Appendix B2: Factors Affecting Transit Choice

1 TRANSIT MARKET

The transit market comprises those trips which have the option of taking transit, that is, those trips for which the trip origin and trip destination are connected by transit. We define access to transit as follows: a person is assumed to have transit access if s/he can access a transit route by walking one mile or less or driving ten miles or less. Based on this definition, we examined the SMZs with transit access within the MSTM (Table B2-1). There are approximately 2.6 million origin and destination pairs within the MSTM. Of those, 750,000 are pairs in which both the origin and destination have transit access. In terms of number of trips, there are 44 million trips within the MSTM region and 16.5 million of these have the potential to be connected by transit, that is, can access transit at both the origin and destination ends of a trip.

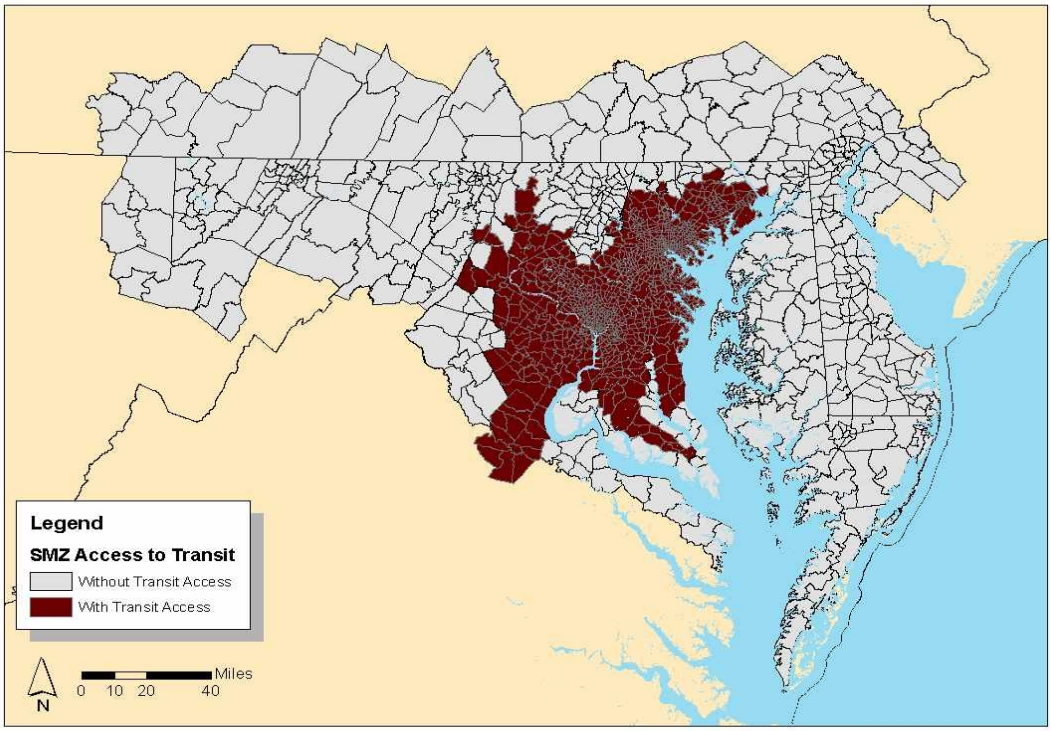
Table B2-1.Transit connectivity as a percentage of trips and percentage of Origin-Destination (OD) pairs

	Total	With Transit Access	Percent (%)
# of OD pairs	2,582,449	736,028	28.5%
# of Trips	43,956,215	16,479,990	37.5%

Figure B2-1 below identifies zones within the MSTM that have access to transit as defined above.

Based on transit accessibility assumptions, the transit market comprises 37.5% of total trips. If they desire, 37.5% of trips can use transit while the remaining 62.5% are auto dependent (without transit access).

Figure B2-1: SMZs within Maryland with access to transit service



1.1 TRANSIT MARKET SHARE

Once the transit market has been determined, we then determine the transit market share or the riders on transit. In estimating transit ridership, the number of trips between each zone pair is known and the question is how many of the trips are made by transit and how many are by auto. Typically, three factors play a critical role in estimating transit usage; time, cost and availability. Each is described below in more detail:

Time – The time to travel by auto is compared to the time to travel by transit.

Auto time – This is the time spent in the vehicle. Auto travel time will increase with delays due to congestion.

Transit time – Transit time breaks down into three main components; access, wait and run time.

Access time – This is the time (walk, drive) required to travel from home or work to a transit station.

Wait time – This is the time spent waiting for the transit vehicle. Generally wait time is estimated to be ½ the time interval between vehicles, or ½ the headway. In the case of scheduled service or use of real time traveler information systems, this may be decreased (knowing the schedule, the traveler may choose to arrive a few minutes before the transit vehicle, thus reducing the wait time). Transfers between transit lines can also add to transit travel time. Usually the transfer time is added to the total wait time and the number of allowed transfers on a transit trip is restricted to two or less.

