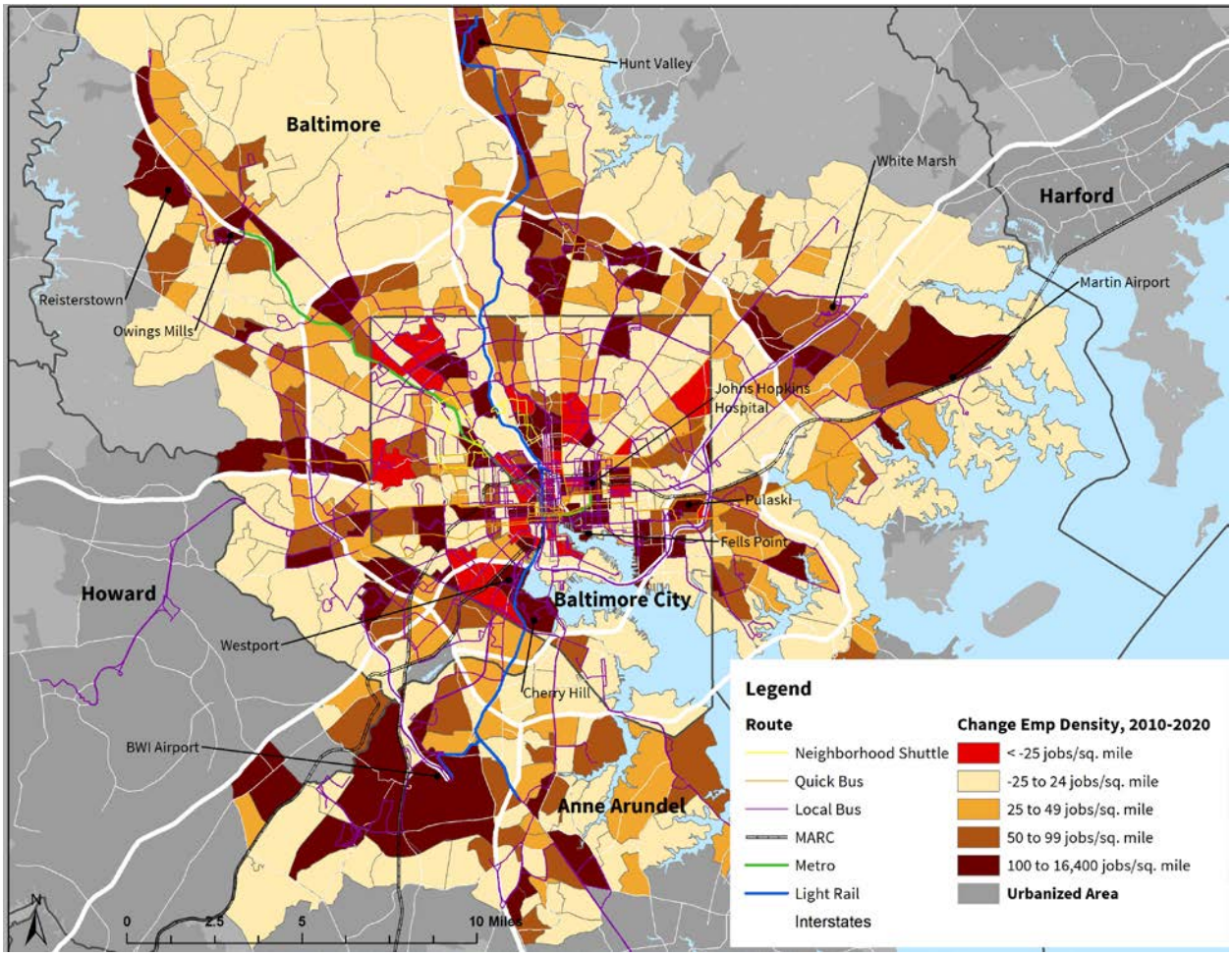
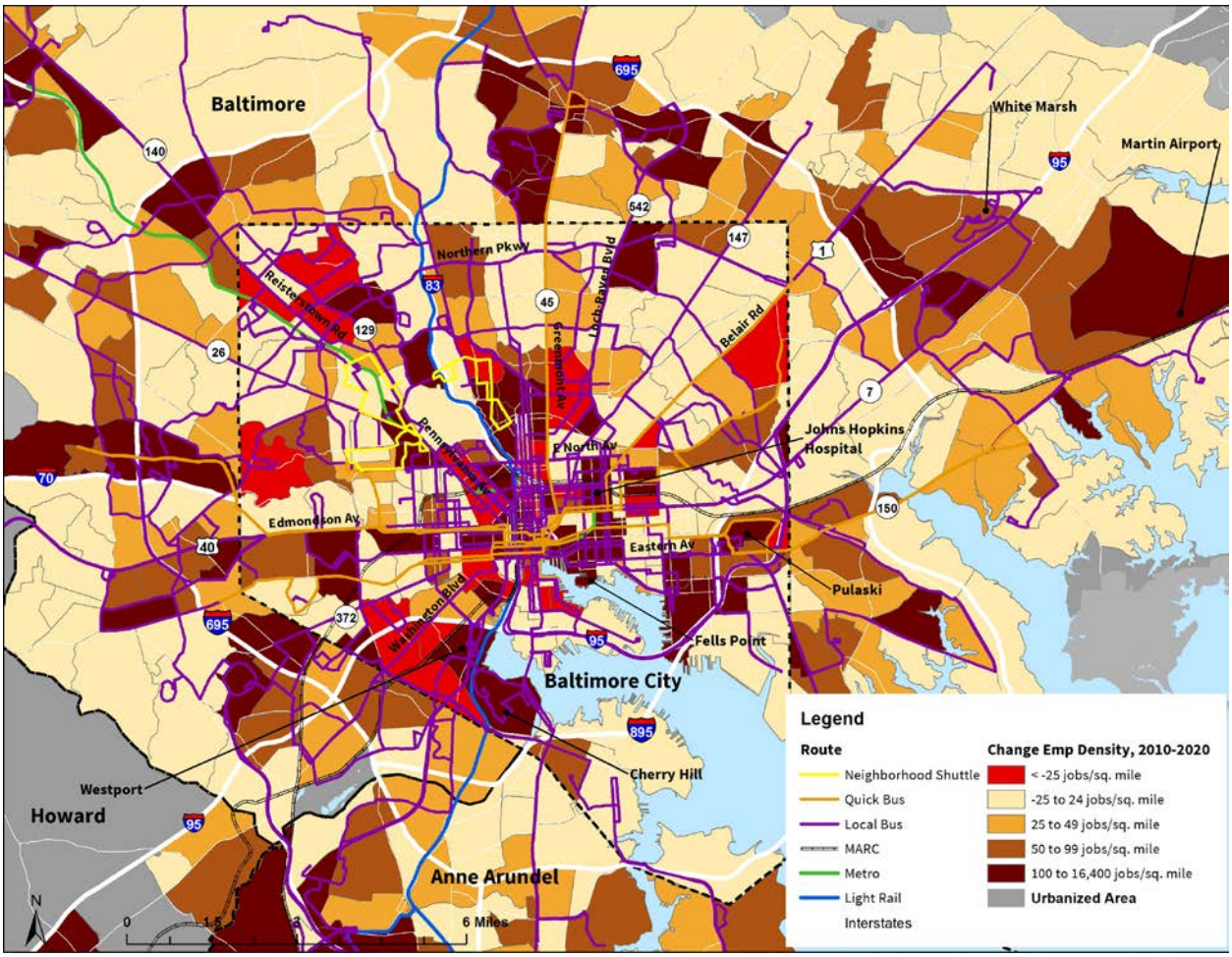


Figure 2.2.20 – Projected Change in Employment Density, 2010-2020

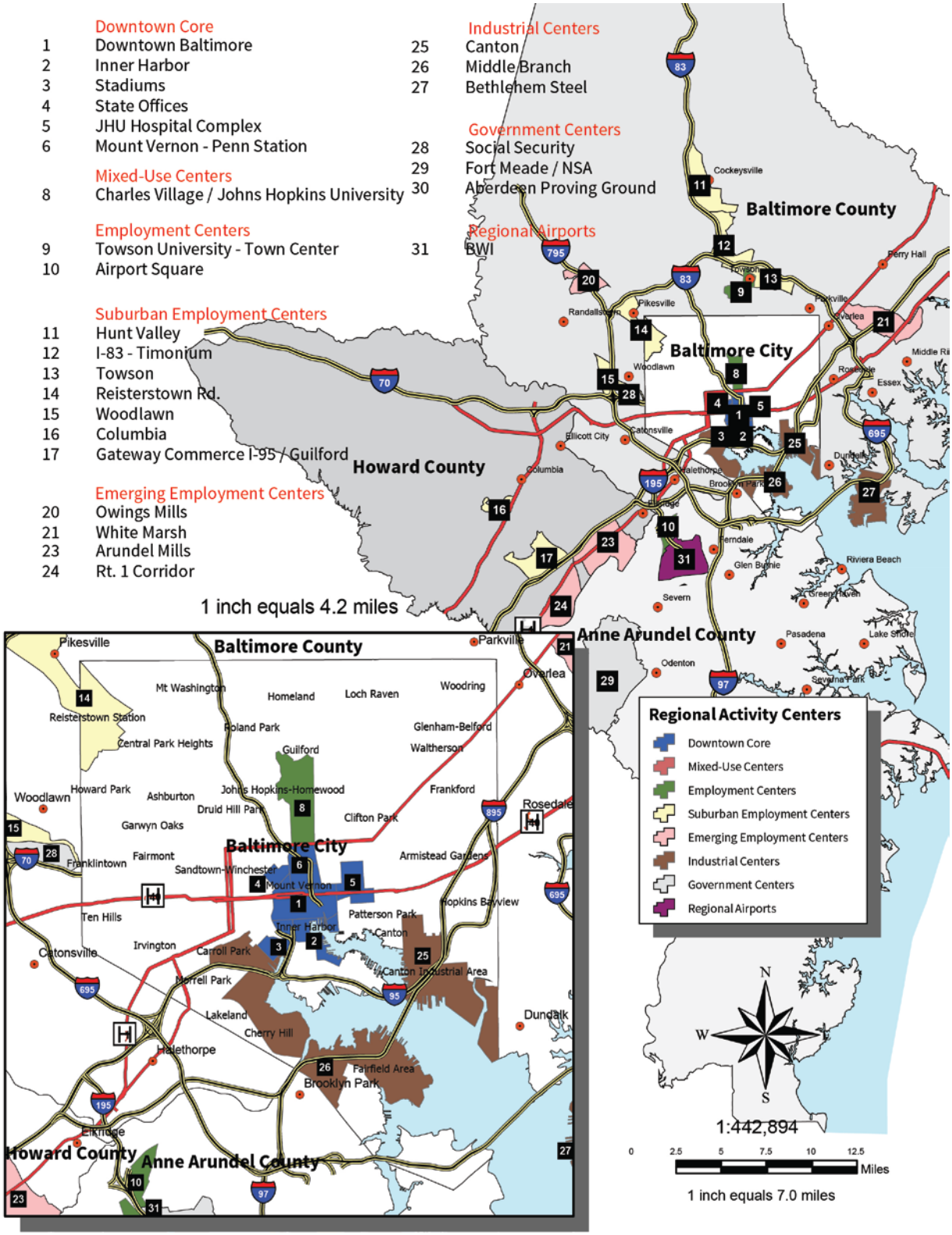


2.3 Travel Patterns

2.3.1 Key Locations within Service Area

Outside of the Maryland suburbs of DC, the Baltimore region forms Maryland's economic and population center. Central Baltimore is home to many of the most important destinations in the region, including the Inner Harbor, Downtown Business District, Johns Hopkins Hospital and the University of Maryland Medical Center. Stretching north of Downtown is a significant corridor that includes Penn Station, Johns Hopkins University and Loyola University Maryland. A number of important commercial centers are located outside the city in surrounding suburbs. White Marsh to the northeast is a major regional retail center. To the north, Towson is home to a major university, shopping center and commercial center, while Hunt Valley, which is further north, features a large business park and shopping center. Owings Mills, to the northwest of Baltimore, is another important retail and commercial destination. To the west the area along Security Boulevard is home to Security Square Mall, a major regional retail center, and the headquarters of the Social Security Administration, one of the largest employment sites in the region. Finally to the south of Baltimore is the BWI Thurgood Marshall Airport, a major commercial center and the region's gateway to the rest of the country and the world. **Figure 2.3.1** details these and other major regional activity centers for the Baltimore area.

Figure 2.3.1 – Map of Regional Activity Centers (BMC, 2004)



2.3.2 Origin and Destination Patterns

Trip generation data from Version 4.2 of the Baltimore Region Travel Demand Model was used to better understand regional transportation patterns. BMC develops and maintains a regional transportation model that projects existing travel patterns, along with projected travel patterns for future years. The forecasts derived from the model are based on a number of inputs, including a large regional travel survey and projected changes to land use and population (see section 2.2). For this study, projections for 2020 were used, showing the origin and destinations for all of the following trip types:

- Auto trips during the AM peak;
- Transit trips during peak periods;
- Auto trips during off-peak periods; and
- Transit trips during off-peak periods.

The following section maps out each of the four data sets and illustrates the number of trips that end in a particular TAZ, along with trip origin and destination patterns. Note that origin–destination (OD) links with low traffic volume are screened out for visual clarity; in some instances a particular TAZ may have a high volume of trips ending there but no apparent links due to trips to that TAZ being widely distributed from across the region.

2.3.2.1 Auto Trips during the AM Peak

While transit has a significant modal share across the region, the majority of AM peak trips still occur by automobile and this is expected to continue into 2020. During the AM peak, clear travel patterns emerge with trips concentrated around a number of important regional nodes. The City of Baltimore stands out as the largest destination during the AM peak; auto trips here are concentrated in Downtown Baltimore and at the city's major hospitals and universities – the largest single destination is Johns Hopkins Hospital just east of Downtown. Outside Baltimore a number of major suburban travel nodes appear. Major destinations include Towson, White Marsh, Hunt Valley, Owings Mills, Security Square Mall, the Social Security Headquarters and BWI Thurgood Marshall Airport (BWI).

Strong travel by auto also appears between these major nodes, with the highest auto trip volumes occurring between major suburban destinations and between Downtown Baltimore and nodes in East Baltimore / Bayview, BWI Thurgood Marshall Airport and Towson. Generally, the busiest travel links are relatively short and connect major nodes to nearby TAZs. The major exception is between BWI Thurgood Marshall Airport and Downtown Baltimore, which stands out as a large trip pair with few major destinations in between. **Figure 2.3.2** illustrates projected automobile trip origins and destinations during the 2020 AM peak period, while **Figure 2.3.3** illustrates the 500 highest volume automobile origin-destination pairs for the 2020 AM peak period.

Figure 2.3.2 – AM Auto Trips Projected for 2020 – Destinations by Number of Trips / Trip Pairs by Volume

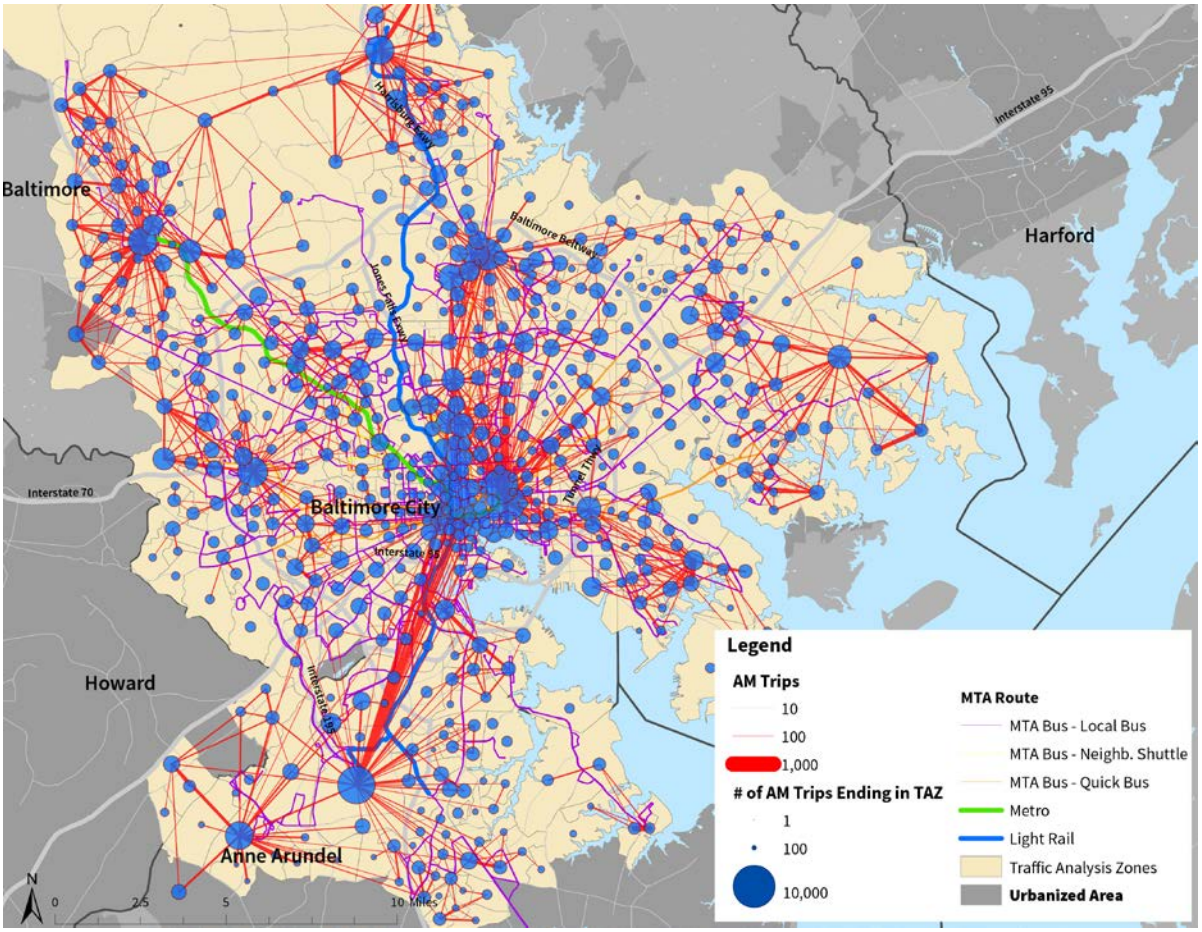
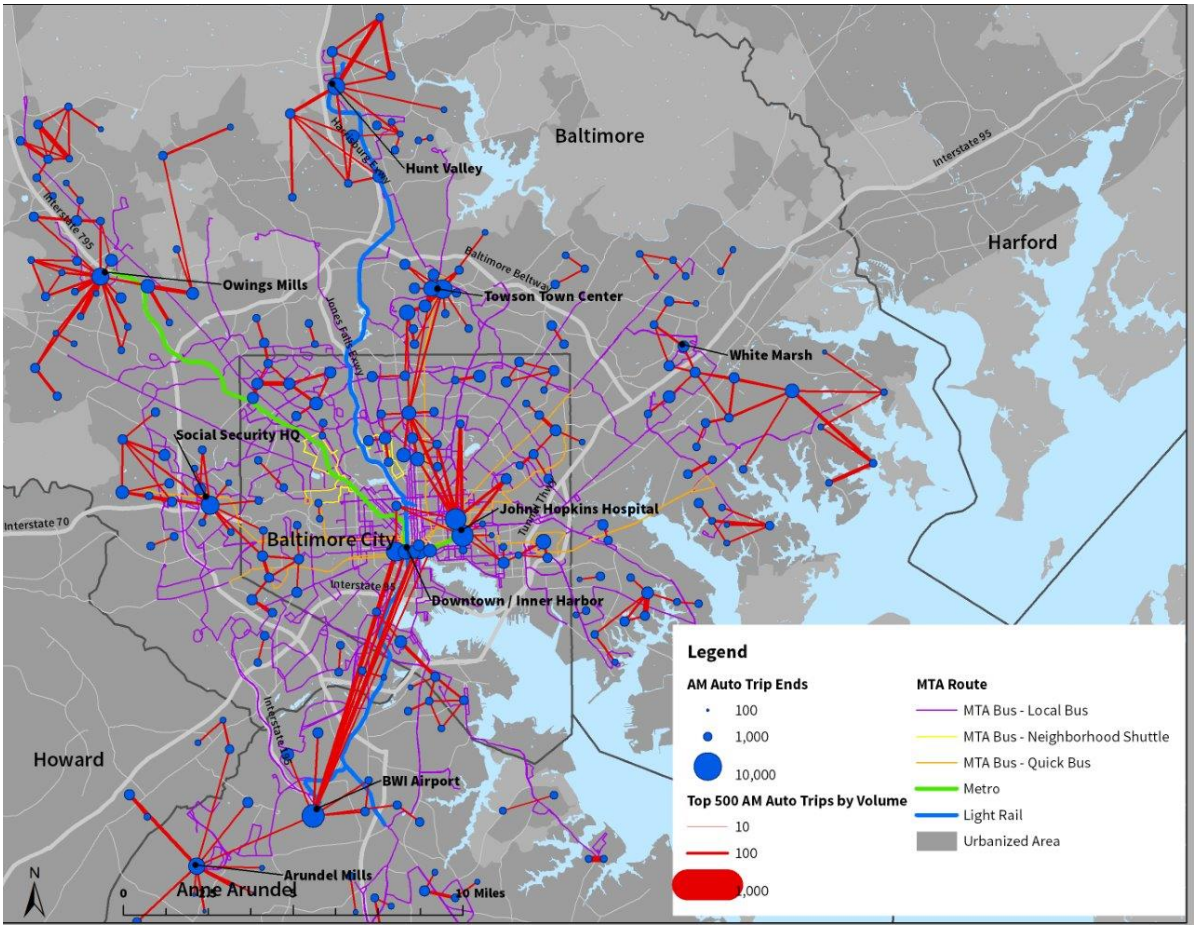


Figure 2.3.3 – AM Auto Trips Projected for 2020 – 500 Highest Volume Origin Destination Pairs



2.3.2.2 Auto Trips during the Off-Peak Period

Outside the peak commute periods, automobile travel patterns are much more evenly distributed across the region, a pattern expected to continue into 2020. Distinct trip patterns are difficult to discern because trip destinations are not concentrated in a few areas as with the peak period. Generally the highest density of trips end in Downtown Baltimore and the Inner Harbor, with major suburban commercial centers also attracting a high volume of off-peak auto trips. Nodes that stand out as significant off-peak destinations include: Central Towson, Owings Mills, Arundel Mills and BWI Thurgood Marshall Airport. **Figure 2.3.4** illustrates off-peak automobile trips projected for 2020 while **Figure 2.3.5** illustrates the top 500 highest volume off-peak automobile trip pairs projected for 2020.

Figure 2.3.4 – Off-Peak Auto Trips Projected for 2020 – Destinations by Number of Trips / Trip Pairs by Volume

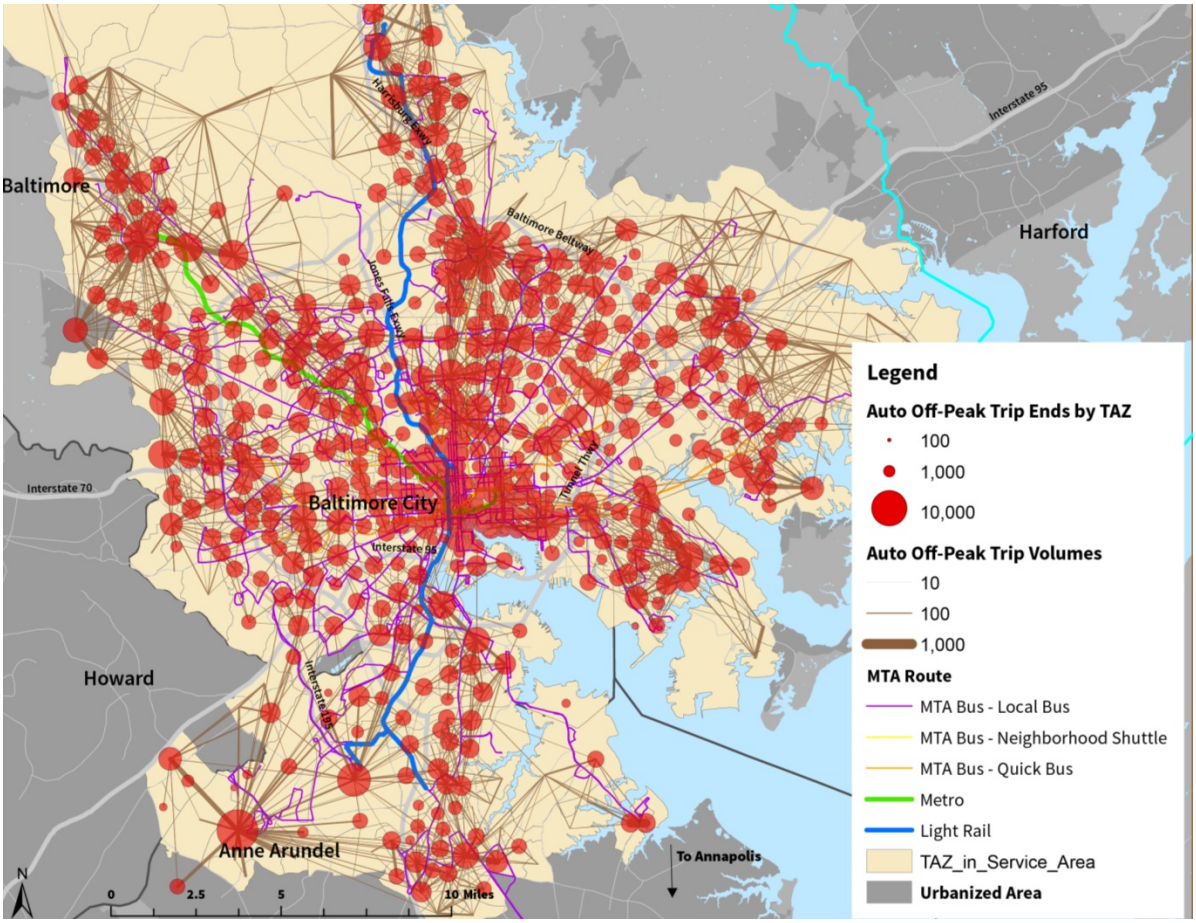
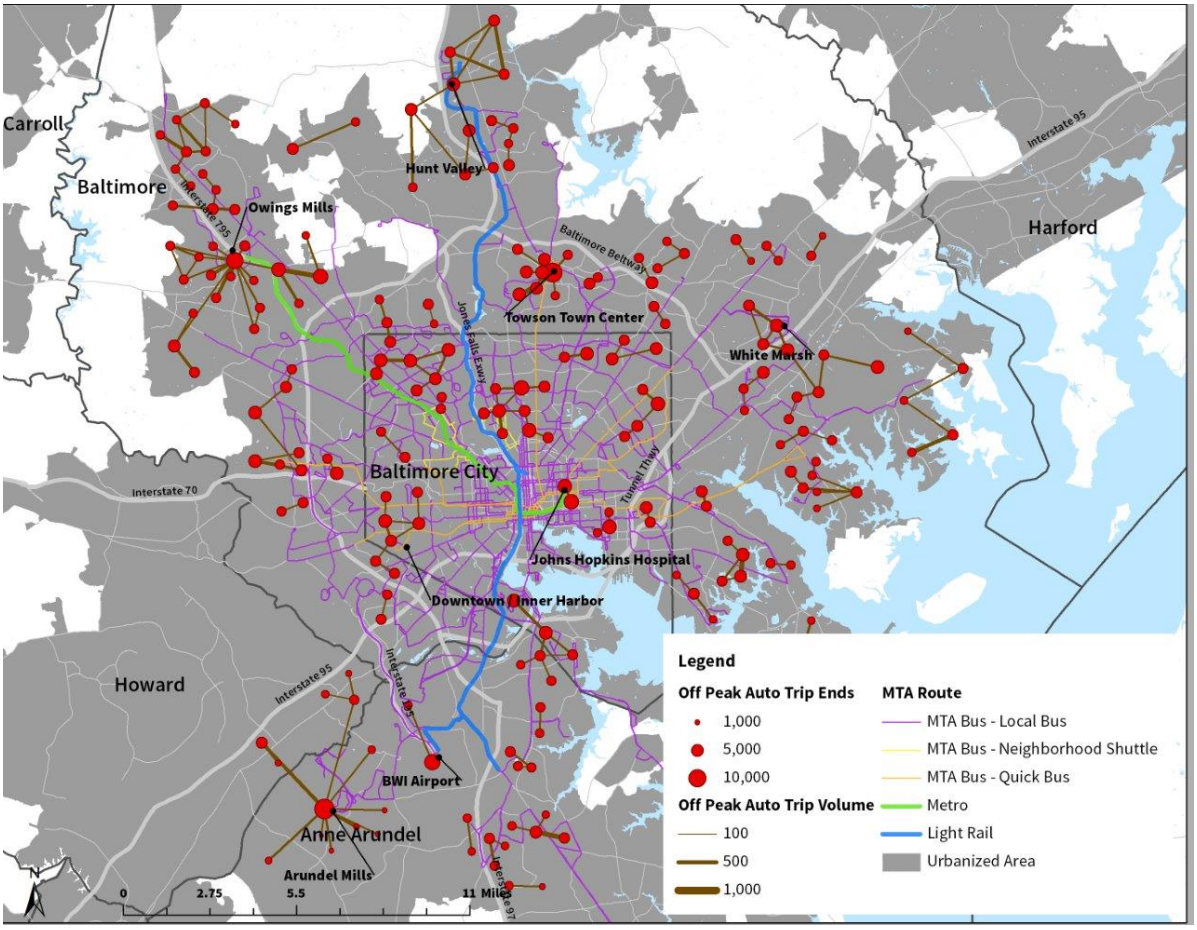


Figure 2.3.5 – Off-Peak Auto Trips Projected for 2020 – 500 Highest Volume Origin Destination Pairs



2.3.2.3 Peak Period Transit Trips

Compared to auto trips, transit trips during the peak period are much more highly concentrated on central Baltimore. This trend is expected to continue into 2020, although the projections from the travel demand model are a bit misleading, as the transit network that is assumed to be in place in 2020 is essentially the same as in 2010, with the exception of large transit projects contained in Baltimore Regional Transportation Board's constrained long range plan, *Plan It 2035*.[3] Nearly all the highest volume transit destinations are located in Downtown Baltimore, the major medical centers of Johns Hopkins and University of Maryland, and campuses of Johns Hopkins and Loyola University. Outlying destinations with high peak transit flow include Towson, the Security Square Mall, and Hopkins Bayview Medical Center. Generally there are almost no strong origin and destination pairs in the outlying parts of Baltimore City or the suburbs. Even at major suburban transit hubs, there are few clear origin-destination links, suggesting that transit trips to these destinations are widely distributed

[3] Plan It 2035 includes four major transit projects, only the first of which is assumed to be operational in 2020: the Red Line LR; an extension of Metro north from Johns Hopkins Hospital to North Avenue; extensions of the current LR from BWI Airport to Dorsey MARC Station and from the Anne Arundel County line to MD-32; and a proposed new MARC station at Hopkins Bayview Medical Center.

across TAZs (possibly through auto access to transit). The high concentration of transit trips in the core reflect the design of the transit network as the highest level of service are on transit lines radiating from the core. **Figure 2.3.6** illustrates peak period transit trips projected for 2020, while **Figure 2.3.7** highlights the top 500 highest volume peak period transit trip pairs projected for 2020.

Figure 2.3.6 – Peak Transit Trips Projected for 2020 – Destinations by Number of Trips / Trip Pairs by Volume

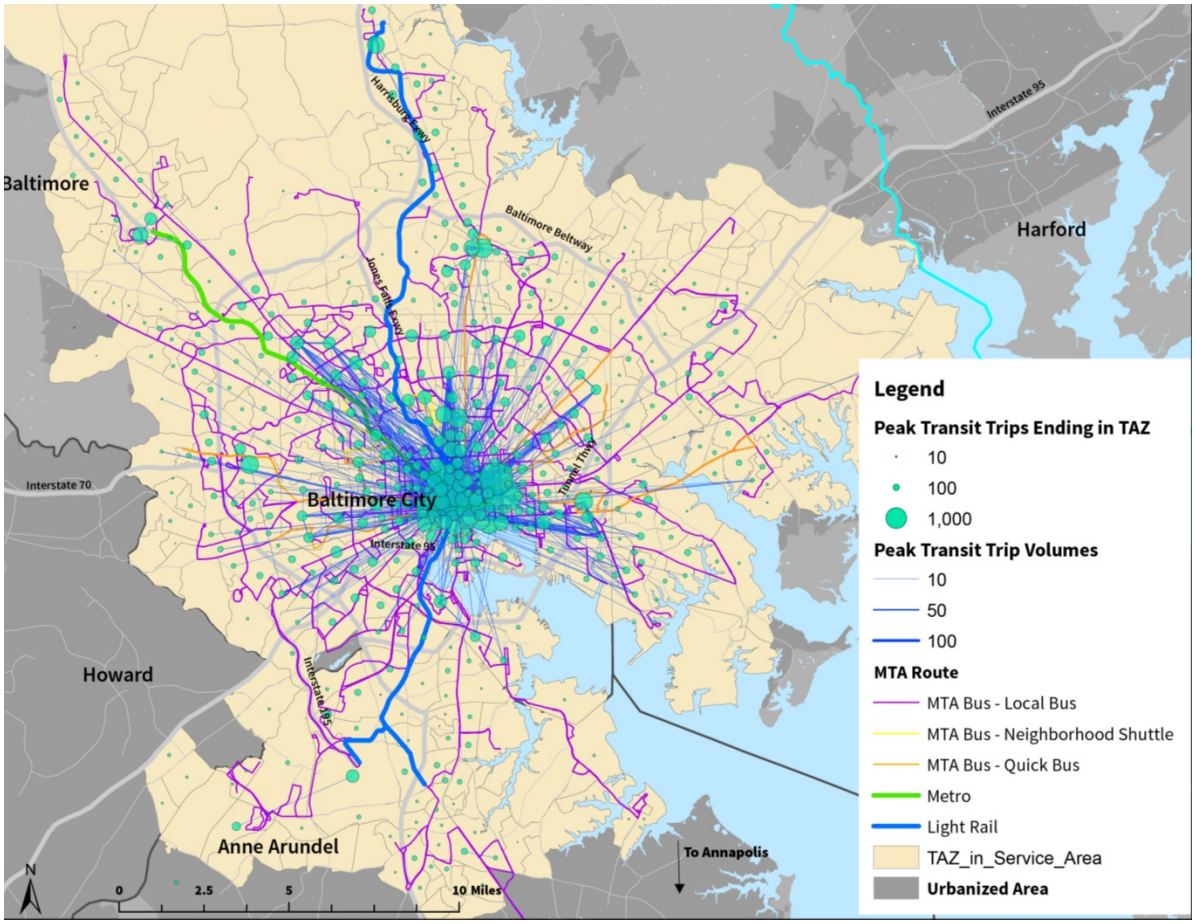
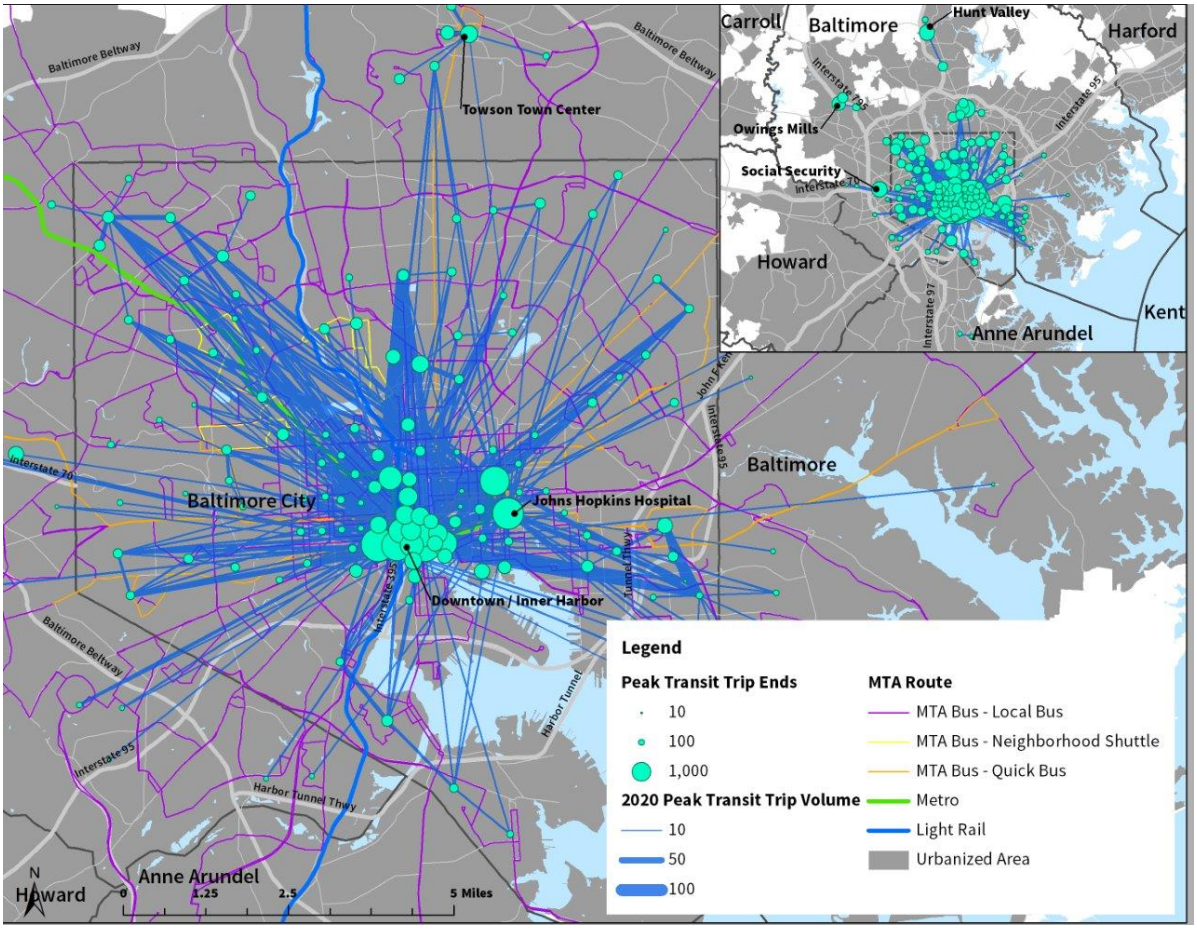


Figure 2.3.7 – Peak Transit Trips Projected for 2020 – 500 Highest Volume Origin Destination Pairs



2.3.2.4 Off-Peak Period Transit Trips

Off-peak transit trip patterns closely mirror travel patterns during the peak period and this trend is expected to continue into 2020. As with peak-transit trips, during the off-peak most trips are focused on central Baltimore, with few suburb to suburb trips. **Figure 2.3.8** illustrates off-peak transit trips projected for 2020, while **Figure 2.3.9** illustrates the top 500 highest volume off-peak transit trip pairs projected for 2020.

Figure 2.3.8 – Off-Peak Transit Trips Projected for 2020 – Destinations by Number of Trips / Trip Pairs by Volume

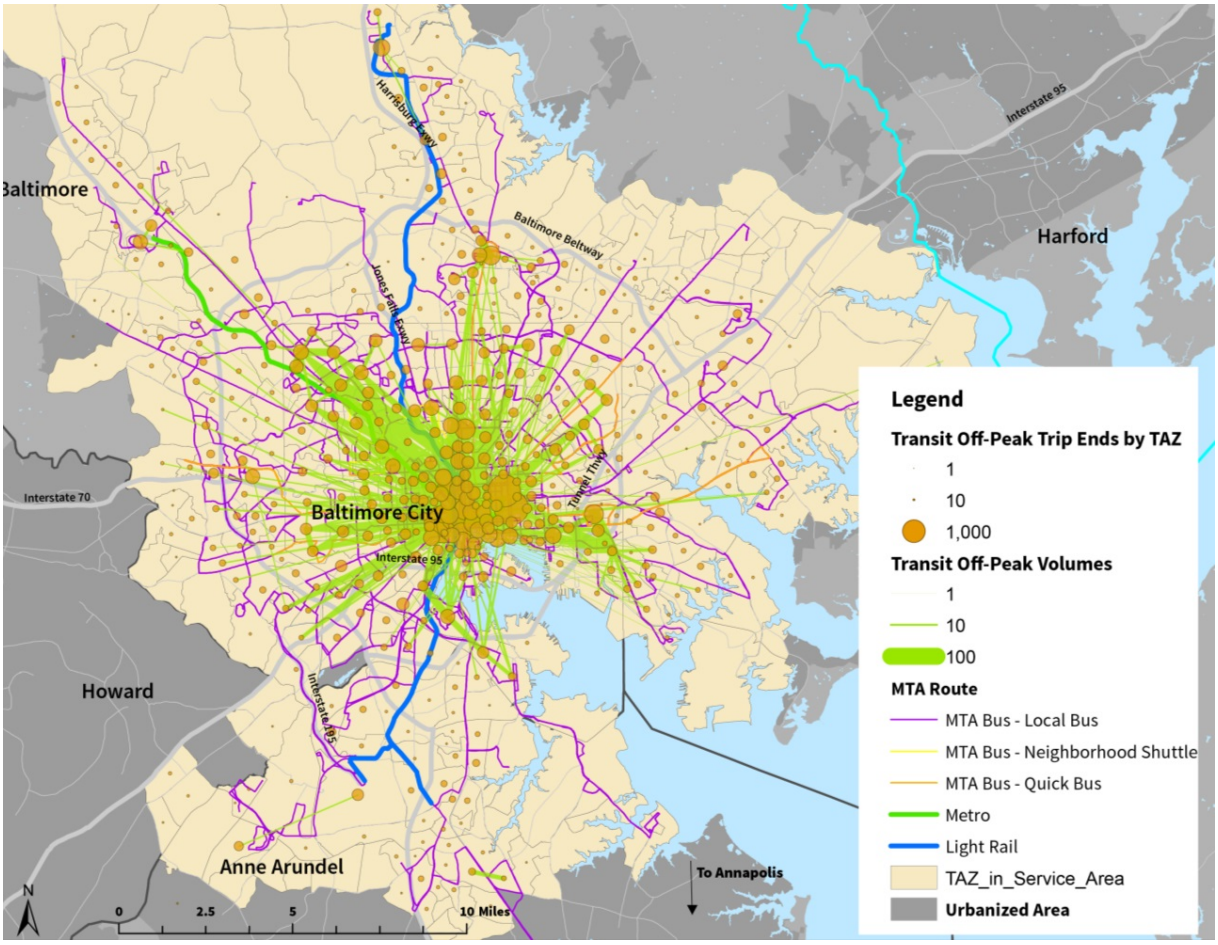
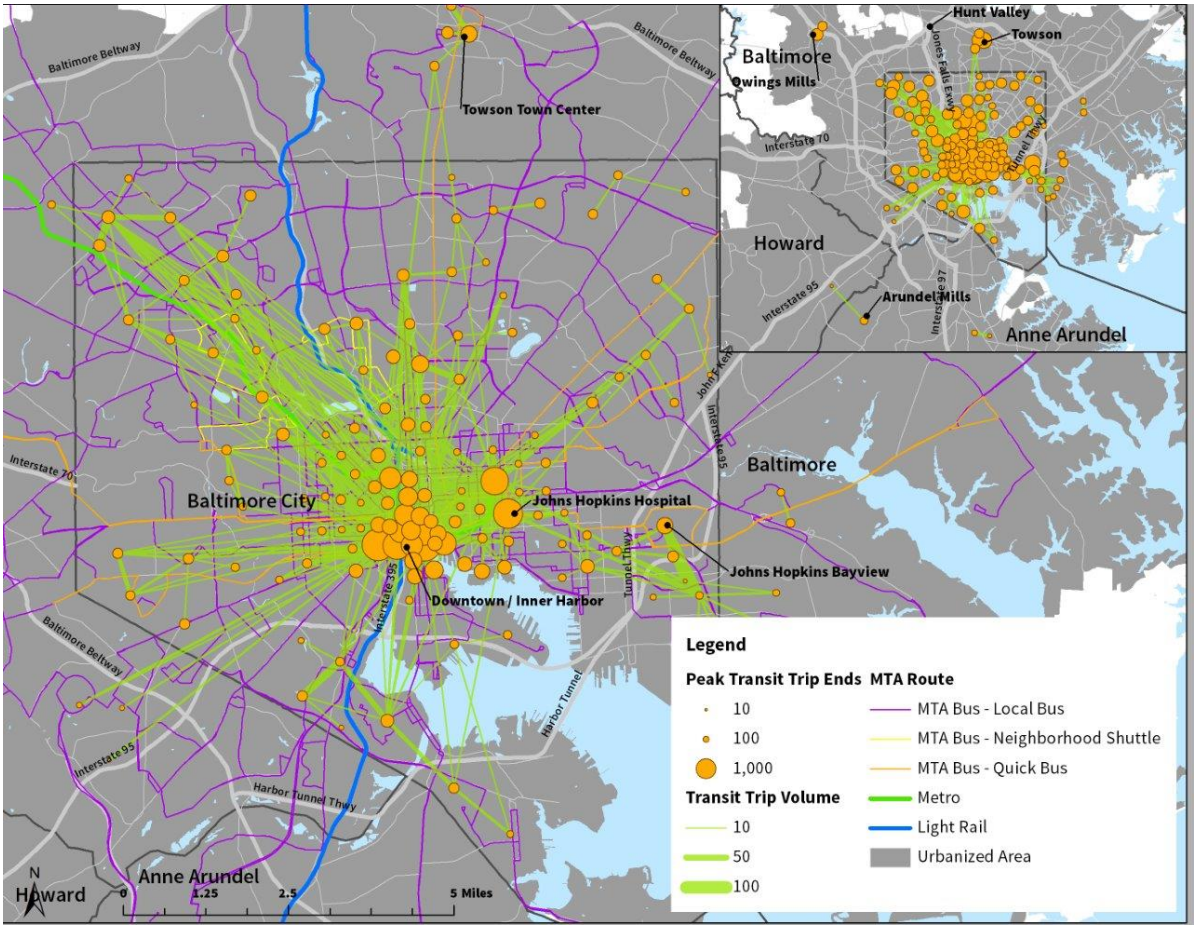


Figure 2.3.9 – Off-Peak Transit Trips Projected for 2020 – 500 Highest Volume Origin Destination Pairs



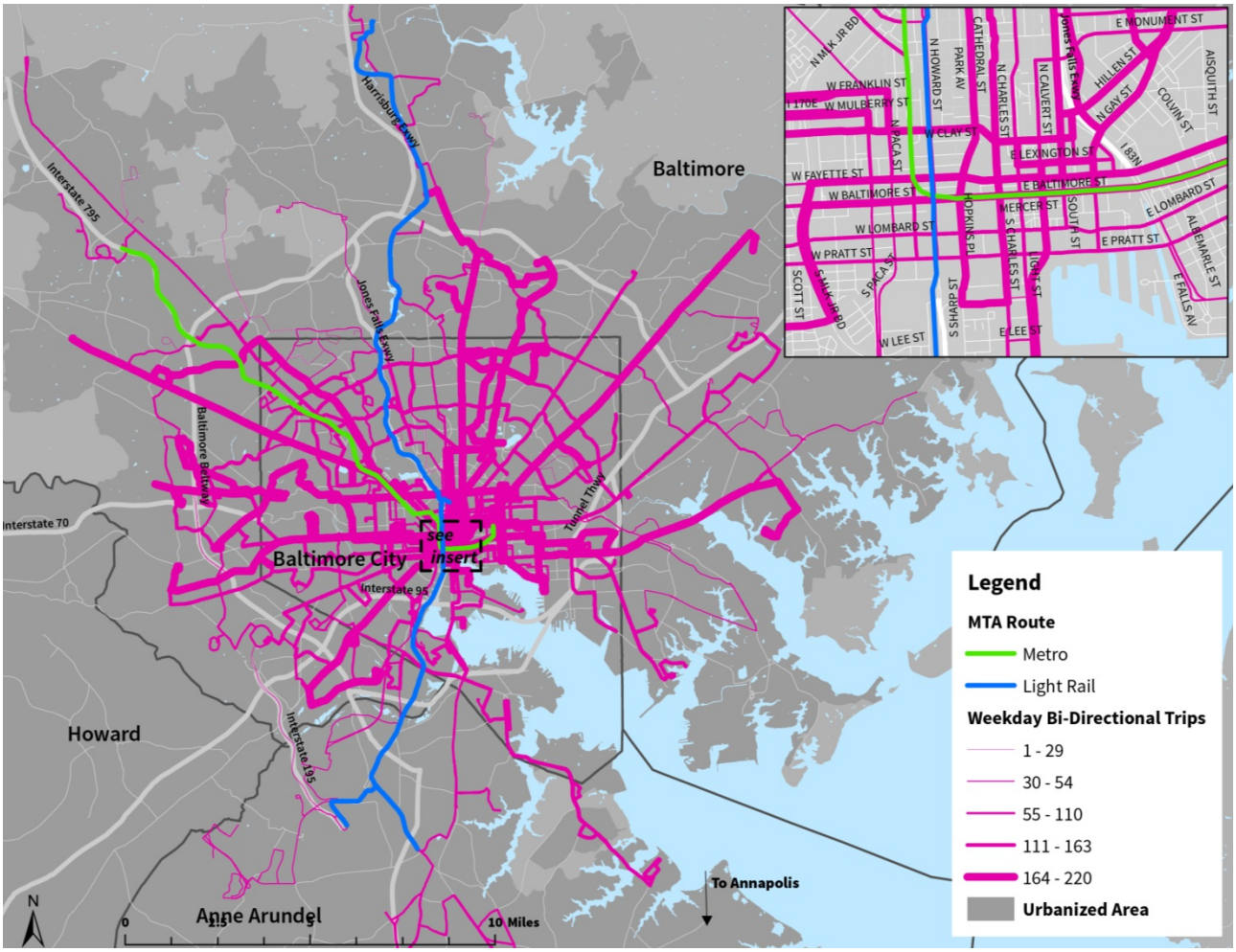
2.4 Operating Characteristics and Performance

2.4.1 Basic Line Characteristics

2.4.1.1 Service Coverage

Baltimore has an extensive bus network that reaches nearly every corner of the city and into a significant portion of the surrounding Baltimore County. A number of lines provide 24 hour service, while most lines operate on both the weekday and weekend. Few lines run at headways of less than 10 minutes; however in the core area many routes overlap, providing high-frequency effective headways. As **Figure 2.4.1** illustrates, bus service is fairly extensive on the typical weekday, with some key corridors featuring service of 150 buses/day or greater. High frequency bus routes radiate from Downtown Baltimore in nearly every direction. However, compared to radial routes, crosstown service operates less frequently.