Run time – The time spent riding in the vehicle.

In analyzing transit, these times have different weighting factors with the wait time having the highest factor or being the most onerous, with walk time the second highest factor and with run time the lowest.

Cost – The auto costs are compared to the transit costs.

Auto cost has three components, operating cost, parking cost and toll cost which are known as out of pocket costs. Long term vehicle amortization, insurance and other costs associated with auto travel are not considered to affect the decision on the choice of mode.

Operating costs include fuel and maintenance.

Parking costs include parking at the destination end or at park and ride lots.

Toll cost include any tolls which must be paid along the way.

Transit cost typically includes the transit fare, however in the case of park and ride; it may also include parking cost at the transit station.

Availability – Is the alternative available?

Transit – Transit availability generally means there is transit service between the desired origins and destinations and the service operates at desired times. For example, someone working at a hospital may have transit service available in the daytime but may not have access to transit service in the evening (due to service not being provided in the evening).

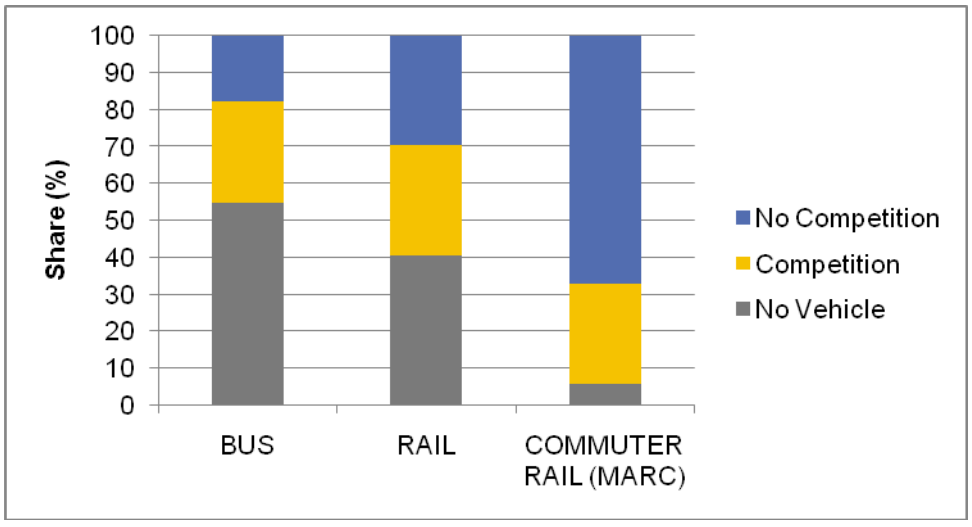
Auto – Auto availability generally means there is a car available to complete the desired trip. Those who do not have access to a car are referred to as transit captives or transit dependent. Some may have partial access to a car, if the vehicle is shared by two or more people.

To illustrate the influence of auto availability on mode share, the following data are adopted from the Baltimore 2007 on Board Transit Survey (Table B2-2 and Figure B2-3).

Table B2-2. Auto availability by transit mode – 2007 (Source: Baltimore 2007 on Board Transit Survey, Table 25. Competition for Vehicles by Mode, page 37)

	Bus	Rail	Commute Rail	All
No Vehicle	50,412	15,357	967	66,726
Competition	25,567	11,284	4,587	41,437
No Competition	16,354	11,181	11,287	38,822
Total	92,332	37,822	16,831	146,985

Figure B2-3. Percentage of trips, by mode, having access to an automobile (Source: Baltimore 2007 on Board Transit Survey)



According to the survey report, competition for vehicles does not exist when the number of drivers is less than or equal to the number of vehicles in a household. Table B2-2 and Figure B2-2 above show that only 17.7 % of the bus transit riders had immediate access to an automobile as an alternative to

completing the trip, while 67% of the commuter rail riders had access to an auto. The likely explanation for this is that commuter rail does not run in traffic and thus is not affected by traffic congestion. Commuter rail can therefore provide a time advantage over driving alone, making it attractive to travelers. Buses, which must run in traffic, do not usually operate faster than traffic. The primary incentive to use the bus, over driving, is the cost of the trip or the lack of auto availability. The fact that most bus riders (54%) do not have a vehicle readily available suggests that for many portions of the transit system, reductions in fares or reductions in wait time will not be sufficient to induce riders to shift from highway to transit. More significant changes to service characteristics such as applications of advanced technologies and increased speeds would be required to make it compatible with auto.

2 MODELING TRANSIT[1]

The MSTM network includes both MPO and intercity transit systems in Maryland and selected counties of adjacent states. This includes the following transit systems and their system miles (2-way distance).