Figure 2.4.1 – Weekday Bus Volumes (Bi-Directional)



There is a significant decrease in service on Saturday, especially on routes operating from Downtown toward the southwest of Baltimore. The north-south corridor along York Road stands out as the only corridor to maintain weekday levels of service on the weekends. In Downtown Baltimore, service frequencies remain relatively high. Sunday service is more infrequent when compared to Saturday service. No bus route in the system features more than 148 trips per day. Generally, service on Sundays, as on Saturdays, is best in the core of the city. **Figures 2.4.2** and **2.4.3** illustrate Saturday and Sunday bi-directional bus volumes respectively.

Figure 2.4.2 – Saturday Bus Volumes (Bi-Directional)

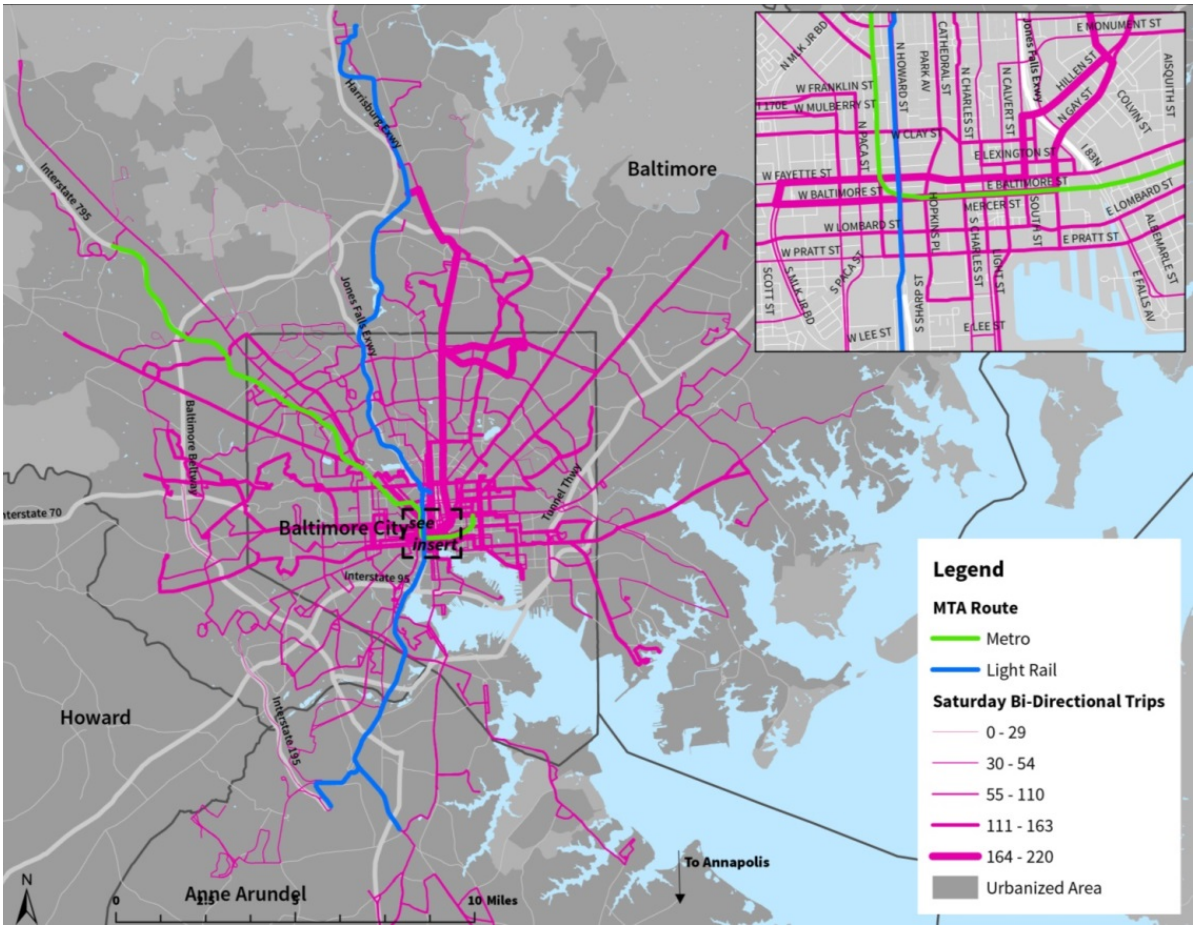
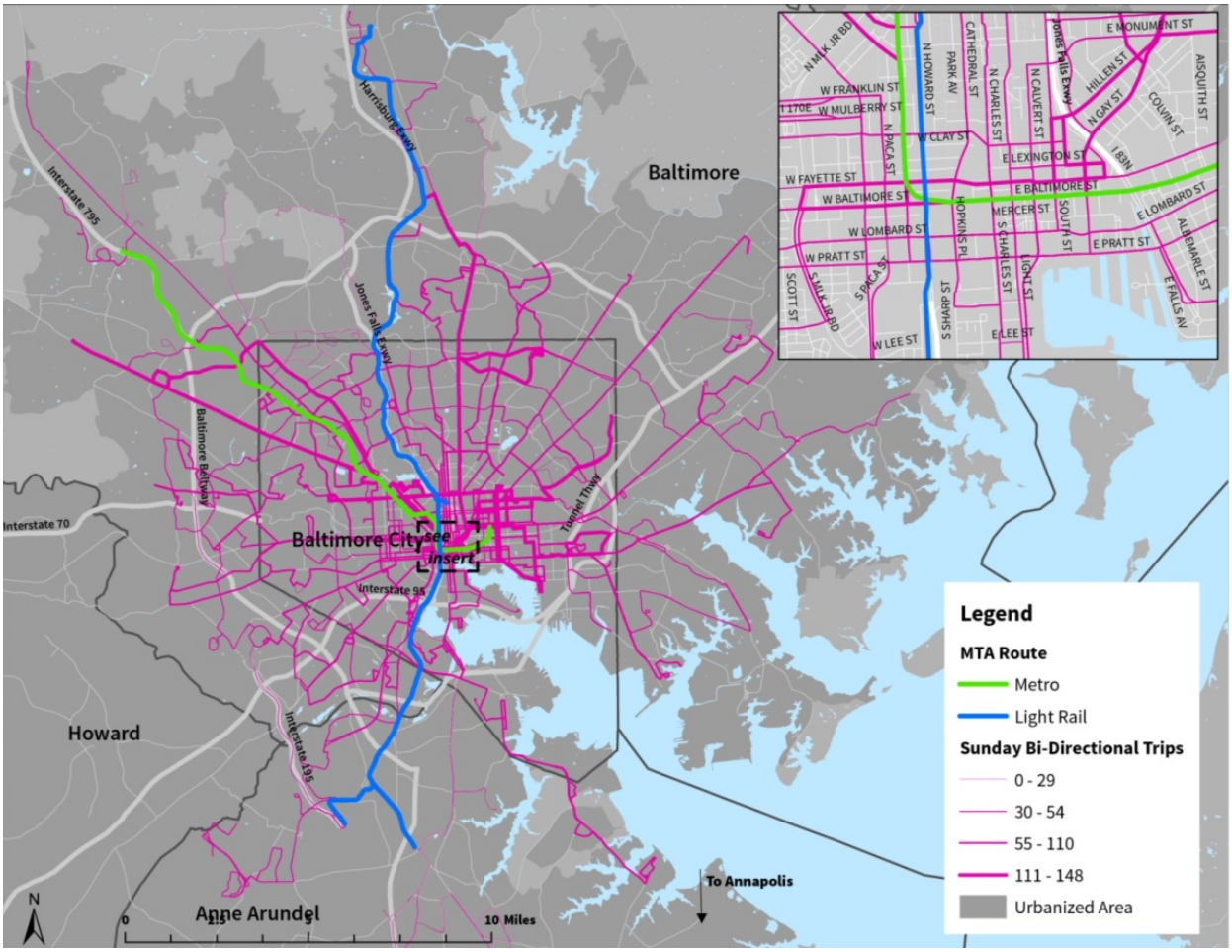


Figure 2.4.3 Sunday Bus Volumes (Bi-Directional)



2.4.1.2 Peak Headway and Span

While the maps in the previous section quickly illustrate the quality of transit coverage, they do not provide the full picture of how well Core Bus routes service the market. Core Bus service provides a good span of coverage but generally does not provide a high frequency of service. Ten routes operate at a peak headway of 10 minutes or better, the qualification for a headway level of service (LOS) rating of A.[4] The majority of routes operate at headways between 10 and 30 minutes (LOS for B,C, and D ratings). Long and inconsistent headways require riders to consult a schedule, make transferring more difficult, and often deter choice riders. **Figure 2.4.4** summarizes the distribution of peak period headways.

The MTA's Core Bus services provide a relatively good service span for riders. A number of routes achieve a span LOS of A (19 to 24 hour service span). The majority of routes provide both daytime, late night and weekend service, and 13 routes operate 24 hours a day, seven days a week. **Figure 2.4.5** summarizes the number of routes operating by time period.

Figure 2.4.4 – Routes by Peak Period Headway

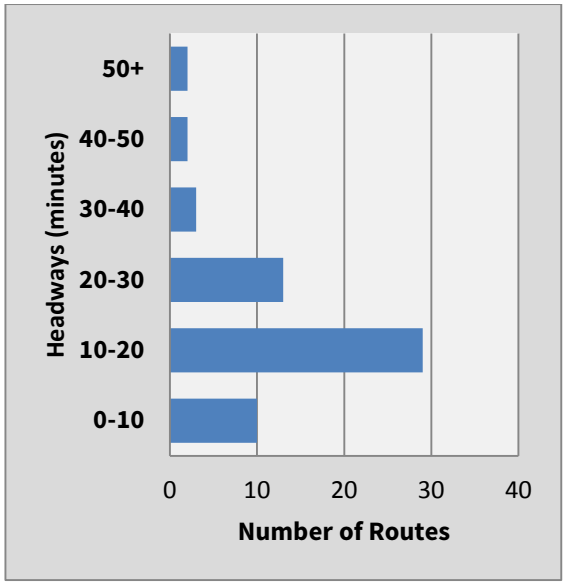


Figure 2.4.5 – Number of Routes Operating Per Period [5]

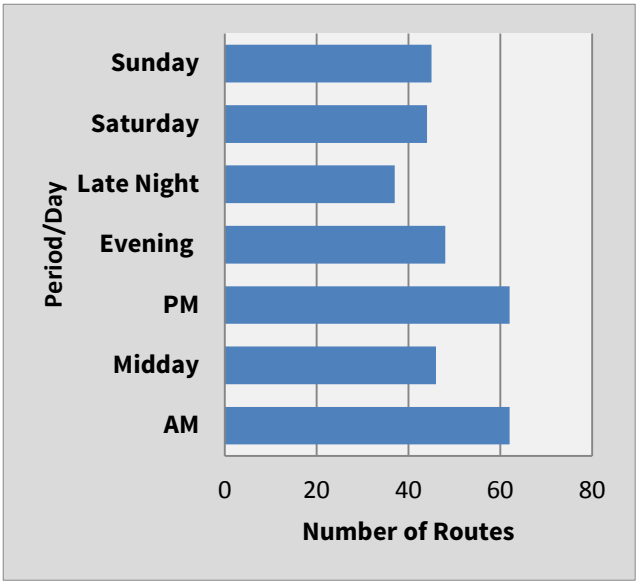


Table 2.4.1 details the basic line characteristics of each Local Bus route, including starting and ending locations, span of service and average headways by time period.

[4] Definitions from Transit Capacity and Quality of Service Manual, 2nd Edition, 2003.

[5] Service time period definitions for PM peak, evening and late night used here differ from standard time definitions used in the rest of the report. Peak: 3PM – 7PM, Evening: 7PM – 12AM, Late Night: 12AM – 6AM. In instances where a route only provided one or two runs in a given time period, the route was not counted toward providing service in that period. Multiple categories can apply to any given route.

Table 2.4.1 – Basic Route Characteristic – Level of Service

Route	Start Location	End Location	Span of Service*			Average Headway**							Garage
			Weekday	Saturday	Sunday	AM Peak	Midday	PM Peak	Evening	Late Night	Sat	Sun	
Radial Routes													
1	Sinai Hospital	Fort McHenry	4:34 AM - 1:46 AM	5:17 AM - 1:24 AM	5:24 AM - 1:27 AM	17	35	29	30	60	40	60	Bush
3	Sheppard Pratt	Inner Harbor	24 hours	24 hour	24 hour	10	15	14	26	26	15	30	Kirk / Bush
5	Mondawmin Metro	Cedonia	24 hours	24 hours	24 hours	15	15	16	15	24	20	20	Northwest / Eastern
7	Mondawmin Metro	Canton	5:00 AM – 3:03 AM	4:47 AM – 2:33 AM	4:34 AM – 2:13 AM	30	35	30	48	47	35	27	Northwest / Eastern
8	Lutherville LR	University of Maryland TC	24 hours	24 hours	24 hours	9	15	15	15	30	15	20	Kirk / Bush
10	Rolling Road/Paradise	Dundalk / Bull Neck Road	24 hours	24 hours	24 hours	15	15	12	20	40	17	31	Bush / Eastern
11	Towson Town Center	Canton Crossing	5:04AM - 1:18 AM	5:10AM - 3:04 AM	5:10 AM - 1:30 AM	20	30	23	30	60	30	33	Kirk / Bush
15	Security Square Mall	Overlea / Perry Hall	24 hours	24 hours	24 hours	10	14	12	14	33	15	30	Bush / Kirk
18	Glen/Key Avenue	Velvet Valley / Copper Ridge/ Scotts Hill	6:48 AM - 8:59 AM / 3:33 PM - 8:54 PM	-	6:57 AM - 7:23 AM / 12:10 PM - 1:49 PM	7	-	7	*1 trip*	-	-	*3 trips*	Northwest
19	State Center	Carney / Goucher and Taylor	3:57 AM - 2:22 AM	4:36 AM - 2:17 AM	4:26 AM - 2:06 AM	13	15	11	27	40	15	33	Kirk
20	Security Square Mall	CCBC Dundalk / Marine Terminal	24 hours	24 hours	24 hours	15	21	15	20	35	33	61	Bush / Eastern
23	Route 40 / Rolling Road	Fox Ridge	24 hours	24 hours	24 hours	11	15	9	19	45	11	11	Bush / Eastern
27	Reisterstown Plaza Metro	Port Convington	4:29 AM - 2:48 AM	5:17 AM - 3:05 AM	4:55 AM - 3:08 AM	15	40	35	47	60	40	24	Northwest / Bush
30	Edmondson Village	City Hall / Johns Hopkins Bayview	5:18 AM - 6:40 PM	-	-	16	21	15	-	-	-	-	Eastern / Bush
35	White Marsh Mall	UMBC / Blind Industries	4:00 AM - 1:40 AM	4:15 AM - 1:31 AM	5:30 AM - 1:27 AM	17	19	14	25	33	30	30	Bush / Eastern
36	Northern Parkway & York Road	Riverview / Monroe Street	24 hours	24 hours	24 hours	10	15	10	20	29	24	24	Kirk / Bush
53	Old Court Metro	Mondawmin Metro	4:21 AM - 3:17 AM	4:30 AM - 2:11 AM	4:54 AM - 2:11 AM	13	30	13	22	33	24	26	Northwest

Route	Start Location	End Location	Span of Service*			Average Headway**							
			Weekday	Saturday	Sunday	AM Peak	Midday	PM Peak	Evening	Late Night	Sat	Sun	Garage
54	Randallstown	Penn-North Metro	24 hours	24 hours	24 hours	11	17	10	20	38	19	19	Northwest
61	Lake Avenue	Inner Harbor	5:00 AM - 9:52 AM / 2:07 PM - 8:46 PM	-	-	27	-	30	47	-	-	-	Bush
64	Curtis Bay / Energy Parkway	North Avenue	4:29 AM - 2:20 AM	5:01 AM - 2:29 AM	5:02 AM - 2:26 AM	12	30	13	21	41	40	50	Bush
91	Sinai Hospital	City Hall	24 hours	24 hours	24 hours	15	20	14	26	42	23	45	Northwest
Crosstown Routes													
4	Turners Station	C.C.B.C Essex	4:26 AM - 12:28 AM	6:00 AM - 11:39 PM	7:05 AM - 11:35 PM	49	60	48	60	60	60	60	Eastern
13	Walbrook Junction	Canton / Fell's Point	24 hours	24 hours	24 hours	8	10	8	15	40	12	18	Eastern / Northwest
16	Mondawmin Metro	Brookyln Homes	3:38 AM - 1:34 AM	3:50 AM - 12:56 AM	5:48 AM - 11:56 AM	20	30	20	30	60	30	60	Bush / Northwest
21	Mondawmin Metro	Fell's Point	4:30 AM - 1:39 AM	5:00 AM - 12:32 AM	6:55 AM - 11:31 PM	26	40	26	34	60	60	60	Eastern
22	Mondawmin Metro	Johns Hopkins Bayview Medical Center	3:56 AM - 3:29 AM	4:15 AM - 2:34 AM	4:50 AM - 2:36 AM	10	20	9	20	37	30	30	Eastern / Northwest
33	Rogers Avenue Metro	Moravia	5:18 AM - 1:11 AM	5:45 AM - 12:50 AM	7:30 AM - 10:52 PM	9	20	16	28	42	30	60	Northwest / Bush
38	North Bend Loop	Cold Spring Lane / Grandview	6:49 AM - 7:47 AM / 3:04 PM - 3:58 PM	-	-	2 trips	2 trips	-	-	-	-	-	Bush
44	Security Square Mall	Rosedale Industrial Park	3:45 AM - 2:50 AM	5:03 AM - 1:21 AM	4:40 AM - 12:54 AM	15	20	22	40	60	26	44	Kirk / Northwest
51	Rogers Avenue Metro	Patapsco LR	4:16 AM - 2:24 AM	4:35 AM - 1:53 AM	5:08 AM - 1:07 AM	17	20	15	20	48	41	35	Bush / Northwest
55	Fox Ridge	Towson Court House	4:42 AM - 12:24 AM	5:31 AM - 12:19 AM	6:25 AM - 10:18 PM	20	30	25	60	60	39	60	Kirk / Eastern
77	Old Court Metro	Patapsco LR	4:54 AM - 2:03 AM	5:49 AM - 1:39 AM	5:45 AM - 1:03 AM	30	30	29	60	62	30	60	Northwest / Bush
99	Old Court Metro	BWI Thurgood Marshall Airport	6:05 AM - 10:11 PM / 2:03 PM - 6:12 PM	-	-	30	-	30	-	-	-	-	Northwest / Bush
Feeder Routes													
9	International Circle	Lutherville LR	3:28 AM - 1:12 AM	5:52 AM - 12:51 AM	5:32 AM - 11:57 PM	20	30	20	40	60	30	51	Kirk / Bush

Route	Start Location	End Location	Span of Service*			Average Headway**							
			Weekday	Saturday	Sunday	AM Peak	Midday	PM Peak	Evening	Late Night	Sat	Sun	Garage
12	Stella Maris	Kirk / Bartlett	5:20 AM - 11:48 PM	6:12 AM - 11:50 PM	6:12 AM - 11:47 PM	180	360	-	240	-	180	360	Kirk / Bush
14	Patapsco LR	Annapolis	4:39 AM - 1:14 AM	5:58 AM - 12:17 AM	6:30 AM - 10:37 PM	20	30	20	32	35	31	84	Bush
17	Patapsco LR	BWI/Arundel Mills/ Parkway Center	24 hours	6:00 AM - 4:50 AM	5:50 AM - 4:27 AM	30	62	36	34	60	60	60	Bush
24	Whispering Woods	Moravia Loop	4:41 AM - 1:10 AM	5:00 AM - 12:44 AM	7:00 AM - 10:44 PM	60	60	60	57	122	60	60	Eastern
52	Milford Mill	Mondawmin Metro	24 hours	24 hours	24 hours	8	13	8	18	24	18	22	Northwest
56	Glyndon	Owings Mills Town Center	4:45 AM - 1:35 AM	5:49 AM - 1:46 AM	5:49 AM - 1:45 AM	23	35	23	35	45	40	44	Northwest
57	Security Square Mall	Rogers Avenue Metro	5:04 AM - 12:40 AM	6:30 AM - 9:40 PM	6:30 AM - 9:40 PM	30	40	30	30	60	54	60	Northwest
58	White Marsh Mall	Reisterstown Plaza Metro	4:40 AM - 12:30 AM	4:35 AM - 12:30 AM	7:35 AM - 8:30 PM	30	30	30	48	60	60	60	Northwest
59	Owings Mills Town Center	Reisterstown Plaza Metro	4:18 AM - 2:03 AM	5:27 AM - 2:19 AM	5:27 AM - 2:16 AM	30	35	30	40	40	35	36	Northwest
60	Stevenson University	Reisterstown Plaza Metro	5:40 AM - 8:02 PM	-	-	43	58	45	49	-	-	-	Northwest
Circulator													
29	Cherry Hill LR	Cherry Hill	4:43 AM - 12:19 AM	4:45 AM - 12:19 AM	-	30	30	30	20	20	20	-	Bush
50	Erdman and Belair	Erdman and Belair	6:00 AM - 7:13 PM	8:00 AM - 7:15 PM	9:20 AM - 6:33 PM	20	40	20	-	-	40	40	Kirk
97	Mondawmin Metro	Mondawmin Metro	5:35 AM - 10:36 PM	7:30 AM - 7:24 PM	7:30 AM - 7:24 PM	30	30	30	27	-	30	30	Northwest
98	Woodberry LR	Woodberry LR	5:40 AM - 10:05 PM	7:40 AM - 7: 26 PM	7:40 AM - 7:26 PM	40	40	40	40	-	40	40	Northwest
QuickBus													
40	Security Boulevard at CMS	Middle River	4:35 AM - 11:00 PM	7:00 AM - 11:46 PM	7:00 AM - 9:47 PM	12	15	12	17	-	16	15	Bush / Eastern
46	Cedonia	Paradise Loop	5:00 AM - 9:36 AM / 2:30 PM - 6:09 PM	-	-	15	-	15	-	-	-	-	Eastern / Bush
47	Walbrook Junction	Overlea Loop	6:17 AM - 9:11 AM / 3:05 PM - 5:58 PM	-	-	15	-	15	-	-	-	-	Bush / Kirk
48	Towson Town Center	University of Maryland TC	4:32 AM - 7:29 PM	8:51 AM - 6:15 PM	-	15	15	15	-	-	15	-	Kirk / Bush

Route	Start Location	End Location	Span of Service*			Average Headway**							
			Weekday	Saturday	Sunday	AM Peak	Midday	PM Peak	Evening	Late Night	Sat	Sun	Garage
Express Bus													
03X	Cromwell Bridge	Inner Harbor	6:25 AM - 9:00 PM / 4:02 PM - 6:05 PM	-	-	13	-	12	-	-	-	-	Kirk / Bush
05X	Cedonia	Mondawmin Metro	6:55 AM - 8:37 AM / 4:25 PM - 5:54 PM	-	-	20	-	20	-	-	-	-	Northwest / Eastern
104	Cromwell Bridge Road	Johns Hopkins Hospital	7:41 AM - 8:18 AM / 5:16 PM - 5:45 PM	-	-	1 Trip	-	1 Trip	-	-	-	-	Kirk
10X	Rolling Road/Paradise Avenue	Downtown Baltimore	7:05 AM - 8:27 AM / 4:45 PM - 5:57 PM	-	-	35	-	23	-	-	-	-	Bush
120	White Marsh Park & Ride	Downtown Baltimore	6:15 AM - 9:18 AM / 3:23 PM - 6:32 PM	-	-	13	-	13	-	-	-	-	Kirk / Eastern
150	Columbia	Downtown Baltimore	5:45 AM - 8:30 AM / 4:40 PM - 7:50 PM	-	-	30	-	28	-	-	-	-	Bush
15X	Perry Hall	Security Square Mall	6:10 AM - 8:35 AM / 4:14 PM - 5:54 PM	-	-	32	-	20	-	-	-	-	Kirk
160	Whispering Woods/Fox Ridge	Johns Hopkins Hospital	6:21 AM - 8:15 AM / 4:21 PM - 6:10 PM	-	-	18	-	15	-	-	-	-	Eastern
19X	State Center	Carney / Goucher and Taylor	6:40 AM - 8:53 AM / 4:14 PM - 6:08 PM	-	-	9	-	10	-	-	-	-	Kirk
64X	North Avenue	Riviera Beach	5:04PM-6:12PM	-	-	-	-	1 Trip	-	-	-	-	Bush

* Span is from first departure to last arrival.

** Time periods defined as AM Peak: 6AM-9AM; Midday: 9AM-3PM; PM Peak: 3PM-6PM; Evening: 6PM – 10PM; Late Night: 10PM – 6AM.

2.4.2 Service Efficiency

One measure of service efficiency is how much service output is used on revenue service. For every hour a route is in service, a portion of that time is non-revenue service – times when the bus is traveling to the start of its route, waiting to begin a run or stopped to provide the operator a break (i.e., layover time). System-wide, 75 percent of service hours are spent in revenue operation; however this ratio varies depending upon the route. Routes with a limited span, such as peak express service, tend to have a higher non-revenue to revenue hour ratio.

Deadhead miles measure the service miles of a route when a bus is not in revenue service. Typically deadhead miles consist of the time it takes for a bus to go from the garage to start of the route, or in the case of one-direction service, the time it takes for a bus to travel from its terminus to route beginning. On average, MTA buses deadhead for 12 percent of total service miles.

Table 2.4.2 shows the top 10 routes listed by proportion of non-revenue hours and deadhead miles to total service provided. In order to screen out routes with limited operations, the list consists of only routes with greater than 50 service hours per day. **Tables 2.4.3**, **2.4.4** and **2.4.5** provide operating statistics for all bus routes by the day of the week.

Table 2.4.2 – Ten Highest Routes by percent Non-Revenue Hours, Layover Hours and Deadhead Miles (Weekday)

	Non-Revenue Hours		Layover Hours		Deadhead Miles	
Rank	**Route**	**Percent of Total**	**Route**	**Percent of Total**	**Route**	**Percent of Total**
1.	**14**	15 %	**48**	18 %	**46**	22 %
2.	**46**	14 %	**53**	15 %	**55**	20 %
3.	**55**	13 %	**54**	15 %	**14**	19 %
4.	**52**	12 %	**16**	14 %	**22**	17 %
5.	**44**	12 %	**3**	14 %	**33**	16 %
6.	**33**	12 %	**13**	14 %	**15**	16 %
7.	**22**	11 %	**33**	14 %	**52**	16 %
8.	**64**	10 %	**91**	13 %	**30**	15 %
9.	**3**	10 %	**51**	13 %	**3**	15 %
10.	**17**	10 %	**52**	13 %	**35**	15 %

Table 2.4.3 – Basic Route Characteristics – Operating Characteristics (Average Weekday)

Route	Service Hours	Revenue Hours	Non-Revenue Hours	Percent Non-Revenue	Recovery Hours	Percent Recovery	Peak Bus	Revenue Miles	Deadhead Miles	Deadhead Ratio
Radial Routes										
1	97	77	7.68	8%	11.53	12%	9	827	116	12%
3	221	168	22.42	10%	31.10	14%	19	1,990	360	15%
5	233	192	16.75	7%	24.57	11%	13	1,966	308	14%
7	64	53	4.68	7%	7.13	11%	4	532	75	12%
8	227	184	16.05	7%	26.83	12%	15	2,177	221	9%
10	265	218	22.07	8%	24.08	9%	19	2,678	398	13%
11	123	97	11.60	9%	14.30	12%	9	1,181	130	10%
15	317	254	29.08	9%	33.47	11%	20	2,876	550	16%
18	18	10	5.98	33%	2.67	15%	4	139	102	42%
19	189	151	13.97	7%	23.50	12%	15	1,675	202	11%
20	231	194	17.07	7%	20.67	9%	17	2,354	338	13%
23	290	245	23.65	8%	21.55	7%	24	3,065	469	13%
27	122	104	6.35	5%	12.00	10%	9	1,375	94	6%
30	88	71	7.38	8%	9.52	11%	10	659	121	15%
35	229	190	20.57	9%	18.90	8%	17	2,660	477	15%
36	232	196	10.27	4%	25.70	11%	22	2,265	159	7%
53	86	69	3.67	4%	12.92	15%	7	927	59	6%
54	169	131	12.73	8%	25.18	15%	11	1,639	172	9%
61	31	21	4.35	14%	4.92	16%	4	231	72	24%
64	144	116	14.73	10%	14.07	10%	13	1,431	188	12%
91	154	124	9.52	6%	20.85	13%	11	1,217	140	10%
Crosstown Routes										
4	65	53	5.50	8%	6.28	10%	4	959	73	7%

Route	Service Hours	Revenue Hours	Non-Revenue Hours	Percent Non-Revenue	Recovery Hours	Percent Recovery	Peak Bus	Revenue Miles	Deadhead Miles	Deadhead Ratio
13	217	171	16.27	7%	29.53	14%	16	1,655	248	13%
16	96	73	8.62	9%	13.75	14%	7	1,042	141	12%
21	66	47	3.42	5%	16.38	25%	5	466	41	8%
22	215	172	23.72	11%	19.32	9%	28	1,778	357	17%
33	116	87	13.42	12%	15.78	14%	14	1,218	237	16%
38	6	4	2.15	35%	0.37	6%	2	42	33	44%
44	185	142	22.20	12%	21.20	11%	18	2,003	358	15%
51	183	150	8.98	5%	24.38	13%	19	1,868	131	7%
55	97	72	12.88	13%	12.12	12%	7	1,199	301	20%
77	129	109	11.73	9%	8.35	6%	8	1,827	205	10%
99	32	25	5.65	18%	1.87	6%	5	511	126	20%
Feeder Routes										
9	55	45	1.17	2%	9.17	17%	4	837	19	2%
12	11	8	0.98	9%	2.75	24%	1	127	9	7%
14	144	110	21.35	15%	13.02	9%	10	2,117	492	19%
17	66	55	6.63	10%	5.12	8%	5	1,224	129	10%
24	47	35	4.60	10%	7.42	16%	4	673	83	11%
52	132	99	16.05	12%	16.92	13%	10	1,322	249	16%
56	57	39	10.18	18%	8.42	15%	4	648	194	23%
57	38	25	2.62	7%	10.08	26%	3	396	43	10%
58	75	65	2.03	3%	8.13	11%	6	1,050	28	3%
59	63	49	2.50	4%	10.85	17%	4	713	38	5%
60	27	20	2.12	8%	4.75	18%	3	371	28	7%
Circulator										
29	21	13	1.60	8%	5.90	29%	1	186	29	13%

Route	Service Hours	Revenue Hours	Non-Revenue Hours	Percent Non-Revenue	Recovery Hours	Percent Recovery	Peak Bus	Revenue Miles	Deadhead Miles	Deadhead Ratio
50	15	11	1.52	10%	2.40	16%	2	143	15	10%
97	34	25	1.03	3%	8.50	25%	2	314	17	5%
98	18	11	2.43	13%	5.10	28%	1	135	46	25%
QuickBus										
40	221	179	16.15	7%	25.15	11%	16	2,890	280	9%
46	62	51	8.87	14%	2.90	5%	9	696	195	22%
47	39	29	7.93	20%	2.43	6%	8	330	121	27%
48	105	81	5.47	5%	18.93	18%	8	1,019	67	6%
Express Routes										
3X	20	13	5.70	28%	1.75	9%	5	158	92	37%
5X	8	5	2.08	25%	1.25	15%	3	57	28	33%
104	2	1	0.53	24%	0.55	25%	1	17	9	35%
10X	5	3	1.17	24%	0.45	9%	2	42	17	29%
120	41	25	11.85	29%	5.00	12%	8	638	254	28%
150	16	12	3.45	22%	0.63	4%	3	225	59	21%
15X	10	7	1.62	17%	0.92	9%	4	105	17	14%
160	12	8	3.28	27%	1.07	9%	4	151	65	30%
19X	23	15	5.95	25%	2.23	10%	7	178	91	34%
64X	2	1	0.53	30%	0.10	6%	1	19	15	45%

Table 2.4.4 – Basic Route Characteristics – Operating Characteristics (Saturday)

Route	Service Hours	Revenue Hours	Non-Revenue Hours	Percent Non-Revenue	Recovery Hours	Percent Recovery	Peak Bus	Revenue Miles	Deadhead Miles	Deadhead Ratio
Radial Routes										
1	56	51	2	3%	3	6%	4	552	29	5%
3	141	110	6	5%	25	18%	9	1,390	112	7%
5	177	146	12	7%	18	10%	11	1,710	231	12%
7	57	44	3	5%	10	17%	3	491	40	8%
8	202	163	10	5%	29	14%	11	2,088	141	6%
10	196	164	11	6%	21	11%	13	2,101	207	9%
11	89	75	10	11%	4	5%	6	944	113	11%
15	228	192	12	5%	24	11%	13	2,353	239	9%
18	-	-	-	-	-	-	-	-	-	
19	131	109	6	5%	16	12%	9	1,332	72	5%
20	136	114	7	5%	15	11%	8	1,427	143	9%
23	163	136	12	7%	15	9%	9	1,895	289	13%
27	102	81	9	9%	12	12%	5	1,230	155	11%
30	-	-	-	-	-	-	-	-	-	
35	148	114	11	7%	22	15%	7	1,720	285	14%
36	115	102	3	2%	10	9%	7	1,276	41	3%
53	69	52	3	5%	13	19%	4	768	66	8%
54	134	101	9	7%	25	18%	7	1,418	116	8%
61	-	-	-	-	-	-	-	-	-	-
64	63	49	4	7%	10	16%	4	628	56	8%
91	111	93	4	4%	14	12%	6	948	55	5%
Crosstown Routes										
4	53	44	4	8%	5	9%	3	777	59	7%

Route	Service Hours	Revenue Hours	Non-Revenue Hours	Percent Non-Revenue	Recovery Hours	Percent Recovery	Peak Bus	Revenue Miles	Deadhead Miles	Deadhead Ratio
13	150	121	7	5%	21	14%	11	1,233	102	8%
16	68	52	4	6%	12	18%	4	799	67	8%
21	40	25	2	6%	13	32%	2	252	35	12%
22	122	97	4	4%	21	17%	6	1,244	67	5%
33	55	48	3	6%	5	8%	4	727	51	7%
38	-	-	-	-	-	-	-	-	-	
44	100	81	7	7%	11	11%	6	1,456	104	7%
51	69	62	2	2%	5	7%	4	858	23	3%
55	56	42	9	16%	5	9%	4	724	162	18%
77	92	77	9	10%	6	7%	6	1,464	163	10%
99	-	-	-	-	-	-	-	-	-	-
Feeder Routes										
9	33	29	0	0%	5	14%	2	570	-	0%
12	10	7	1	9%	2	16%	1	115	14	11%
14	90	77	7	8%	5	6%	6	1,520	155	9%
17	46	35	5	11%	5	12%	2	771	99	11%
24	39	30	2	6%	8	19%	2	592	40	6%
52	87	63	6	7%	17	20%	5	988	92	8%
56	37	27	4	11%	6	16%	2	478	76	14%
57	24	15	2	10%	6	26%	2	245	41	14%
58	55	48	1	1%	6	12%	3	823	10	1%
59	49	37	1	2%	11	23%	3	531	17	3%
60	-	-	-	-	-	-	-	-	-	-
Circulator										
29	21	14	4	17%	3	14%	1	205	65	24%

Route	Service Hours	Revenue Hours	Non-Revenue Hours	Percent Non-Revenue	Recovery Hours	Percent Recovery	Peak Bus	Revenue Miles	Deadhead Miles	Deadhead Ratio
50	13	10	2	12%	1	10%	1	114	27	19%
97	25	18	1	5%	6	24%	2	222	19	8%
98	13	8	2	12%	4	27%	1	97	29	23%
QuickBus										
40	168	141	7	4%	21	12%	10	2,281	128	5%
46	-	-	-	-	-	-	-	-	-	
47	-	-	-	-	-	-	-	-	-	
48	61	50	4	7%	7	11%	7	623	49	7%
Express Routes										
3X	-	-	-	-	-	-	-	-	-	
5X	-	-	-	-	-	-	-	-	-	-
104	-	-	-	-	-	-	-	-	-	-
10X	-	-	-	-	-	-	-	-	-	-
120	-	-	-	-	-	-	-	-	-	-
150	-	-	-	-	-	-	-	-	-	-
15X	-	-	-	-	-	-	-	-	-	-
160	-	-	-	-	-	-	-	-	-	-
19X	-	-	-	-	-	-	-	-	-	-
64X	-	-	-	-	-	-	-	-	-	-

Table 2.4.5 – Basic Route Characteristics – Operating Characteristics (Sunday)

Route	Service Hours	Revenue Hours	Non-Revenue Hours	Percent Non-Revenue	Recovery Hours	Percent Recovery	Peak Bus	Revenue Miles	Deadhead Miles	Deadhead Ratio
Radial Routes										
1	42	35	1	3%	6	14%	3	416	21	5%
3	89	66	4	4%	18	21%	5	905	72	7%
5	160	131	9	5%	20	13%	8	1,512	153	9%
7	64	52	4	6%	9	13%	4	583	49	8%
8	110	90	5	5%	15	14%	8	1,243	66	5%
10	123	100	8	7%	14	12%	7	1,385	187	12%
11	73	62	7	9%	5	6%	5	803	77	9%
15	154	125	12	8%	17	11%	7	1,654	261	14%
18	4	2	1	29%	1	20%	1	29	16	35%
19	71	59	3	4%	9	13%	4	767	28	3%
20	75	59	11	15%	5	7%	4	823	247	23%
23	156	124	11	7%	21	14%	8	1,820	267	13%
27	121	105	4	3%	13	11%	6	1,606	61	4%
30	-	-	-	-	-	-	-	-	-	-
35	122	105	9	7%	8	7%	6	1,614	230	12%
36	114	91	3	2%	20	18%	7	1,276	41	3%
53	58	46	3	5%	9	15%	3	689	50	7%
54	135	97	9	6%	29	21%	7	1,418	113	7%
61	-	-	-	-	-	-	-	-	-	-
64	49	41	4	9%	4	7%	3	543	56	9%
91	64	50	4	7%	10	16%	3	549	69	11%
Crosstown Routes										
4	48	39	4	9%	5	10%	3	708	61	8%

Route	Service Hours	Revenue Hours	Non-Revenue Hours	Percent Non-Revenue	Recovery Hours	Percent Recovery	Peak Bus	Revenue Miles	Deadhead Miles	Deadhead Ratio
13	109	93	5	5%	11	10%	7	995	85	8%
16	39	28	4	11%	7	18%	2	436	61	12%
21	35	19	3	8%	13	37%	2	220	39	15%
22	72	60	3	4%	9	12%	4	855	47	5%
33	23	20	1	6%	2	8%	2	312	23	7%
38	-	-	-	-	-	-	-	-	-	-
44	63	47	10	16%	7	10%	5	873	156	15%
51	76	60	2	2%	15	19%	4	940	28	3%
55	36	26	7	21%	3	9%	2	509	130	20%
77	57	46	9	16%	2	3%	3	942	211	18%
99	-	-	-	-	-	-	-	-	-	-
Feeder Routes										
9	21	18	1	3%	3	12%	2	380	11	3%
12	10	7	0	4%	2	22%	1	115	4	4%
14	33	31	2	5%	1	2%	3	637	24	4%
17	45	34	5	11%	7	16%	2	807	93	10%
24	31	23	2	7%	6	20%	2	468	40	8%
52	65	53	5	8%	7	11%	4	816	84	9%
56	32	23	3	10%	6	18%	2	430	66	13%
57	16	12	1	8%	3	21%	1	185	20	10%
58	34	30	1	2%	4	12%	3	513	9	2%
59	42	31	2	5%	10	23%	3	465	29	6%
60	-	-	-	-	-	-	-	-	-	-
Circulator										
29	-	-	-	-	-	-	-	-	-	-

Route	Service Hours	Revenue Hours	Non-Revenue Hours	Percent Non-Revenue	Recovery Hours	Percent Recovery	Peak Bus	Revenue Miles	Deadhead Miles	Deadhead Ratio
50	10	8	1	8%	1	13%	1	94	8	8%
97	25	18	1	4%	6	24%	2	222	17	7%
98	13	8	2	14%	3	27%	1	97	32	25%
QuickBus										
40	157	129	8	5%	20	13%	10	2,109	140	6%
46	-	-	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-	-	-
Express Routes										
3X	-	-	-	-	-	-	-	-	-	-
5X	-	-	-	-	-	-	-	-	-	-
104	-	-	-	-	-	-	-	-	-	-
10X	-	-	-	-	-	-	-	-	-	-
120	-	-	-	-	-	-	-	-	-	-
150	-	-	-	-	-	-	-	-	-	-
15X	-	-	-	-	-	-	-	-	-	-
160	-	-	-	-	-	-	-	-	-	-
19X	-	-	-	-	-	-	-	-	-	-
64X	-	-	-	-	-	-	-	-	-	-

2.4.3 Recent Service Changes

This section outlines the service changes that MTA has implemented over the past three and a half years, specifically those that modified service location or major changes in frequency (i.e., not the addition of one additional trip) ; this section does not include small schedule changes. The information listed here provides insight into the changes that the MTA deemed necessary in recent years and serves as a basis for the route planning component of this study.

- 2013
  - Route 35 – Eliminated service at White Marsh Mall after 9:30PM
  - Route 58 – Eliminated service at White Marsh Mall after 9:30PM
  - Route 36 – Modified to serve Kaiser Permanente Hospital
- 2012
  - Route 14 – Extended all Sunday trips to Walmart at George Clauss Boulevard
  - Route 18 – Added trips in morning and evening to Owings Mills Center via Torah Institute
  - Route 20 – Added two Saturday trips
  - Route 23 – Added one Saturday trip
  - Route 150 – Service frequency adjusted during PM peak period
- 2011
  - Route 12 – Extended the south end of the route to Kirk Avenue and Bartlett Street
  - Route 14 – Added two southbound morning trips via Anne Arundel Community College
  - Route 15 – Added stop at White Marsh Park & Ride
  - Route 24 – Extended the last trip to Whispering Woods
  - Route 27 – Extended service through the Seton Business Park to serve NAACP, New Psalmist Baptist Church and ARC
  - Route 30 - Added service to North Bend Road and Frederick Avenue for one PM peak trip
  - Route 64 – Added service to Marley Neck Business Park
- 2010
  - Route 4 – Eliminated trips via Marshfield Business Park and improve peak service
  - Route 5 – Reduced Express trips in coordination with new Quickbus 46
  - Route 6 – Replaced route with new Route 30 operating between Edmondson Village and Bayview Medical Center
  - Route 7 – Changed end of line from East Avenue and Toone Street to First Mariner Bank on Eastbourne Avenue between Clinton Street and Highland Avenue
  - Route 10 – Turned back late night trips at Turners Station rather than Bullneck and reduced peak Express Service to two trips each
  - Rote 10 – Reduced Express trips in coordination with new Quickbus 46
  - Route 11 – Revised route in Towson to serve Chesapeake Avenue northbound and Pennsylvania Avenue southbound
  - Route 15 – Eliminated branches to Rutherford Industrial Park and Social Security Complex and increase peak service to CMS and Security Square Mall

- Route 15 – Reduced express trips in coordination with the new Quickbus 47
- Route 18 – New route operating between Glen and Key Avenues and Park Heights Avenue and Velvet Valley Way, and Smith Avenue and Copper Ridge Drive to Old Court and Scotts Hill Drive
- Route 30 – Replaced Route 6 currently operating between Cedonia and Edmondson Village
- Route 46 – New limited stop service between Cedonia and Paradise Avenue, coordinating with Routes 5 and 10
- Route 47 – New limited stop service between Overlea and Walbrook Junction, coordinating with Route 15
- Route 50 – Widened the Parkside Gardens Shopping Center loop to serve the Moravia Park Drive Apartments
- Route 64 – Eliminated Express service
- Route 91 – Eliminated Express service
- Route 160 – Eliminated service to Oliver Beach by terminating at Whispering Woods

2.4.4 Bus Interlining

The number of vehicles required to operate a transit route at a particular time of day is a function of the level of service provided at that time and the length of the route in terms of the total cycle time (trip time plus layover time) required to complete a round trip. Once these schedule elements are determined and the trip table is completed, the scheduler can then construct the vehicle blocks by hooking trips together. Each block represents the assignment for one vehicle beginning with the garage pull-out, a series of revenue service trips on a designated route or routes and then a garage pull-in. The goal of the blocking exercise is to minimize bus operating hours and miles and the number of vehicles required for any period subject to other service and operating needs.

Often, schedulers will seek opportunities to "interline" as the vehicle blocks are constructed. As defined by TCRP 135 "Interlining is the use of the same vehicle on a block operating on more than one route. . . . This is most often done at common terminal or for routes sharing a common trunk."[6] A scheduler may construct an interline for one of three primary purposes:

1. As a convenient hook for a single trip to avoid an extra vehicle pull-out and pull-in from the garage. This action helps to manage the growth in vehicle hours and miles.
2. To accommodate passenger demands to reduce the need to physically transfer between two buses, two routes may be through-routed.
3. Two or more routes with a common terminal and demand headway, but each with excess cycle time if scheduled individually, may be interlined to eliminate this excess and save a bus. Each block will be constructed with trips alternating among the designated routes.

[6] TCRP Report 135 *Controlling System Costs: Basic and Advanced Scheduling Manuals and Contemporary Issues in Transit Scheduling,* Glossary page G-7, Transportation Research Board, Washington D.C. 2009

The MTA Service Development unit provided a list of route pairs (approximately 400 for the core bus network) that are currently interlined. Based upon a discussion with staff and a preliminary review of the schedule documents, it is apparent that MTA's application of interlines falls primarily within the first category listed above. Given the structure of the MTA route network, (i.e., several long routes that run through the city center from one end of the city to another), the network design essentially emulates the second category without actual scheduled interlines. Four interlines were identified that may achieve the intentions of the third category. These route pairs include 8/9, 11/55, 15/47, and 56/59, although a review of the detail block schedule reports is necessary to confirm this categorization.

2.4.5 On-Time Performance (OTP)

On-time performance for the MTA Core Bus system was obtained for 2014 from MTA's CAD/AVL system for the purpose of identifying those routes that experience the most difficulties with schedule adherence, whether it be arriving too early or too late. Timestamps from 2014 APC data for each stop along the route were used to compare actual time with the times scheduled at each timepoint along the route. For its Core Bus system, MTA considers a bus to be on-time if it departs a stop between 59 seconds early and 4 minutes, 59 seconds late. Overall, on average, the Core Bus System had 84% of its stops considered on-time. At the route level, Route 35 had the lowest percentage of stops that were on-time at 76%. Routes 46 and 104 each had 79% of their stops considered on-time, while Routes 13, 27, 30, 47, 48, and 120 each reported 80% of their stops as on-time. At 92%, Route 1 had the highest percentage of on-time stops; Route 50 reported 91%, while 22 total routes had at least 85% or more of their stops considered on-time. **Table 2.4.6** summarizes and ranks on-time performance at the route level for the MTA Core Bus system.

Table 2.4.6 – Weekday On-Time Performance[7]

Rank	Route	% On-Time
1	1	92%
2	50	91%
3	29	90%
4	60	89%
5	98	89%
6	56	88%
7	97	88%
8	61	88%
9	12	88%
10	11	87%
11	55	87%
12	18	86%
13	160	86%
14	5	86%
15	51	86%
16	7	86%
17	53	86%
18	9	85%
19	44	85%
20	58	85%
21	64	85%
22	3	85%
23	52	85%
24	19	85%
25	59	85%
26	77	84%
27	22	84%
28	21	84%
29	4	84%
30	14	84%
31	150	84%
32	91	84%
33	15	84%
34	99	84%
35	54	83%
36	33	83%

[7] On-time is defined as up to 59 seconds early and up to 4 minutes and 49 seconds late.

Rank	Route	% On-Time
37	16	83%
38	36	83%
39	24	82%
40	23	82%
41	10	82%
42	8	82%
43	40	81%
44	38	81%
45	20	81%
46	57	81%
47	17	81%
48	30	80%
49	48	80%
50	47	80%
51	27	80%
52	13	80%
53	120	80%
54	46	79%
55	104	79%
56	35	76%
Total/Average:		**84%**

2.4.6 Bus Ridership

Ridership statistics for the Core Bus service were obtained for fall 2012.[8] The three busiest routes during this time period were Route 15, Route 23 and Route 40, each with over 17,500 average weekday boardings. Route 15 connects Security Square Mall, Downtown Baltimore and White Marsh. Route 23 connects Catonsville, Downtown Baltimore, Johns Hopkins Bayview Medical Center, Middle River and Fox Ridge. Route 40 connects Security Square Mall, Downtown Baltimore and Middle River. Route 23 and Route 40 largely parallel each other through the City of Baltimore in an east-west direction. Other routes with notably high ridership include Route 8 (Lutherville Light Rail to University of Maryland), Route 10 (Paradise to Dundalk) and Route 13 (Walbrook Junction to Canton/Fell's Point). These routes all have average weekday ridership between 15,000 and 17,500. **Figure 2.4.6** illustrates these six high-ridership routes. **Table 2.4.7** summarizes ridership statistics for the MTA bus system for the fall of 2012.

[8] All ridership figures are estimates.

Figure 2.4.6 – High Ridership Routes (Weekday Boardings >15,000)

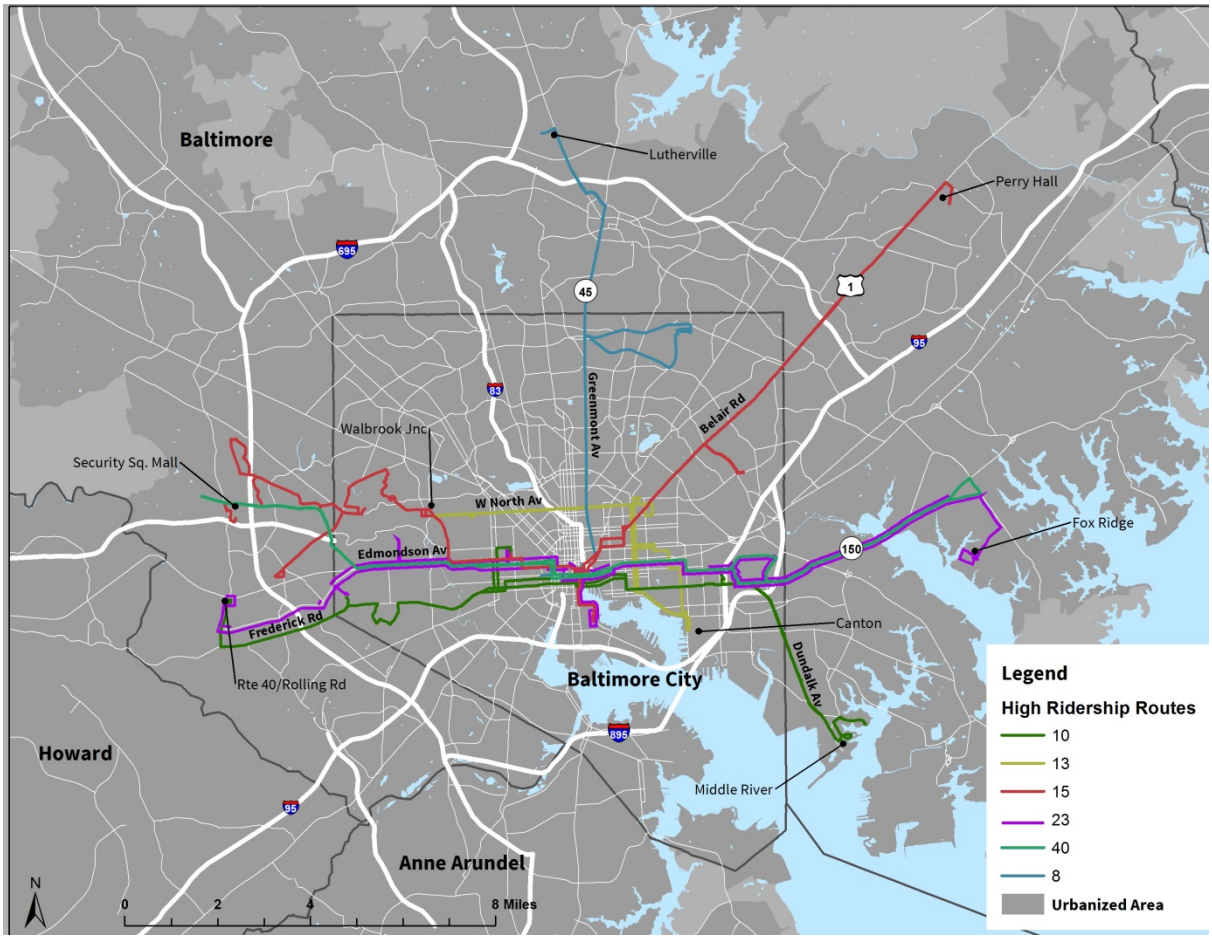


Table 2.4.7 – Bus Ridership Summary

	Average Weekday					Average Saturday				Average Sunday			
Route	Ridership	Boardings per Hour	Boardings per Mile	Average Maximum Load	Cost Recovery Ratio[9]	Ridership	Boardings per Hour	Boardings per Mile	Cost Recovery Ratio[6]	Ridership	Boardings per Hour	Boardings per Mile	Cost Recovery Ratio[6]
Radial													
1	4,238	44.35	4.54	21	42.2%	1,846	35.5	3.2	18.4%	1,037	30.7	2.4	10.3%
3	13,788	62.59	5.88	37	56.8%	6,524	59.5	4.3	26.9%	3,665	54.6	3.8	15.1%
5	13,230	56.81	5.81	33	54.1%	7,418	54.8	3.8	30.3%	5,058	41.4	3.0	20.7%
7	2,562	39.78	4.22	15	38.7%	1,410	31.0	2.7	21.3%	1,017	19.6	1.6	15.3%
8	17,291	76.26	7.21	37	69.5%	9,594	58.0	4.3	38.6%	5,627	62.4	4.3	22.6%
10	15,543	58.92	5.05	40	50.7%	9,280	59.0	4.0	30.3%	5,210	51.9	3.3	17.0%
11	4,051	36.14	3.17	23	31.5%	1,518	21.5	1.4	11.8%	1,151	18.4	1.3	9.0%
15	20,305	64.34	5.95	40	57.9%	9,484	51.5	3.7	27.1%	5,326	43.6	2.8	15.2%
18	430	23.31	1.71	19	18.2%	-	-	-	-	32	16.0	0.7	1.3%
19	12,725	67.44	6.78	41	63.6%	5,462	48.8	3.9	27.3%	2,708	45.2	3.4	13.5%
20	14,077	60.89	5.23	42	52.5%	6,708	57.5	4.3	25.0%	2,951	48.6	2.8	11.0%
23	20,278	70.31	5.75	44	58.9%	8,937	64.8	4.1	25.9%	6,217	49.0	3.0	18.0%
27	5,722	46.69	3.88	31	39.4%	2,996	38.2	2.2	20.7%	3,483	33.4	2.1	24.0%
30	4,824	54.42	6.19	28	54.9%	-	-	-	-	-	-	-	-
35	13,068	57.15	4.14	43	44.4%	6,187	53.6	3.1	21.0%	4,302	43.8	2.3	14.6%
36	14,509	62.51	5.99	36	57.4%	4,979	47.3	3.8	19.7%	3,786	40.5	2.9	15.0%
53	6,640	77.03	6.73	25	67.1%	3,538	66.8	4.2	35.7%	2,312	49.0	3.1	23.4%
54	13,556	80.29	7.49	35	72.6%	7,061	76.1	4.6	37.8%	5,305	56.7	3.5	28.4%
61	938	30.96	3.10	16	29.1%	-	-	-	-	--	-		-
64	6,052	41.87	3.74	25	36.9%	2,470	48.6	3.6	15.1%	1,408	33.1	2.4	8.6%

[9] Cost Recovery is calculated with the following formula: (Boardings * $0.86)/Route Cost, where $0.86 is the overall average fare per passenger for the Core Bus system.

Route	Average Weekday Ridership	Boardings per Hour	Boardings per Mile	Average Maximum Load	Cost Recovery Ratio[9]	Average Saturday Ridership	Boardings per Hour	Boardings per Mile	Cost Recovery Ratio[6]	Average Sunday Ridership	Boardings per Hour	Boardings per Mile	Cost Recovery Ratio[6]
91	10,652	68.97	7.85	31	69.6%	5,083	58.0	5.1	33.2%	2,816	64.0	4.6	18.4%
Crosstown													
4	3,585	56.90	3.44	33	39.2%	1,648	44.3	2.0	18.0%	1,142	33.1	1.5	12.5%
13	15,846	73.29	8.37	37	74.0%	7,059	63.3	5.3	33.0%	4,712	51.4	4.4	22.0%
16	7,593	79.34	6.42	29	66.0%	3,789	71.9	4.4	32.9%	1,791	62.1	3.6	15.6%
21	3,539	54.28	6.98	20	58.2%	1,026	41.1	3.6	16.9%	700	35.8	2.7	11.5%
22	13,944	65.60	6.58	40	61.8%	5,374	55.1	4.1	23.8%	2,945	48.7	3.3	13.1%
33	7,789	66.92	5.35	33	55.2%	1,995	42.2	2.6	14.2%	954	48.2	2.8	6.8%
38	170	27.42	2.26	40	23.1%	-	-	-	-	-	-	-	-
44	12,155	65.37	5.15	40	53.5%	4,458	59.3	2.9	19.6%	2,171	46.4	2.1	9.5%
51	12,431	67.93	6.22	35	60.8%	2,857	44.6	3.2	14.0%	2,617	44.1	2.7	12.8%
55	6,362	65.03	4.20	37	46.9%	2,100	48.1	2.4	15.5%	1,051	41.0	1.6	7.7%
77	9,512	72.36	4.56	46	51.3%	3,318	43.2	2.0	17.9%	1,602	34.0	1.4	8.6%
99	1,407	43.63	2.21	29	26.6%	-	-	-	-	-	-	-	-
Feeder													
9	2,001	36.28	2.34	14	26.1%	950	35.6	1.7	12.4%	595	34.6	1.5	7.8%
12	374	33.24	2.75	19	28.0%	245	32.9	1.9	18.4%	201	27.9	1.7	15.1%
14	7,340	50.95	2.82	33	33.1%	2,984	41.6	1.8	13.5%	1,056	38.1	1.6	4.8%
17	2,177	36.19	1.74	21	21.3%	1,168	42.5	1.3	11.4%	1,180	45.5	1.3	11.6%
24	2,147	45.83	2.84	18	32.1%	933	30.0	1.5	14.0%	585	24.8	1.2	8.8%
52	8,399	64.61	5.41	29	54.8%	4,132	65.2	3.8	27.0%	2,666	50.7	3.0	17.4%
56	4,660	84.34	5.76	26	63.1%	-	-	-	-	-	-	-	-
57	1,392	36.49	3.17	14	31.7%	752	48.9	2.6	17.1%	336	28.3	1.6	7.6%
58	3,558	47.63	3.30	29	36.0%	1,998	41.5	2.4	20.2%	748	24.4	1.4	7.6%

	Average Weekday					Average Saturday				Average Sunday			
Route	**Ridership**	**Boardings per Hour**	**Boardings per Mile**	**Average Maximum Load**	**Cost Recovery Ratio[9]**	**Ridership**	**Boardings per Hour**	**Boardings per Mile**	**Cost Recovery Ratio[6]**	**Ridership**	**Boardings per Hour**	**Boardings per Mile**	**Cost Recovery Ratio[6]**
59	2,675	42.83	3.56	18	36.2%	1,876	50.4	3.4	25.4%	1,075	36.8	2.2	14.5%
60	483	18.02	1.21	9	13.3%	-	-	-	-	-	-		-
Express													
3X	129	6.31	0.52	-	5.3%	-	-	-	-	-	-	-	-
5X	350	41.18	4.12	-	38.8%	-	-	-	-	-	-	-	-
10X	318	65.57	5.41	-	55.2%	-	-	-	-	-	-	-	-
15X	776	80.41	6.34	-	65.8%	-	-	-	-	-	-	-	-
19X	407	17.39	1.50	-	15.0%	-	-	-	-	-	-	-	-
64X	54	30.86	1.61	-	19.2%								
104	49	22.27	1.88	19	19.0%	-	-	-	-	-	-	-	-
120	1,020	24.52	1.14	18	14.1%	-	-	-	-	-	-	-	-
150	375	23.96	1.32	26	15.5%	-	-	-	-	-	-	-	-
160	347	28.68	1.61	33	18.8%	-	-	-	-	-	-	-	-
Circulator													
29	1,371	66.55	6.37	15	61.1%	985	72.0	3.7	43.9%	-	-	-	-
50	748	49.21	4.74	13	45.3%	267	27.0	1.9	16.2%	122	15.6	1.2	7.4%
97	2,248	65.25	6.79	23	62.7%	832	46.6	3.5	23.2%	655	36.4	2.7	18.3%
98	315	17.26	1.74	6	16.3%	159	20.3	1.3	8.2%	154	19.8	1.2	8.0%
QuickBus													
40	17,790	80.55	5.61	50	61.0%	9,094	65.3	3.8	31.2%	6,475	50.1	2.9	22.2%
46	4,301	68.93	4.82	40	52.4%	-	-	-	-	-	-	-	-
47	2,282	57.77	5.06	37	50.4%	-	-	-	-	-	-	-	-
48	9,375	89.20	8.63	42	82.4%	3,197	63.9	4.8	28.1%	-	-	-	-

*Based on fall 2012 data

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2.4.7 School Trippers

MTA operates two unique routes that operate only during school days, along with a number of other runs that are operated during school days. **Table 2.4.8** lists all routes with at least one run that operates only on school days.

Table 2.4.8 – School Tripper Routes

Route Type	Routes
School Day Only Routes	18, 38
Routes with School Trips	1, 3, 5, 8, 10, 13, 15, 19, 20, 22, 24, 27, 33, 36, 44, 52, 53, 61, 64, 91

2.4.8 Overcrowding Analysis

In order to highlight MTA Core Bus routes that may experience overcrowding during certain time periods, maximum passenger load data was obtained and compared to MTA's maximum passenger load design standards for each route, direction and time period on an average weekday. A difference of -0.5 passengers or greater between observed maximum loads and design standard maximum loads was used as a threshold to demonstrate the likelihood of overcrowding. MTA's design standard maximum load factors vary by route type (Radial, Crosstown, Feeder, Circulator, Express or QuickBus) and time period, ranging from 100 percent of seated capacity to 130 percent of seated capacity during peak periods on non-express routes (see Section 7 for further explanation). Therefore, observed maximum loads approaching or greater than the design standard maximum loads are indicative of overcrowding.

This analysis showed the potential for overcrowding on several routes, with the highest potential on Routes 10, 13, 15, 19, 20, 23, 35, 40, 44, 46, 55 and 77. Routes 15 (northbound), 23 (southbound), 40 (eastbound) and 44 (eastbound) had the highest overall difference between observed maximum loads and design standard maximum loads. The potential for overcrowding existed on the most number of routes during the midday (9AM to 3PM) time period. Average headways during the midday period are higher than peak hour headways for all of these routes, and this decrease in service results in more passengers per bus. **Table 2.4.9** summarizes the difference in passengers between observed maximum loads and design standard maximum loads by route, direction and time period; the table only shows situations where the number of passengers at the max load point compared to the design standard was at least -0.5, measure indicating that with "half of an additional person" the route would be filled to capacity. **Table 2.4.10** summarizes the design standard maximum load factor and the observed maximum load factors as percentages of total seats per trip by route, direction and time period.

Table 2.4.9 – MTA Core Bus Service Routes with Potential for Overcrowding by Time Period and Direction (Observed Max Passengers minus Design Standard Max Passengers)

Route	Direction	Early AM	AM Peak	Midday	PM Peak	Evening	Late Night
3	South			-0.2			
3	North			-0.2			
4	South			-0.5			
10	South			1.4			
13	South			2.4			
15	North			9.1			
15	South			4.4			
16	South			-0.1			
19	South		5.3	0.1	1.3		
19	North			-0.2			
20	North			0.1			
20	South			2.7			
22	South			0.5			
22	North					0.8	
23	North			-0.1			
23	South			6.8			
35	South			1.4			
35	North			4.5			
40	East		3.0	7.1			
40	West		0.8	1.7	0.2		
44	East	7.8					
44	West					0.6	
46	North			5.7			
55	South			5.0			
55	North			-0.3			
77	North			2.3			

Table 2.4.10 – MTA Core Bus Service Routes with Potential for Overcrowding by Time Period and Direction (Max Load Factors as Percentage of Total Seats)

Route	Direction	Early AM		AM Peak		Midday		PM Peak		Evening	
		Std	Obs	Std	Obs	Std	Obs	Std	Obs	Std	Obs
3	South					110%	110%				
3	North					110%	109.%				
4	South					100%	99%				
10	South					110%	114%				
13	South					100%	106%				
15	North					110%	134%				
15	South					110%	122%				
16	South					100%	100%				
19	South			130%	144%	110%	110%	130%	133%		
19	North					110%	109%				
20	North					110%	110%				
20	South					110%	117%				
22	South					100%	101%				
22	North									100%	102%
23	North					110%	101%				
23	South					110%	128%				
35	South					110%	114%				
35	North					110%	122%				
40	East			130%	138%	110%	129%				
40	West			130%	132%	110%	115%	130%	131%		
44	East	100%	121%								
44	West									100%	101%
46	North					110%	125%				
55	South					100%	113%				
55	North					100%	99%				
77	North					100%	109%				

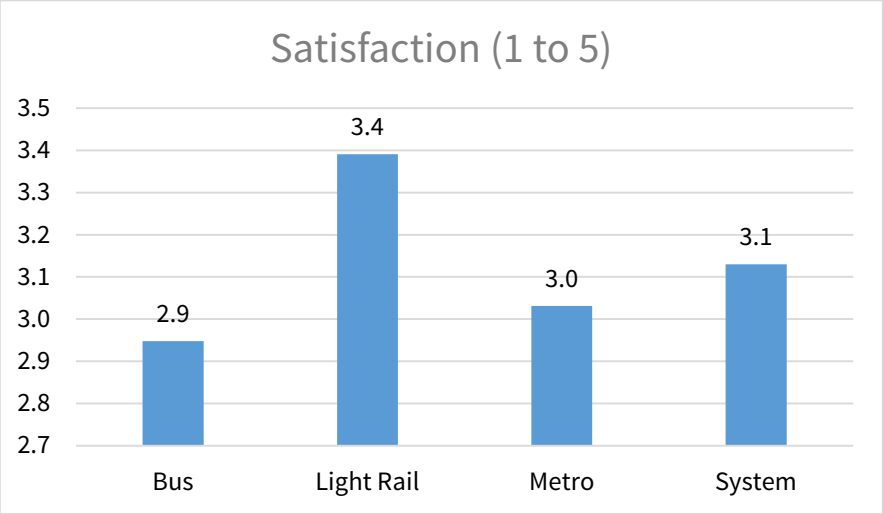
Std = MTA Standard; Obs = Observed passenger load

2.4.9 Customer Satisfaction Survey Results

2.4.9.1 Rate Your Ride Program

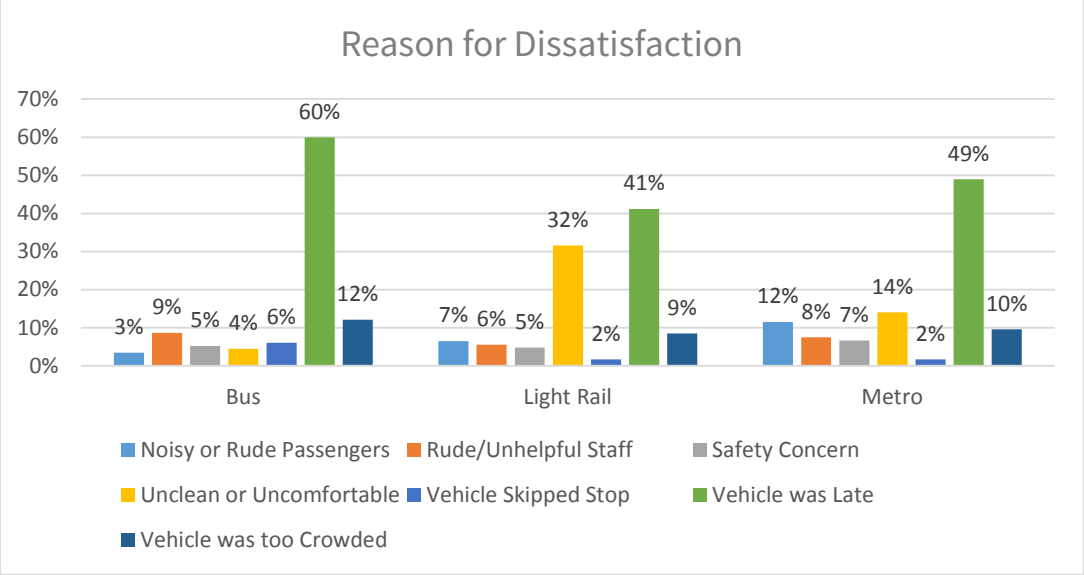
One of the ways by which MTA measures customer satisfaction is through its "Rate Your Ride" (RYR) program, which allows customers to give feedback about their transit experiences by taking an online survey, calling or text-messaging. Between Bus, Light Rail and Metro, the Light Rail system had the highest satisfaction, with an average score of 3.4 out of 5. **Figure 2.4.7** illustrates the average satisfaction rating by mode.

Figure 2.4.7 – Satisfaction Rating by Mode, MTA Rate Your Ride Program, January 2013 – June 2013



The RYR program results are a good indicator of potential service needs, evident through complaints about late buses, skipped stops and vehicle overcrowding. **Figure 2.4.8** summarizes the tops reasons for dissatisfaction expressed by RYR users.

Figure 2.4.8 – Top Reasons for Dissatisfaction, Rat Your Ride Program



Specifically, Route 35, Route 11 and Route 13 buses received the most complaints about late vehicle arrivals, while Route 13, Route 10 and Route 35 buses received the most complaints about overcrowding. Route 3, Route 10 and Route 15 buses also received the most complaints regarding skipped bus stops, though more in-depth analysis found that only 53 percent of skipped stop reports were because a driver skipped the stop out of negligence.

Several initial improvements were made by MTA in response to these findings. These improvements included adjusting schedules on Routes 77, 11 and 35 as well as consolidating bus stops on the Routes 11 and 35. In addition, several internal initiatives were launched, including operator customer service training, enhanced LR cleaning processes and improvements to the operations of MTA's Mobility Call Center. Additional action plans and improvement initiatives are currently being planned on other bus routes and services.

2.4.9.2 2012 Customer Ridership Study

In 2012, MTA commissioned a customer ridership study in order to be informed of customer travel habits, needs and levels of satisfaction with service. Data obtained in this effort that is of particular interest to this study includes trip purpose, trip reason, reliability, usage frequency, usage change and support for fare increases for the Local Bus, Metro and Light Rail modes.

Trip Purpose **-** Trip purpose questions revealed that the majority of respondents use MTA to get to and from work. Overall, 51 percent of local bus riders, 61 percent of Metro riders and 54 percent of LR riders used the service to get to and from work. **Table 2.4.11** summarizes responses for trip purpose by mode for 2012 and for the prior two years in which this study was also conducted.

Table 2.4.11 –Trip Purpose

	Local Bus			Metro Subway			Light Rail		
PURPOSE OF TRIP	2012	2011	2010	2012	2011	2010	2012	2011	2010
Going to/ from work	51%	57%	52%	61%	62%	58%	54%	70%	59%
Going to/ from school	10%	12%	17%	7%	13%	19%	5%	12%	16%
Going to/ from shopping	11%	15%	17%	10%	15%	20%	12%	15%	21%
Going to/ from a social/ recreation event	9%	11%	16%	7%	16%	21%	11%	15%	23%
Going to/ from Doctor/ Medical	9%	14%	14%	9%	19%	13%	7%	17%	15%
Other (Specify)	7%	8%	5%	5%	7%	3%	9%	6%	6%
N =	1,390	1,615	1,446	397	409	359	307	298	275

Reasons for Riding - The top reasons for riding MTA revealed contributing factors to the mode choice of respondents. The top reason that respondents used Local Bus, Metro and LR was a lack of a personal vehicle. These respondents would be considered "no-choice" riders. Overall, 62 percent of Local Bus riders, 49 percent of Metro riders and 52 percent of LR riders fell into this category. The second highest reason for riding was monetary savings by not owning a personal vehicle for all three modes. **Table 2.4.12** summarizes the top reasons for riding MTA by mode.

Table 2.4.12 – Reason for Riding

	Local Bus			Metro Subway			Light Rail		
TOP REASONS FOR TAKING MTA	2012	2011	2010	2012	2011	2010	2012	2011	2010
No personal vehicle/No choice	62%	66%	65%	49%	43%	53%	52%	45%	44%
Save money by not using a personal vehicle	24%	27%	23%	38%	44%	30%	32%	42%	38%
More convenient	18%	19%	24%	28%	36%	33%	24%	28%	35%
Save gas by not using a personal vehicle	16%	17%	16%	26%	32%	27%	24%	31%	34%
Do your part to help the environment	9%	12%	13%	15%	19%	13%	16%	22%	23%
Avoid traffic	12%	11%	13%	26%	35%	24%	22%	30%	33%
Save time	6%	8%	8%	14%	16%	15%	8%	11%	11%
Encouraged by employer	4%	3%	4%	6%	8%	6%	5%	7%	8%
Other (Specify)	4%	6%	4%	6%	7%	3%	5%	8%	5%
N =	1,390	1,615	1,446	397	409	359	307	298	275

Reliability of Service - Reliability questions revealed customer satisfaction with on-time performance, ease of transfer, service frequency and speed. Based on a 1 (poor) to 5 (excellent) rating, Metro and LR riders were generally more satisfied with reliability than Local Bus riders. Local Bus riders and LR riders rated "arriving at your pickup point on time" and "frequency of service" the lowest, while Metro riders rated "east of transferring from one mode to another" and "getting you to your destination on time" the lowest. **Table 2.4.13** summarizes reliability satisfaction by MTA mode.

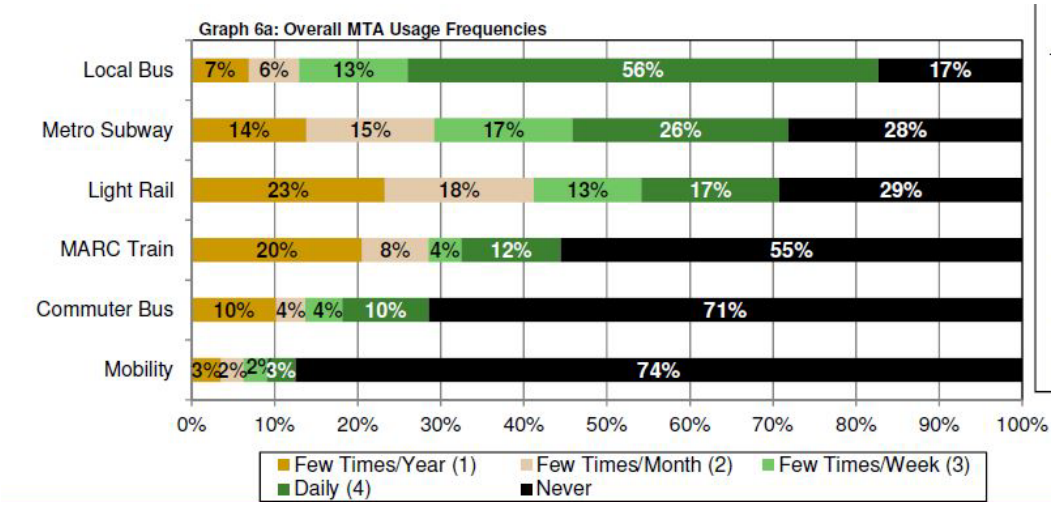
Table 2.4.13 – Reliability Satisfaction

	Local Bus			Metro Subway			Light Rail		
RIDING & RELIABILITY	2012	2011	2010	2012	2011	2010	2012	2011	2010
Arriving at your pickup point on time	2.67	2.85	3.03	3.52	3.28	3.29	3.12	2.93	3.35
Frequency of service	2.72	2.89	3.02	3.57	3.38	3.23	3.19	2.95	3.25
Speed of service	2.87	3.06	3.17	3.71	3.44	3.41	3.26	3.05	3.38
Getting you to your destination on time	2.81	3.03	3.22	3.51	3.38	3.43	3.31	3.00	3.43
Ease of transferring from one mode to another	3.02	3.24	3.34	3.40	3.37	3.43	3.39	3.10	3.45
N =	1,390	1,615	1,446	397	409	359	307	298	275

Use Frequency - Frequency of usage questions revealed how often respondents utilized MTA services by mode. Overall, Local Bus saw the highest percentage of daily riders (56 percent), followed by Metro (26 percent) and LR (17 percent). A fairly high percentage of LR riders only ride a few times per year (23 percent), while this figure is

much lower for Metro (14 percent) and Local Bus (7 percent). **Figure 2.4.15** summarizes overall mode use frequency.

Figure 2.4.15 – Usage Frequency by Mode



Use Behavior - Questions about changes in use behavior revealed how and why customers may have changed their habits in the past 12 months. For Local Bus riders, 58 percent said their usage stayed the same, 28 percent said their usage increased and 9 percent said their usage decreased. The top reasons for decreasing their usage were because of a move (29 percent) or a new job (22 percent). For Metro riders, 57 percent said their usage stayed the same, 30 percent said it increased and 8 percent said it decreased. The top reasons for decreasing their use were a new job (33 percent) or a move (31 percent). For LR riders, 58 percent said their usage stayed the same, 27 percent said it increased and 7 percent said it decreased. The top reasons for decreasing their usage were a new job (30 percent) or a move (21 percent).

Fare Increases - Questions regarding support for fare increases revealed some potential support for fare increases when they are coupled with service increases. Overall, 47 percent of Local Bus riders, 47 percent of Metro riders and 44 percent of LR riders would support a fare increase if it also means an increase in service.

2.4.10 Farebox Transfer Rate Data

Farecard purchase and use data was obtained for a single weekday in November 2012 for the purpose of determining the major transfer points and transfer characteristics in the system. Transfers between bus routes were calculated using bus farebox hits on individual farecards within certain time period thresholds. Transfers between bus routes and rail stations were calculated using bus farebox, Metro turnstile and LR ticket vending machine hits on farecards. Since riders of the LR do not have to tap farecards at a turnstile or farebox when entering the system, transfer data between LR and other modes is limited to those riders that actually purchased their fare prior to boarding at a LR ticket vending machine. Compared to Metro and bus farebox hits, LR ticket vending machine hits were very low; therefore, the analysis that follows does not include transfers to and from

LR. Two sets of transfer types were looked at specifically: bus to bus and bus to Metro. The most common transfers for each of these types were identified in order to build the framework necessary to consolidate or change routes accordingly. Appendix A of this report includes the detailed methodology used to calculate transfers within the system as well as a matrix that shows all transfers between routes.

2.4.11 Bus to Bus Transfers

The top three most common bus to bus transfers occurred between Route 13 and Route 8, Route 19 and Route 22, and Route 8 and Route 44. Route 13 and Route 8 intersect at East North Avenue and Greenmount Avenue just north of Downtown Baltimore. Major trip generators on Route 13 include Walbrook Junction, Fell's Point and Canton. Major trip generators on Route 8 include Lutherville, Towson, Downtown Baltimore and the University of Maryland. Both routes also have high ridership (greater than 15,000 boardings per day).

Route 19 and Route 22 intersect and briefly run concurrently along Harford Road between Erdman Avenue and The Alameda, northeast of Downtown Baltimore. Major trip generators on Route 19 include State Center, Downtown Baltimore, the Hamilton shopping district and Carney. Major trip generators on Route 22 include Mondawmin, Johns Hopkins University and Johns Hopkins Bayview Medical Center.

Route 8 and Route 44 intersect at Northern Parkway and York Road in northern Baltimore City. Major trip generators on Route 8 include Lutherville, Towson, Downtown Baltimore and the University of Maryland. Major trip generators on Route 44 include Security Square Mall, the Social Security Administration headquarters, Rogers Avenue Metro Station, Pimlico, Sinai Hospital and the Rosedale Industrial Park. Both routes have high ridership in excess of 12,000 boardings per weekday. **Figure 2.4.9** illustrates these top three bus to bus transfer route pairs.

Large numbers of transfers occurred between other routes as well, most notably between Routes 8 and 22, 22 and 3, and 40 and 23. While Routes 8/22 and 22/3 only have one major point of intersection, Routes 40 and 23 largely parallel each other through Baltimore City. Route 40 is a QuickBus route with limited stops however, while Route 23 is a Local Bus route. **Table 2.4.14** summarizes the major bus to bus transfer routes in the MTA system.

Figure 2.4.9 – Top Three Bus to Bus Transfers

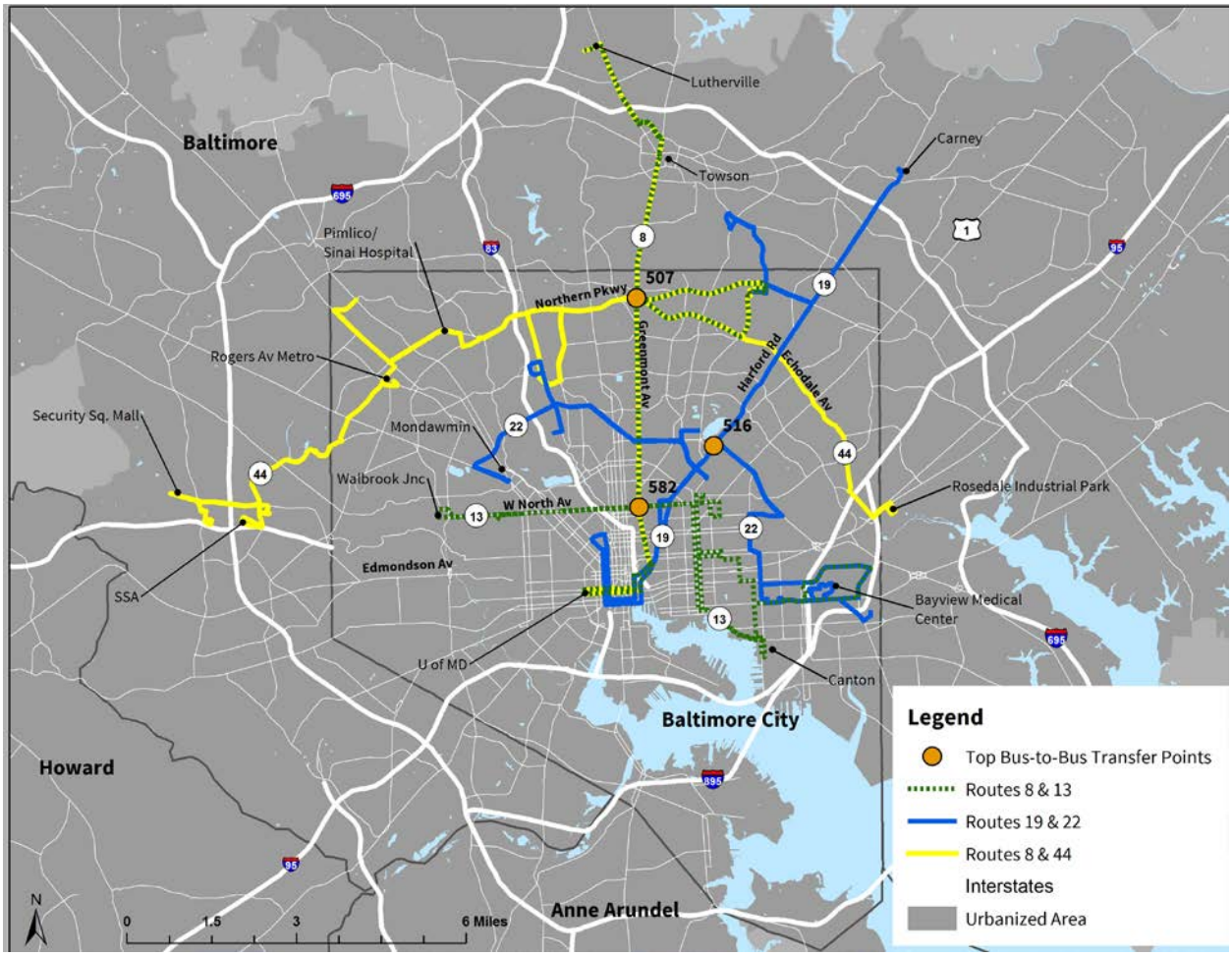


Table 2.4.14 – Major Bus to Bus Transfers

Route A	Route B	Transfers A to B	Transfers B to A	Total Daily Transfers
13	**8**	296	286	582
19	**22**	262	254	516
44	**8**	256	251	507
8	**22**	249	234	483
22	**3**	248	210	458
40	**23**	243	239	482
15	**13**	238	198	436
23	**20**	214	202	416
19	**13**	206	202	408
36	**8**	209	196	405
44	**3**	201	177	378

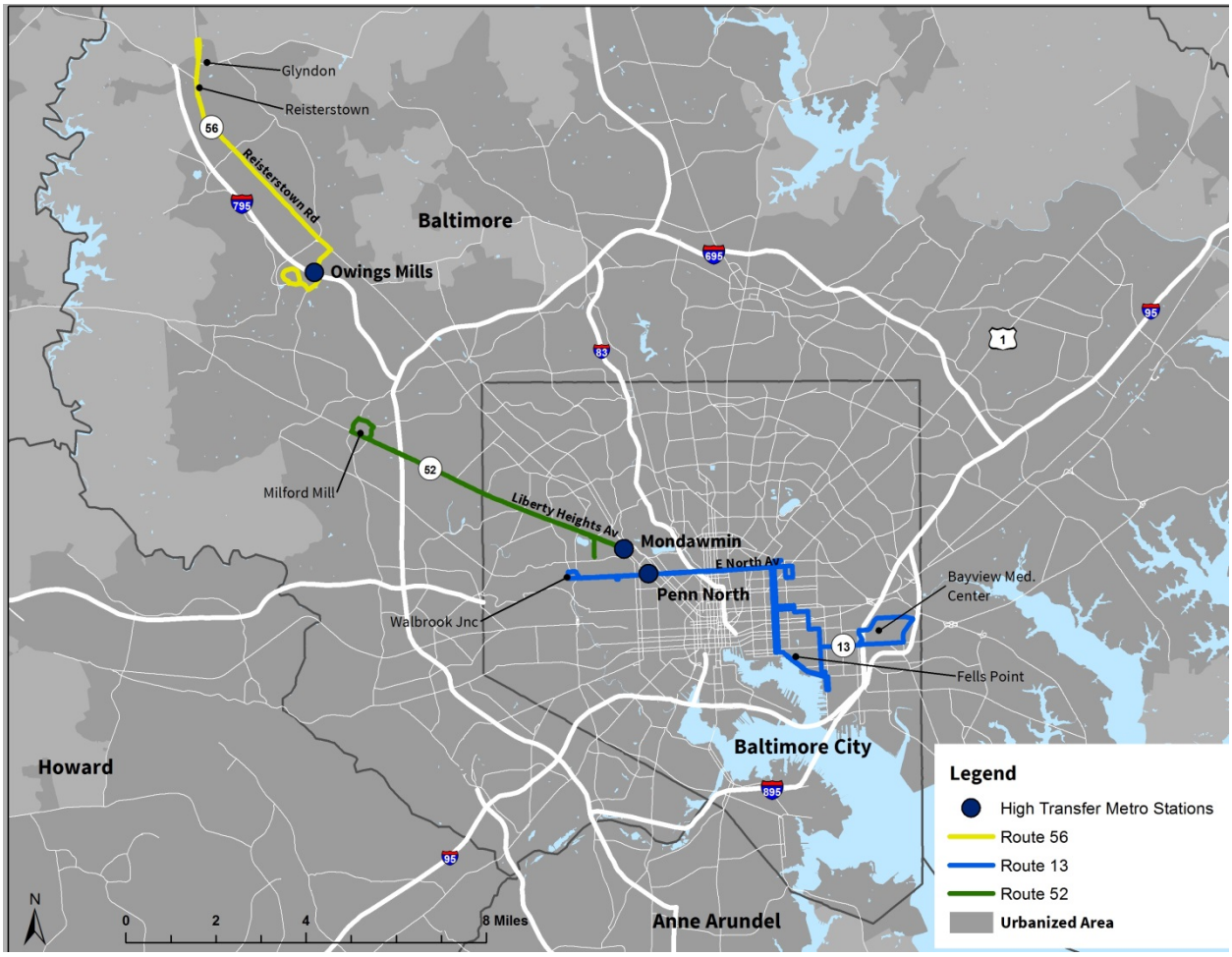
2.4.12 Bus and Metro Transfers

The top three most common transfers between bus routes and the Metro occurred at Mondawmin Station, Penn North Station and Owings Mills Station. At Mondawmin, the most common transfer was to/from the Route 52, which follows Maryland Route 26 out to shopping centers in Milford Mill. At Penn-North, the most common transfer was to/from the Route 13, which follows North Avenue and serves Walbrook Junction, Canton, Fell's Point and Johns Hopkins Bayview Medical Center. At Owings Mills, the most common transfer was the Route 56, which follows Reisterstown Road to Reisterstown Center and Glyndon. Other major bus and rail transfers occurred at these and other Metro stations as well. Mondawmin Station in particular showed a high number bus and rail transfers, as it is served by nine different bus routes. **Table 2.4.15** summarizes these major transfers, while **Figure 2.4.10** illustrates the top three.

Table 2.4.15 – Major Bus and Metro Transfers

Bus Route	Rail Station	Bus to Rail	Rail to Bus	Total Transfers
52	**Mondawmin**	770	955	1,725
13	**Penn-North**	800	683	1,483
56	**Owings Mills**	586	717	1,303
54	**Milford Mill**	618	514	1,132
44	**Rogers Avenue**	511	568	1,079
54	**Mondawmin**	520	388	908
22	**Mondawmin**	330	538	868
77	**Old Court**	323	407	730
51	**Mondawmin**	345	360	705
91	**Rogers Avenue**	319	313	632

Figure 2.4.10 – Top Three Bus and Metro Transfers



2.4.13 Three-Seat Transfers

The most common three-seat transfers found were all bus to Metro to bus transfers, although none of the common patterns showed more than 68 people per day making the trip. Owings Mills Station and Mondawmin Station stand out as the stations with the most common three-seat transfers of this pattern. The most common three-seat transfer was Route 56 to Owings Mills to Old Court to Route 77. Route 56 to Owings Mills is also one of the top three bus to rail transfers, as it connects Glyndon and Reisterstown Center to the station. Route 77 connects Old Court Station to several important destinations, including Security Square Mall, the Social Security Administration Headquarters, the University of Maryland-Baltimore County, the Halethorpe MARC Station, and the Patapsco LR Station.

The second most common three-seat transfer was Route 13 to Penn North to Mondawmin to Route 52. Route 13 follows North Avenue and serves Walbrook Junction, Canton, Fell's Point and Johns Hopkins Bayview Medical Center. Route 52 follows Maryland Route 26 out to shopping centers in Milford Mill. Both Route 52 to Mondawmin

and Route 13 to Penn North also represent the first and second most common bus and rail transfer in the system, as discussed in the previous section.

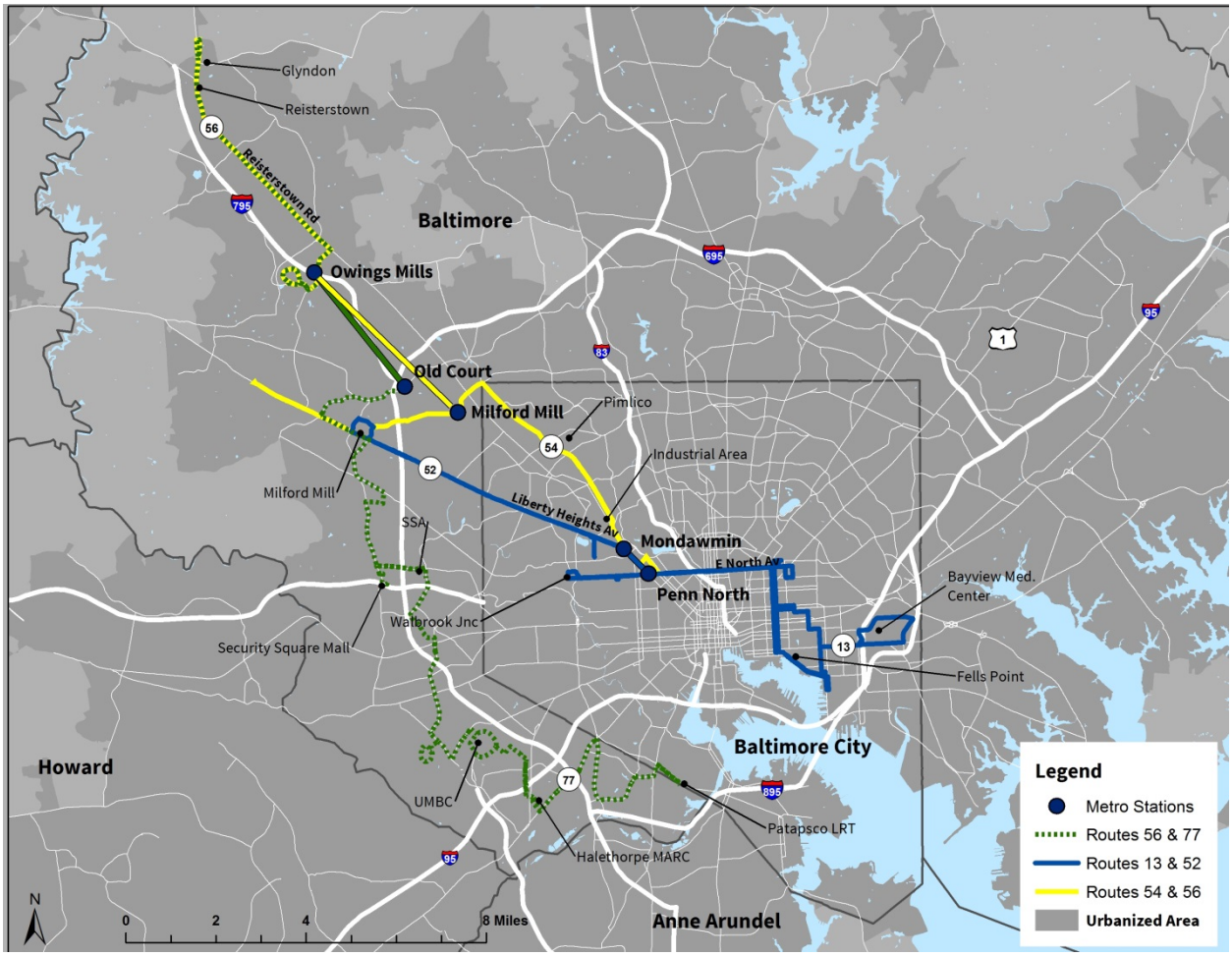
The third most common three-seat transfer was Route 54 to Milford Mill to Owings Mills to Route 56. Route 54 connects Randallstown to Penn-North Station via Milford Mill Station and Park Heights Avenue/Reisterstown Road. It also serves Pimlico Racetrack and the industrial area on Druid Park Drive. Route 56, as previously discussed, connects Glyndon and Reisterstown Center to Owings Mills.

Table 2.4.16 summarizes the top three-seat transfers in the MTA system. **Figure 2.4.11** illustrates the top three.

Table 2.4.16 – Major Three-Seat Transfers

Route A	Station On	Station Off	Route B	A to B Transfers	B to A Transfers	Total
56	Owings Mills	Old Court	77	36	32	**68**
13	Penn-North	Mondawmin	52	23	15	**38**
54	Milford Mill	Owings Mills	56	26	11	**37**
56	Owings Mills	Rogers Avenue	44	19	14	**33**
56	Owings Mills	Old Court	99	17	14	**31**
52	Mondawmin	Johns Hopkins	35	13	12	**25**
77	Old Court	Owings Mills	59	13	11	**24**

Figure 2.4.11 – Top Three Three-Seat Transfers



2.5 MTA Light Rail and Metro Subway

2.5.1 Operating Characteristics

The Light Rail and Metro provide an overall high level of service, with frequent headways during the weekday and an extensive span of service. The Light Rail operates as one line with numerous run patterns and branches. Some trains during the peak period in the direction of Hunt Valley turn back early at the Timonium Fairgrounds Station. When trains are taken out of service they typically terminate at North Avenue Station adjacent to the Light Rail Maintenance Facility. Headways on the 1.7 mile central portion of the Light Rail (between Camden Yards and North Avenue Station) operate at headways of 10 minutes or better, providing customers frequent enough service that a schedule is not needed. Service on the branches of the Light Rail is not as frequent, with some branches operating at up to 30 minute headways, more typical of a commuter rail than Light Rail service.

The Metro operates as one line with no run pattern variations. During the weekday, headways average 10 minutes or less, while during the weekend trains operate every 16 minutes. **Table 2.5.1** summarizes service span and headways by time period for the Light Rail and Metro Subway.

Table 2.5.1 –: Span of Service and Headway – Light Rail and Metro Subway

	Span of Service			Headway						
	Weekday	Saturday	Sunday	AM	Mid	PM	Eve	Late	Sat	Sun
Light Rail (All)	**3:56 AM - 1:30 AM**	**4:21 AM - 1:23 AM**	**9:44 AM - 10:06 PM**	**8**	**10**	**8**	**10**	**10**	**10**	**10**
To BWI Thurgood Marshall Airport				*20*	*30*	*20*	*30*	*30*	*30*	*30*
To Camden Yards				*8*	*10*	*8*	*10*	*10*	*10*	*10*
To Glen Burnie				*20*	*30*	*18*	*30*	*30*	*30*	*30*
To Fairgrounds				*10*	*15*	*10*	*15*	*15*	*15*	*15*
To Hunt Valley				*20*	*15*	*17*	*15*	*15*	*15*	*15*
To North Avenue Station				*10*	*15*	*10*	*13*	*13*	*15*	*15*
To Penn Station				*30*	*30*	*30*	*30*	*30*	*30*	*30*
Metro	**4:54 AM - 12:31 AM**	**6:01 AM - 12:31 AM**	**6:10 AM - 12:31 AM**	8	10	8	11	11	15	15

Operationally, both services have very few non-revenue hours and lose little time to deadheading. Despite running on an exclusive guideway, average recovery times as a percentage of service hours is comparable to bus service during most periods; the Metro on weekends operates with a high scheduled recovery time of 35 percent of total service hours. **Table 2.5.2** summarizes the major operating characteristics of the Light Rail and Metro.

Table 2.5.2 – Weekday Operating Characteristics – Light Rail and Metro

Day	Route	Revenue Hours	Layover Hours *(% of total)*	Non-Revenue Hours *(% of total)*	Revenue Miles	Deadhead Miles *(% total)*	Peak Trains	Trips
Weekday	LR	272	59 (18%)	3 (1%)	5,106	10 (0%)	19	304
Weekday	Metro	117	24 (17%)	2 (2%)	3,524	57 (2%)	9	249
Saturday	LR	226	45 (17%)	2 (1%)	4,208	6 (0%)	14	246
Saturday	Metro	74	51 (35%)	21 (28%)	2,195	16 (1%)	5	154
Sunday	LR	129	26 (17%)	2 (2%)	2,408	6 (0%)	14	149
Sunday	Metro	74	51 (35%)	21 (28%)	2,195	16 (1%)	5	154

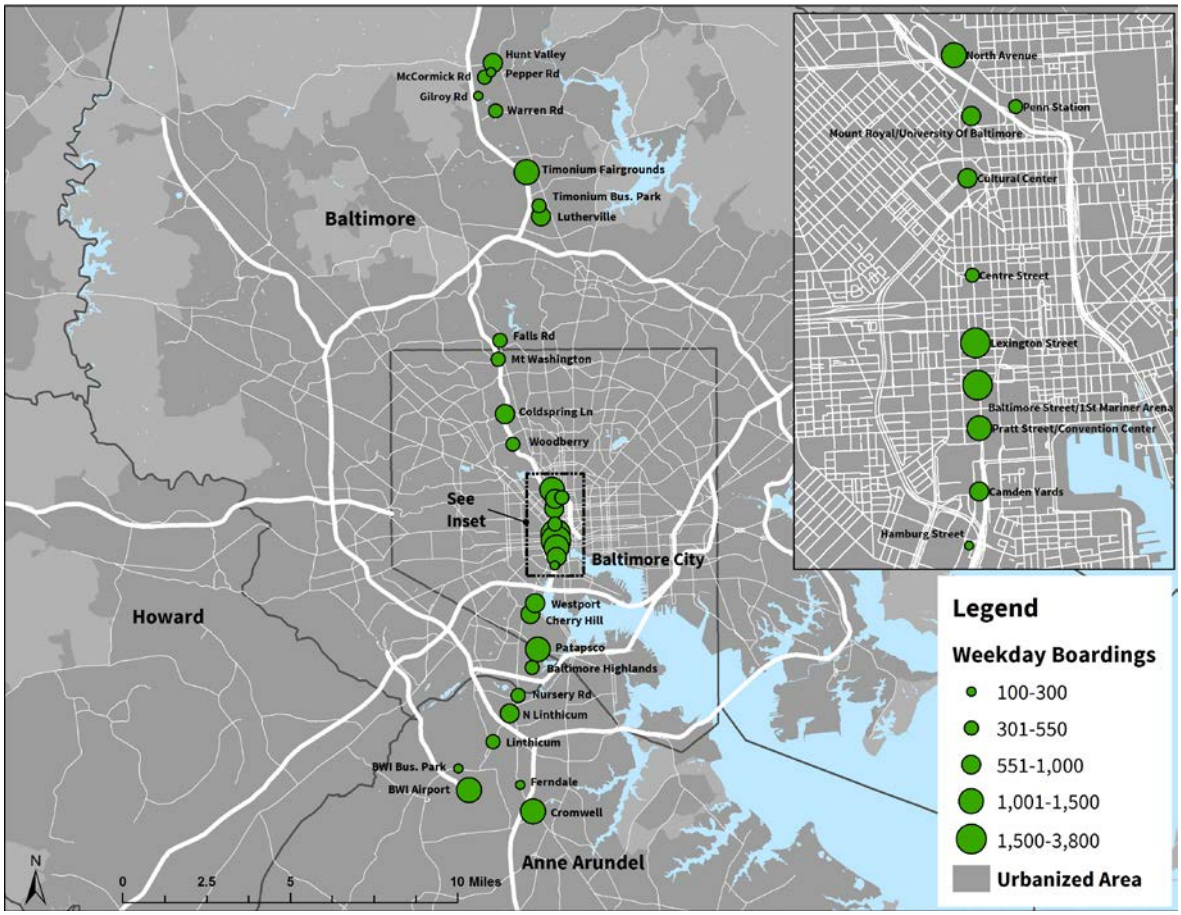
2.5.2 Light Rail Ridership

Light Rail ridership data was obtained for the time period of July, 2012 and April, 2013 in the form of average weekday boardings by station. In total, there were 27,275 boardings on an average weekday, while average Saturday and Sunday boardings for the same time period were 19,888 and 10,758, respectively. The two busiest stations, Lexington Street and Baltimore Street, are both located in Downtown Baltimore. In addition to being Downtown, Lexington Street offers the closest transfer point between the Light Rail and the Metro. The third busiest station, Patapsco, is located south of Downtown and is the closest station to the Fairfield Marine Terminal. A number of Core Bus routes serve this station, including the 14, 16, 17, 51 and 77. The fourth busiest station, Cromwell/Glen Burnie, is an end-of-the-line station adjacent to a shopping plaza and is the closest station to Downtown Glen Burnie. **Table 2.5.3** summarizes and **Figure 2.5.1** illustrates average weekday boardings at each Light Rail station.

Table 2.5.3 – Light Rail Average Weekday Ridership, July 2012 - April 2013

Station	Weekday Boardings
BWI Thurgood Marshall Airport	1,208
BWI Business District	248
Cromwell Station / Glen Burnie	1,309
Ferndale	113
Linthicum	538
North Linthicum	703
Nursery Road	519
Baltimore Highlands	327
Patapsco	1,448
Cherry Hill	805
Westport	734
Hamburg Street	286
Camden Yards	749
Pratt Street / Convention Center	1,226
University Center / Baltimore Street	2,686
Lexington Market	3,702
Centre Street	549
Cultural Center – State Center	888
Mount Royal / University Of Baltimore	854
Penn Station	346
North Avenue	1,132
Woodberry	466
Cold Spring Lane	715
Mount Washington	512
Falls Road	500
Lutherville	959
Timonium Business Park	376
Timonium Fairgrounds	1,166
Warren Road	335
Gilroy Road	271
McCormick Road	527
Pepper Road	192
Hunt Valley	884
Total	**27,275**

Figure 2.5.1 – Light Rail Average Weekday Boardings, July 2012 - April 2013



2.5.3 Metro Ridership

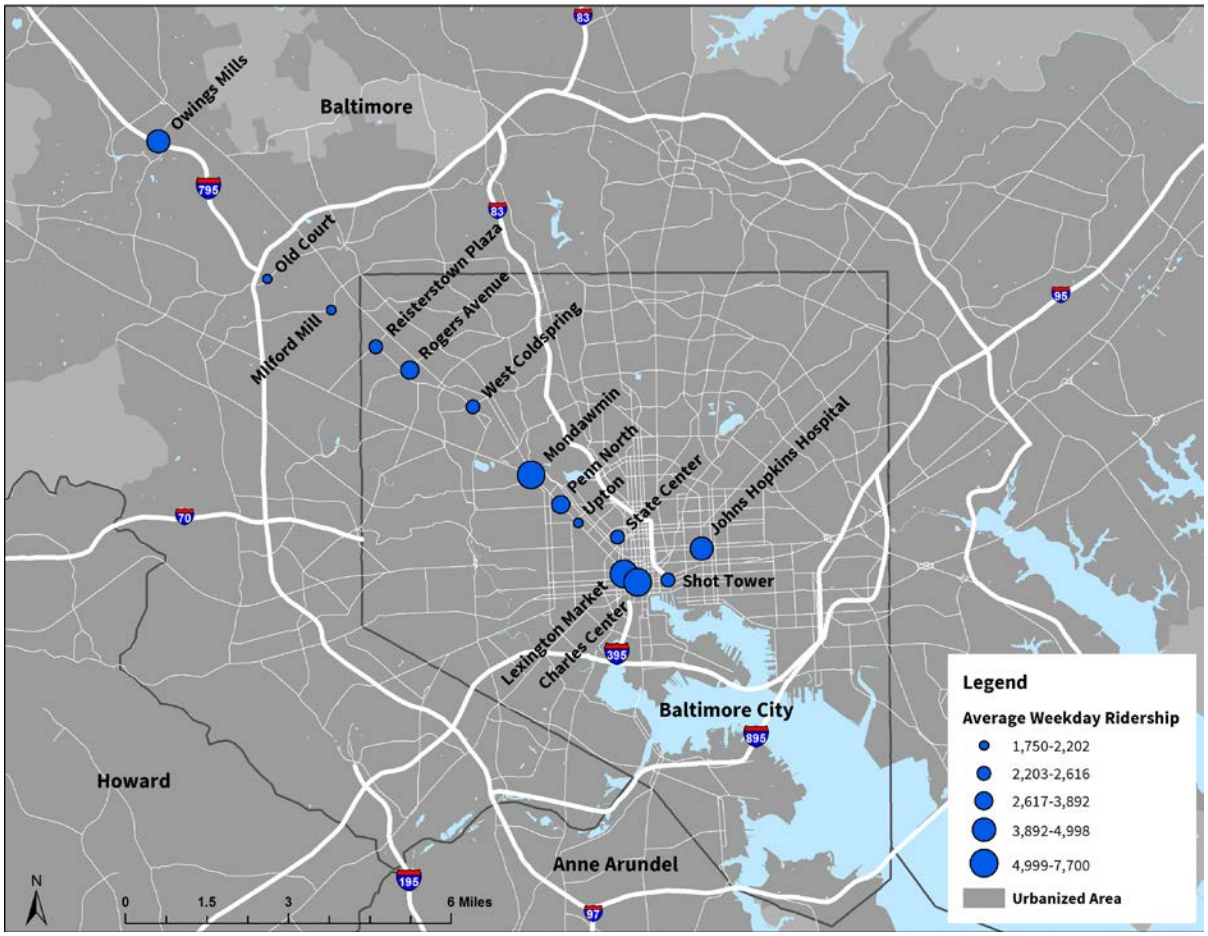
Metro ridership by station was obtained for the month of November 2012. Average weekday ridership for this month totaled nearly 55,000 riders, while Saturday and Sunday ridership totaled approximately 29,500 and 15,500 respectively. The three stations with the highest ridership were Lexington Market, Mondawmin and Charles Center. Lexington Market and Charles Center are both Downtown, while Mondawmin is northwest of Downtown yet adjacent to a major shopping mall, Baltimore City Community College and Coppin State University. End of the line stations at Owings Mills and Johns Hopkins Hospital had the fourth and fifth highest weekday ridership respectively. **Table 2.5.4** summarizes ridership by station on the Metro while **Figure 2.5.2** illustrates weekday ridership by station.

Table 2.5.4 – Average Daily Ridership – Metro Subway

Station	Weekday Ridership	Sat Ridership	Sun Ridership
Owings Mills	4,999	2,212	1,230
Old Court	1,797	828	488
Milford Mill	2,134	947	615
Reisterstown Plaza	2,572	1,406	746
Rogers Avenue	3,399	1,874	998
West Cold Spring	2,325	1,351	727
Mondawmin	7,100	4,424	2,269
Penn-North	3,892	2,373	1,334
Upton / Avenue Market	2,202	1,454	798
State Center	2,617	1,067	576
Lexington Market	7,687	4,978	2,014
Charles Center	6,924	2,784	1,648
Shot Tower / Market Place	2,391	1,531	835
Johns Hopkins Hospital	4,831	2,244	1,201
Total	**54,871**	**29,472**	**15,478**

November, 2012

Figure 2.5.2 – Average Weekday Metro Ridership by Station



Weekday ridership by time of day shows the peak hours of travel on the Metro to be from 7AM to 9AM and from 4PM to 6PM. Together, these four hours represent 36 percent of weekday ridership. **Table 2.5.5** summarizes average weekday ridership by time of day.

Table 2.5.5 – Weekday Ridership by Time of Day – Metro Subway

Hour	Total	% of Daily Total
4:00AM- 5:00AM	4	0.0%
5:00AM - 6:00AM	871	1.6%
6:00AM- 7:00AM	2,101	3.8%
7:00AM- 8:00AM	4,408	**8.0%**
8:00AM- 9:00AM	5,115	**9.3%**
9:00AM- 10:00AM	3,304	6.0%
10:00AM - 11:00AM	2,548	4.6%
11:00AM - 12:00PM	2,547	4.6%
12:00PM- 1:00PM	2,958	5.4%
1:00PM- 2:00PM	3,005	5.5%
2:00PM- 3:00PM	3,226	5.9%
3:00PM- 4:00PM	4,290	7.8%
4:00PM - 5:00PM	5,117	**9.3%**
5:00PM - 6:00PM	5,306	**9.7%**
6:00PM- 7:00PM	3,330	6.1%
7:00PM- 8:00PM	2,093	3.8%
8:00PM- 9:00PM	1,478	2.7%
9:00PM- 10:00PM	1,200	2.2%
10:00PM - 11:00PM	951	1.7%
11:00PM - 12:00AM	802	1.5%
12:00AM- 1:00AM	217	0.4%
1:00AM- 2:00AM	1	0.0%
Total	54,871	100.0%

November, 2012

Overall, the LR and Metro have a very good on-time performance. The data available for LR and Metro OTP, however, is limited and does not provide detailed information on actual vs. scheduled travel times. LR and Metro report between 97 percent and 100 percent on-time performance.

2.6 Fleet and Facilities

2.6.1 Maintenance Facilities

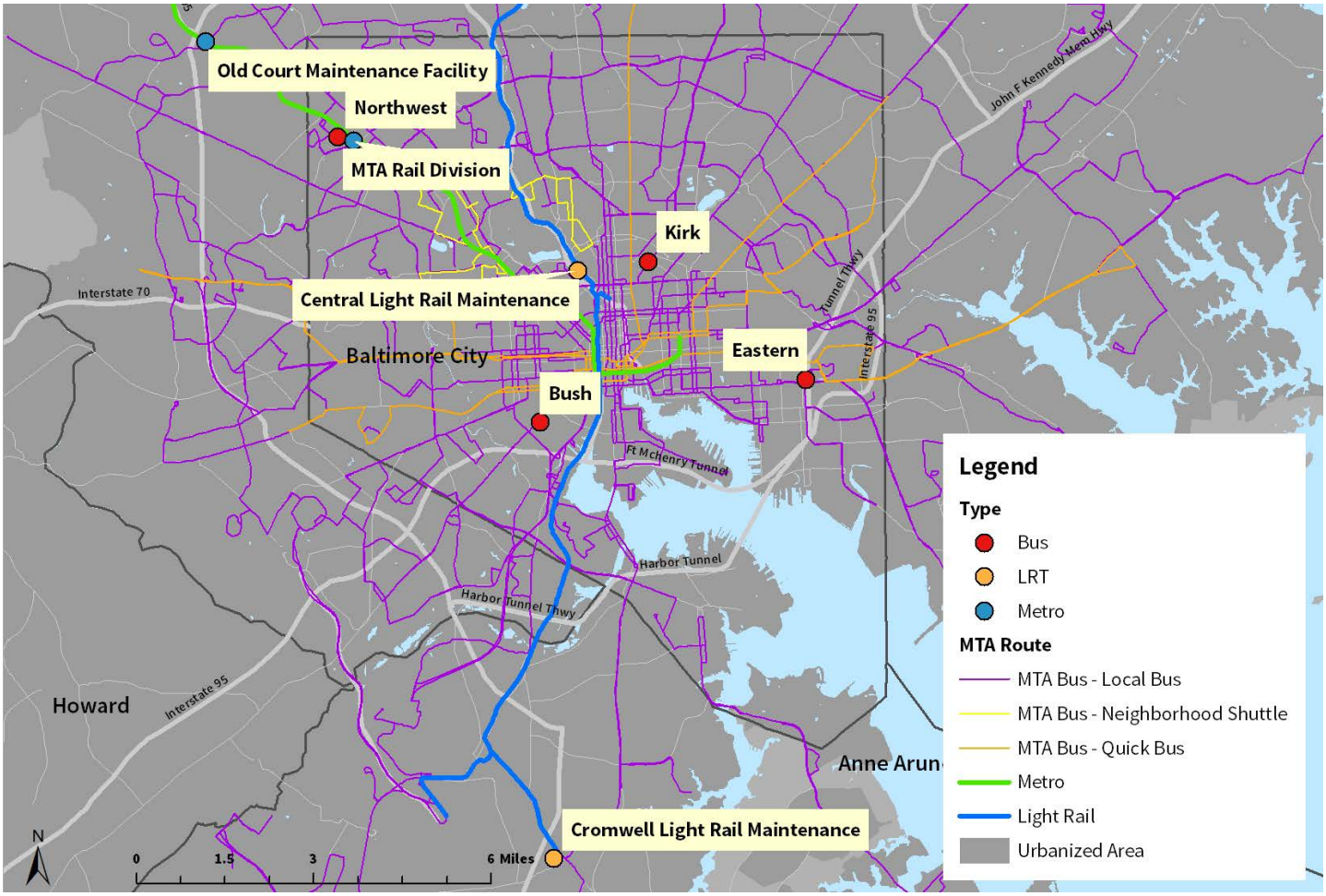
The MTA transit network in Baltimore is served by eight maintenance facilities for bus, LR, and Metro operations. The Core Bus service is split into four divisions based on the bus garage serving the route. While routine maintenance and inspections are conducted at all four garages, Bush Division is home to MTA's main bus maintenance facility. Some routes are based out of multiple garages. The Metro's main maintenance garage is located near Rogers Avenue Station with a smaller facility adjacent to Old Court Station. The LR has a main facility by North Avenue Station and a second facility at the terminus in Cromwell. **Table 2.6.1** summarizes and **Figure 2.6.1** illustrates the major MTA maintenance facilities.

MTA has two major maintenance facility upgrades planned: a new Kirk Division garage and enclosed bus storage building; and a new main maintenance facility at Bush Division.

Table 2.6.1 – MTA Transit Maintenance Facilities

Route Type	Routes
Bush Division	1, 3, 8, 10, 14, 15, 16, 17, 20, 23, 27, 29, 30, 35, 36, 38, 40, 46, 47, 48, 51, 61, 64, 77, 99, 150
Eastern Division	1, 3, 5, 8, 10, 13, 15, 19, 20, 22, 24, 27, 33, 36, 44, 52, 53, 61, 64, 91
Kirk Division	3, 8, 9, 11, 12, 15, 19, 36, 44, 47, 48, 50, 55, 104, 120
Northwest Division	5, 7, 13, 16, 18, 22, 27, 33, 44, 51, 52, 53, 54, 56, 57, 58, 59, 60, 77, 91, 97, 98, 99
Central Light Rail Maintenance	All Light Rail Routes
Cromwell Light Rail Maintenance	All Light Rail Routes
Metro Rail Division	Metro
Old Court Maintenance Facility	Metro

Figure 2.6.1 – MTA Transit Maintenance Facilities



2.6.2 Transit Fleet

As of 2013, MTA has a fleet consisting of 824 buses used on its core bus service (774 active buses and 50 in reserve), 53 LR vehicles and 100 subway cars. According to the 2012 MTA Fleet Management report, MTA's fleet averages 6.4 years old and compares favorably to peer systems in Washington DC, Pittsburgh, Richmond VA, and Atlanta. The MTA bus fleet is primarily composed of New Flyer Hybrid buses, but also includes older NABI and Neoplan vehicles approaching their retirement age. **Table 2.6.2** summarizes the major characteristics of MTA's core bus service fleet.

Table 2.6.2 – Bus Fleet Overview

Manufacturer	Passenger Capacity[10]	Length	Purchase Year	Recommended Replacement Year	# of Vehicles (Active/Reserves)
NABI 416 Diesel	56	40'	1998	2010	0/50
NABI 416 Diesel	56	40'	1999	2011	66/0
NABI 416 Diesel	56	40'	2000	2012	77/0
Neoplan	49	40'	2002	2014	99/0
New Flyer D40LF Diesel	49	40'	2004	2016	125/0
New Flyer D40LF Diesel	49	40'	2005	2019	94/0
New Flyer Hybrid	49	40'	2006	2018	10/0
New Flyer Hybrid	83	60'	2008	2020	30/0
New Flyer Hybrid	49	40'	2009	2021	100/0
New Flyer Hybrid	49	40'	2010	2022	41/0
New Flyer Hybrid	83	60'	2011	2023	12/0
New Flyer Hybrid	49	40'	2011	2023	57/0
New Flyer Hybrid	49	40'	2012	2024	53/0
New Flyer Hybrid	83	60'	2012	2024	10/0

The LR and Metro fleet are composed entirely of electrical multiple units (EMUs), powered by overhead wires in the case of the LR, and a third rail with the subway. LR vehicles can operate independently or as two and three car consists. The Metro cars are operated as linked pairs forming trains of two, four or six car lengths. **Table 2.6.3** summarizes the major characteristics of the LR and Metro fleet.

[10] Passenger capacity is based on MTA max load capacity of 130% of the number of seats. This capacity does vary by type of service; for example it is 100% of seats for Express routes.

Table 2.6.3 – Rail Fleet Overview

Manufacturer	Mode	Type	Passenger Capacity (Sitting/Standing)	Purchase Year	# of Vehicles
ABB	LR	Articulated EMU	85/91	1991-1992	35
ABB	LR	Articulated EMU	85/91	1997	18
Budd / Transit America	Metro	EMU	76/90	1983 (overhauled 2002-2005)	100

2.6.3 Bus and Bus/Rail Transfer Facilities

Unlike some peer systems organized around a series of large transit centers, the MTA has relatively few formal transfer centers. The largest bus transfer facility in the system is located at Mondawmin Station, and serves nine bus routes along with the Metro. A number of other Metro and LR stations feature transfer facilities in the form of a bus loop or bus bays. Outside of these few locations, the majority of bus to bus connections occur at on-street bus stops. The only formal bus-only transfer center is located at the University of Maryland Medical Center campus. **Table 2.6.4** summarizes the major transfer centers present in the MTA system.

Table 2.6.4 – Transfer Centers

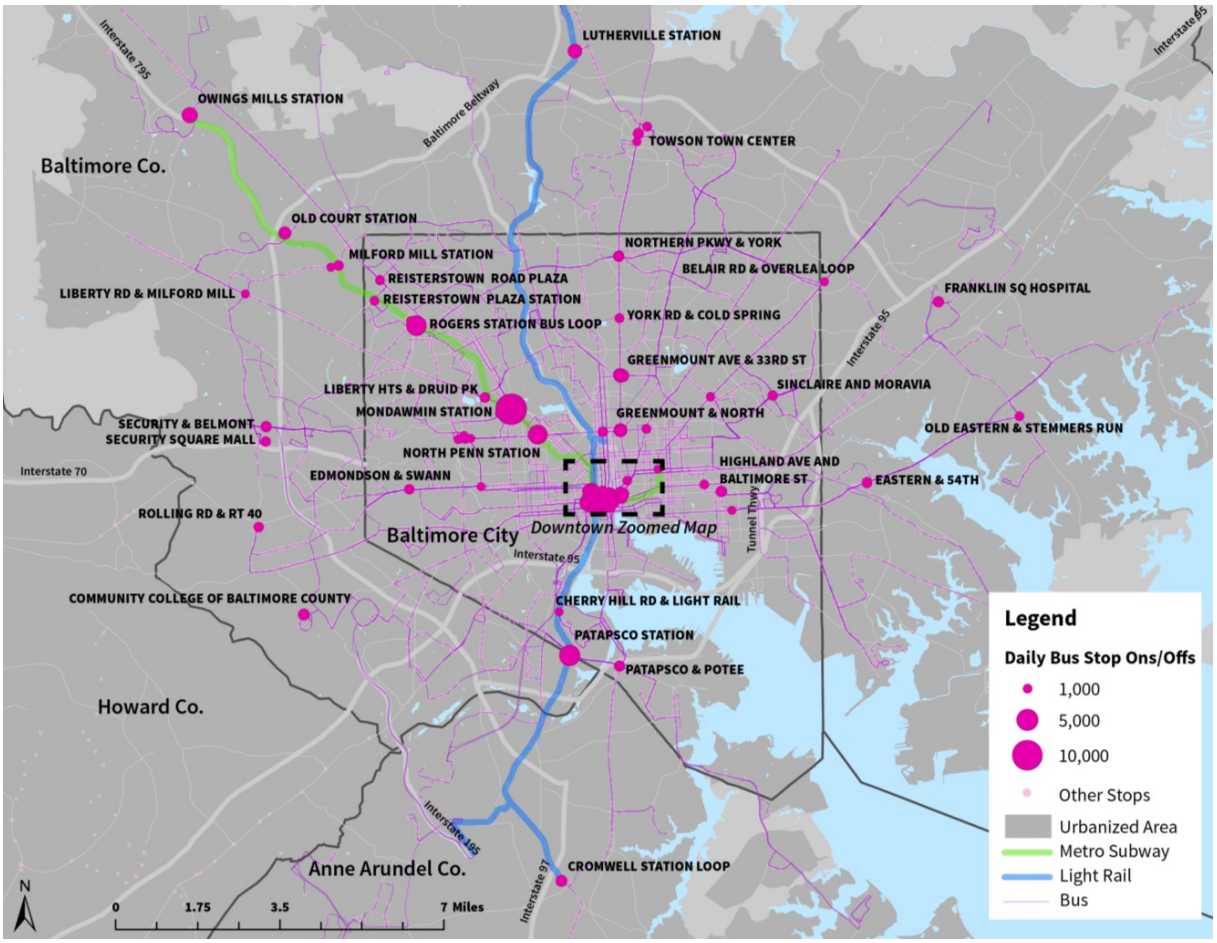
Name	Routes	Mode	On / Off Street Facility	Buses per Weekday
Owings Mills	56, 59	Metro	Off-Street	154
Old Court	53, 77, 99	Metro	Off-Street	229
Milford Mill	54	Metro	Off-Street	172
Reisterstown Plaza	27, 58, 59, 60	Metro	Off-Street	236
Rogers Avenue	27, 33, 44, 51, 57, 91	Metro	Off-Street	656
West Cold Spring	33, 51, 97	Metro	Off-Street	296
Mondawmin	1, 5, 7, 16, 21, 22, 52, 53, 97	Metro	Off-Street	1,321
Penn North	7, 13, 21, 54, 91	Metro	On-Street	661
Upton / Avenue Market	7	Metro	On-Street	70
State Center	21, 91, 19, 19X	Metro	On-Street	370
Lexington Market	5, 27, 91, 19, 19X, 5X	Metro	On-Street	536
Charles Center	1, 3, 5, 8, 10, 10X, 11, 20, 23, 30, 36, 3X, 40, 46, 5, 5X, 61, 64, 91	Metro	On-Street	2,080
Shot Tower / Market Place	20, 23, 40	Metro	On-Street	462
Johns Hopkins Hospital	5, 5X, 15X, 35, 46, 47	Metro	On-Street	375
BWI Thurgood Marshall Airport	17, 99	LR	On-Street	76

Name	Routes	Mode	On / Off Street Facility	Buses per Weekday
BWI Business District	17, 99	LR	Off-Street	76
Cromwell Station / Glen Burnie	14	LR	Off-Street	91
Ferndale	None	LR	On-Street	N/A
Linthicum	None	LR	On-Street	N/A
North Linthicum	None	LR	Off-Street	N/A
Nursery Road	17	LR	On-Street	54
Baltimore Highlands	None	LR	On-Street	-
Patapsco	14, 16, 17, 51, 77	LR	Off-Street	445
Cherry Hill	27, 29, 51	LR	On-Street	264
Westport	51	LR	On-Street	139
Hamburg Street	None	LR	On-Street	-
Camden Yards	None	LR	On-Street	-
Pratt Street / Convention Center	7, 19, 19X, 27, 35	LR	On-Street	437
University Center / Baltimore Street	1, 10, 10X, 19, 19X, 20, 27, 30, 36, 40, 46, 48, 5, 5X, 8, 91	LR	On-Street	1681
Lexington Market	19, 19X, 27	LR	On-Street	243
Centre Street	19, 19X, 27	LR	On-Street	243
Cultural Center	19, 19X, 27	LR	On-Street	243
Mount Royal / University Of Baltimore	27	LR	On-Street	72
Penn Station	3, 3X, 11, 61, 64	LR	On-Street	458
North Avenue	13	LR	On-Street	220
Woodberry	98	LR	On-Street	25
Cold Spring Lane	33, 38	LR	On-Street	126
Mount Washington	27, 58, 60	LR	On-Street	162
Falls Road	60	LR	Off-Street	37
Lutherville	8, 9	LR	Off-Street	286
Timonium Business Park	None	LR	-	-
Timonium Fairgrounds	9, 83s *(Rabbit Transit)*	LR	Off-Street	88
Warren Road	9, *83s (Rabbit Transit)*	LR	Off-Street	88
Gilroy Road	None	LR	-	-
McCormick Road	9	LR	On-Street	88
Pepper Road	None	LR	On-Street	-
Hunt Valley	*83s (Rabbit Transit)*	LR	On-Street	-

2.6.4 High Use Bus Stops

As transit centers currently play only a secondary role in the organization of the MTA bus network, the location of high ridership bus stops is a good way to identify major nodes of activity in the bus system. **Figure 2.6.2** shows the distribution of the top 100 busiest bus stops in terms of combined boardings and alightings. While these stops are located across MTA's core bus service area, they are highly concentrated in Downtown and along the Metro.

Figure 2.6.2 – 100 Busiest Bus Stops (Combined Boardings and Alightings)



A few key corridors emerge from looking at high ridership stop locations. A number of corridors radiate from Downtown, the best defined of which follows York Road out to Towson; here, stops with daily ridership exceeding 1,000 people are distributed at regular intervals. Other major corridors include east from Downtown along Eastern Avenue, northeast along Belair Road, west along Edmondson Road and northwest following the Metro line.

Metro and LR stations form many of the top boarding locations for MTA Core Bus service. Mondawmin Station and adjacent bus stops have over 10,000 boardings each day. Other key locations along the Metro include: Owings Mills, Old Court, Milford Mill, Reisterstown Plaza, Rogers Avenue, and Penn-North. Fewer high ridership bus stops

are located adjacent to the LR. Top bus stops along the LR include Patapsco Station, Lutherville Station and Cromwell Station. **Table 2.6.5** summarizes the bus stops with the highest weekday boardings in the MTA system.

Table 2.6.5 – Bus Stops with Highest Daily Boardings

Rank	Station	Daily On/Offs	Routes	Note
1	Mondawmin Metro Station	10,796	1, 5, 7, 16, 21, 22, 52, 53, 97	
2	Baltimore Arena	5,938	1, 5, 05X, 8, 10, 10X, 20, 30, 36, 40, 48, 91, 150, 160	
3	Baltimore Street & Charles Street	5,421	1, 5, 05X, 8, 10, 10X, 20 , 23, 30, 36, 40, 46, 48, 91, 120	
4	Fayette & Charles St Paul	5,100	5, 05X, 8, 20, 23, 30, 36, 40, 48, 91, 150, 160	
5	Reisterstown & Liberty	4,907	1, 5, 7, 16, 21, 22, 51, 52, 53, 54, 97	Across from Mondawmin Station
6	Patapsco LR Station	4,771	14, 16, 17, 51, 77	
7	Fayette Street & Howard Street	4,750	1, 5, 5X, 8, 19, 19X, 20, 27, 30, 36, 40, 48, 91, 150	Adjacent to Lexington Market Station
8	Rogers Avenue	4,531	27, 44, 57, 33, 51, 91	
9	North Avenue & Pennsylvania	4,089	7, 21, 91, 13, 54	
10	Baltimore Street & Paca Street	3,779	1, 8, 10X, 30, 40, 48, 7, 10, 20, 36, 46	
11	Owings Mills Metro (Bus Loop)	2,822	56, 59	
12	Eutaw Street & Saratoga Street	2,609	5, 15X, 23, 47, 150, 19X, 15, 19, 27, 91, 05X	Lacks shelter
13	North Avenue & Pennsylvania	2,413	7, 21, 91, 13, 54	Adjacent to North Avenue & Pennsylvania Stop / Penn-North Metro Station
14	Saratoga & Howard	2,406	5, 15X, 23, 47	1 block from Lexington Market Station
15	Baltimore Street & Light Rail	2,403	1, 5, 5X, 8, 10, 10X, 20, 23, 30, 36, 91, 150, 160, 310	
16	Lutherville LR Station	2,392	8, 9	
17	Gay & Lexington	2,336	5, 8, 15, 15X, 19, 19X, 30, 36, 46, 47, 48, 91, 150	
18	Saratoga & Eutaw	2,312	5, 15, 15X, 19, 23, 27, 47, 91, 150, 5X, 19X	Adjacent to Eutaw and Saratoga stop

Rank	Station	Daily On/Offs	Routes	Note
19	Baltimore Street & Eutaw Street	2,295	1, 8, 10, 10X, 20, 30, 36, 150, 310	
20	Saratoga & Paca	2,283	7, 15, 15X, 23, 40, 150	Lacks shelter
21	Fayette Street & Paca Street	2,231	1, 7, 8, 20, 30, 36, 40, 48	
22	Fayette Street & Calvert Street	2,166	5, 5X, 8, 20, 23, 30, 36, 91, 150, 160	
23	Greenmount & 33rd (Gorsuch)	2,102	3, 8, 12, 22, 48	Lacks shelter
24	Eutaw Street & Saratoga Street	2,031	5, 5X, 15, 15X, 19, 23, 27, 47, 91, 150	Adjacent to Eutaw and Saratoga stop
25	Fayette Street & Eutaw Street	1,971	1, 5, 5X, 8, 19, 20, 27, 30, 36, 91, 150, 19X	

High ridership stations are distributed fairly evenly across Downtown Baltimore. Within Downtown, the Baltimore Arena is the busiest single bus stop with over 5,000 daily boardings. A number of bus stop clusters, however, exceed the ridership at this location. Important bus stop clusters include multiple locations along Fayette Street; at Paca Street and Saratoga Street; and along Baltimore Street. **Figure 2.6.3** illustrates the 100 busiest bus stops in Downtown Baltimore, including the Baltimore Arena bus stop.

Figure 2.6.3 – 100 Busiest Bus Stops

2.7 Service Standards

2.7.1 MTA Service Standards

In December of 2011 the MTA's Office of Service Development issued a document entitled *Local Bus Service Standards.* This policy document, yet to be formally adopted, covers more than just "service standards" which is typically interpreted as "performance standards." It has 11 sections, of which five cover significant areas of service design and performance, as well as bus stop placement. A sixth section covers issues related to Title VI. The other sections are introductory in nature. The summary presented here is concerned with the five main sections, numbered 5 through 9 in the MTA document:

5. Service Definitions and Route Design
6. Vehicle Loads
7. Service Span and Frequency
8. Bus Stop Placement
9. Route Performance

Section 5 defines six types of service: radial, crosstown, feeder, circulator, express and QuickBus. These definitions follow standard industry concepts about bus service. QuickBus is the MTA's name for limited-stop service which is usually overlaid on local service and intended to offer a faster ride; it is not full bus rapid transit, but can be thought of as a step toward BRT. The document lists current MTA route numbers by route type, but notes that some radial or circulator routes could be classified as feeder routes depending on how passengers use the service.

After this classification, Section 5 contains a series of route design guidelines including:

- Overall coverage – 1/4 mile buffer around a route
- Directness – route mileage between two points should not be more than 1.3 times the direct roadway mileage for express routes, and 2.0 times the roadway mileage for other types of service
- Transfer times – three to five minutes for bus-to-bus transfers; five minutes for at-grade bus-to-rail transfers, and six to eight minutes for grade separated bus-to-rail transfers
- Avoiding private property – such as parking lots at shopping centers
- Avoiding redundancy – bus should not parallel rail service and bus routes that use the same streets should be coordinated or restructured
- Focusing service on areas with high demand – though other considerations are important, including employment opportunities and shift times, population density, Title VI considerations and ADA accessibility.

Section 6 of the document lists load standards by route type and service time period (base, peak, evening, weekend). The standards are expressed in terms of percent of seated capacity and range from 100 percent to 130 percent. By industry standards, these percentages are on the low side, allowing for as few as 10 or 11 standees on 40-foot buses. The percentages are reproduced below:

Route type	Maximum base load	Maximum peak load	Maximum evening load	Maximum weekend load
Radial	110%	130%	120%	110%
Crosstown	100%	130%	100%	100%
Feeder	100%	130%	100%	100%
Circulator	110%	130%	110%	100%
Express	100%	100%	N/A	N/A
QuickBus	110%	130%	110%	110%

Section 7 covers span and frequency of service. There are some policy statements concerning efficient use of resources, equitable provision of resources, flexibility and interpretation of the standards, definitions of level of service (all day, peak only, targeted), and the use of clockface headways. The span and frequency standards are presented in a table by route type and time period, as reproduced below:

Route type	Minimum span	Minimum peak period frequency	Minimum midday frequency	Minimum evening frequency	Saturday and Sunday	Owl service?
Radial	4 AM—12 AM	20	30	30	60	Potential
Crosstown	6 AM—10 PM	20	30	30	60	Potential
Feeder	6 AM—9 PM	30	60	60	60	No
Circulator	6 AM—9 PM	30	60	60	60	No
Express	Rush hours	15	N/A	N/A	N/A	No
QuickBus	5 AM--11 PM	10	15	15	60	No

The section continues with a number of scheduling practices:

- Defining “build points” of schedules – the most significant trip generator which determines when the buses should run
- Shouldering of headways – smooth transitions from peak to off-peak periods
- Coordination of routes and patterns that share a common trunk alignment
- Splitting or through-routing services – dependent on reliability and deadhead mileage
- Layover and recovery – target range is 9-12 percent.

Section 8 is an extensive treatment of bus stop placement. Many topics are covered including passenger safety, impacts on operations, preferred spacing, curb length requirements, proximity to trip generators, and mitigation of impacts on abutters. Advantages and disadvantages of near side, far side and mid-block stops are discussed. Spacing of stops for QuickBus routes is treated separately. Finally, the section discusses procedures and timing of modifications of bus stops.

The final section concerns route performance and is perhaps the most relevant to the present study. To evaluate bus routes, MTA has devised a four-part metric, with each part relating to ridership productivity from a particular angle. The four measures are as follows:

1. Passenger boardings per total hour
2. Passenger boardings per trip
3. Passenger boardings per total mile
4. Cost per passenger (using an incremental cost model rather than average cost).

The use of total hours and total miles instead of revenue hours and revenue miles is a bit unusual. Most agencies calculate productivity based on when the bus is in revenue service, but MTA has chosen to include deadhead time and mileage in the calculation. This choice penalizes routes that happen to be located far from the bus garages, but it nonetheless reflects the actual cost of operations better than calculating the productivity in terms of revenue hours and miles.

Bus routes are divided into the six types and the average performance for each measure for each type is calculated. A route operating at the average for its type would receive a rating of 100 for that measure. If the productivity is 25 percent better than the average, it would receive a rating of 125. Then each of the four measures are weighted equally (at 25 percent) and combined into a single performance measure. Again, a final figure of 100 is exactly average, while figures over 100 indicate relatively high performance and figures below 100 indicate relatively poor performance. These measures are calculated with each schedule change and MTA looks for consistent results for each of the routes.

Once all of the metrics are calculated over four schedule changes, the routes by type are sorted into five action categories:

- Routes with scores consistently above 125 will be targeted for resource investments such as improved headways or span
- Routes with scores consistently between 75 and 125 are considered performing at standard - no action
- Routes with scores consistently below 75 are targeted for review and modification
- Routes with scores consistently between 50 and 74 will be reviewed for modifications to improve performance
- Routes with scores consistently under 50 will be targeted for elimination or replacement

The four metrics are somewhat redundant, as a route that has few boardings per hour likely also has few boardings per trip or per mile. In other areas, agencies target various productivity measures by route type. For instance, urban radial routes that experience significant traffic congestion are best measured by boardings per mile, so as not to penalize them for slow operations (which accumulates hours more quickly than miles). Suburban routes that move faster are best measured by boardings per hour, since they accumulate miles more quickly. Express routes and feeder routes are often best measured by boardings per trip because the capacity of

the bus can limit ridership when all or most passengers are destined for a single stop at the route terminal. Express routes that operate on highways would be unfairly penalized by the measure of boardings per mile, since they travel many miles without making stops.

MTA uses the composite measure so that all operational aspects of a route can be taken into account. The method tries to avoid unfair comparisons by grouping the routes by type, so that express routes are not compared to radial routes. While the method may entail more calculations than are absolutely necessary, it likely produces robust results, in that a route that performs poorly on all the productivity measures almost certainly needs review and/or restructuring.

The document concludes with a statement that the policy is subject to review no less than every two years and that it supersedes any prior service standards. It is worth noting that MTA had published a document entitled Maryland Transit Guidelines in May 2002, but those policies were never officially adopted. That document was much more broadly conceived, covering both bus and rail service, facilities, vehicles and equipment, information and marketing, and various policies. Where the two documents overlap in considering the details of bus service, the proposed guidelines are roughly consistent.

Overall, the service guidelines are workable for service reviews. In the route analysis to take place later in this study, specific guidelines for span and frequency will be reviewed to determine if they are relevant to the levels of service that can be provided in the current budget climate. Likewise, loading standards should be reviewed carefully, given changes in the bus fleet and the trend toward fewer seats on buses due to low-floor designs.