Urban Transit

MSTM contains Baltimore and Metro Washington urban transit networks. These networks are taken directly from the BMC and MWCOG MPO model network files. There are two separate files, one for the Peak and one for the Off-Peak periods. These files consist of the route information for the Urban Transit Service. Bus Lines and Rail Lines are also present in separate files. The route files have been modified to reflect the re-numbered nodes in the MWCOG area. Since MSTM network derives parts of its network from different MPO networks, the transit lines had to be modified to fit the new network that came in from other MPO model. For example, parts of transit lines from BMC MPO area lying in the MWCOG's network had to be altered to fit the new network.

[1] This section is drawn heavily from the Maryland Statewide Transportation Model (MSTM): User Guide, prepared for State Highway Administration. The Draft Guide is available through National Center for Smart Growth and Education (NCSGRE) and it will be available in Fall 2012.

Modes from BMC and MWCOG models have been reorganized to form the MSTM mode system. All modes are accessible via walk and Park-n-Ride (PnR). Below is a brief summary of the urban transit modes used in MSTM:

MODE 1. Local Bus- includes the following Bus Systems:

- BMC Buses: MTA Local Bus, MTA Premium Bus, Harford County Bus, HATS/Howard Transit/Connect-a-Ride (Howard County Bus), Carroll County Bus, Annapolis Transit Bus.
- MWCOG Buses: Local Metrobus, Other Primary - Local Bus, Other Secondary - Local Bus.

MODE 2. Express Bus- includes the following Bus Systems:

- BMC Buses: MTA Express Bus, MTA Premium Bus
- MWCOG Buses: Express Metrobus, Other Primary - Express Bus, Other Secondary - Express Bus.

MODE 3. Premium Bus: Includes BMC's MTA premium bus.

MODE 4. Light Rail: includes Baltimore light rail, Georgetown Branch, Anacostia and Montgomery Co. Corridor Cities Light Rail Lines.

MODE 5. Metro Rail: includes Baltimore Metro rail and DC Metro Subway.

MODE 6. Commuter Rail: includes MARC and Virginia Rail Express' Frederick and Manassas Lines.

Urban Transit Fares, Routes, and Schedules

Fare matrices were imported from the BMC (Version 3.3) and MWCOG (Version 2.2) models and combined to obtain the Fare matrix for the MSTM model (in 2000$). The weighted average of the trip matrix and fare matrix were used to convert the matrix from the earlier format to the newer one. Some other additional parameters like the HEADWAY for the lines is imported from the MPO models. HEADWAY 1 is for Peak period and HEADWAY 2 is for the Off-Peak Period.

Intercity Transit

Intercity transit includes Greyhound Bus and Amtrak Rail Lines in the model area, which covers six states. It may be noted that some of the routes described in

the Urban Transit section also serve multiple MPOs within the State. These may also be used to commute between DC and Baltimore. Below are brief summaries of the Intercity Transit modes.

MODE 7.Amtrak Rail: Includes those routes that run regularly between DC and Baltimore. Only parts of the routes lying inside or close to the model area are coded and headways are also based on the coded segments of these routes. The following Amtrak stations are included:

- Wilmington, DE (WIL)
- Baltimore - Penn Station, MD (BAL)
- BWI Airport - Thurgood Marshall Airport, MD (BWI)
- Washington - Union Station, DC (WAS)
- Rockville, MD (RKV)
- Alexandria, VA (ALX)
- Newark, DE (NRK)
- Aberdeen, MD (ABE)
- New Carrollton, MD (NCR)

MODE 8.Greyhound Buses: Some of these routes are coded in the same way as Amtrak lines. Intercity Bus includes the following major stations:

- Annapolis
- Baltimore Downtown
- Baltimore Travel Plaza
- Easton
- Frederick
- Hagerstown
- New Carrollton
- Ocean City
- Salisbury
- Silver Spring
- Univ Of Md Eastern Shore
- Washington DC
- Wilmington DE

Intercity Transit Fares, Routes, and Schedules

Fare and scheduling data was collected for intercity transit including Greyhound Bus and Amtrak Rail line systems (in 2000$). The Amtrak data and some Greyhound data were collected using online resources from the transit providers in 2008. Web pages were used to find the data for city pairs that are included in the model area, and one stop into the halo. This allowed the modeling

team to approximate the frequency of service for the transit modes. Greyhound does not have an online schedule information so a Greyhound schedule book was obtained for the route and headway information.

Non-Transit Modes

Some of the mode numbers are reserved for Non-transit modes that connect Transit services to the Highway links. A Non-transit leg is an imaginary entity representing a series of links required to establish the connection between transit and highway. The costs, such as distance and time, needed to traverse the leg are derived from the sum of the links traversed. In the following diagrams, roadway and non-transit links are combined to form the following links for three non-transit modes:

W2R = C1 + L1 + W1

W2B = C1 + L1 + L2

D2R = C1 + L1 + D1 (drive segment) and W3 (walk segment)

D2B = C1 + L1 + D1 (drive segment) and W2 + L2 (walk segment)

Figure B2-4. Transit Coding Diagram, Transit and Non-transit Links

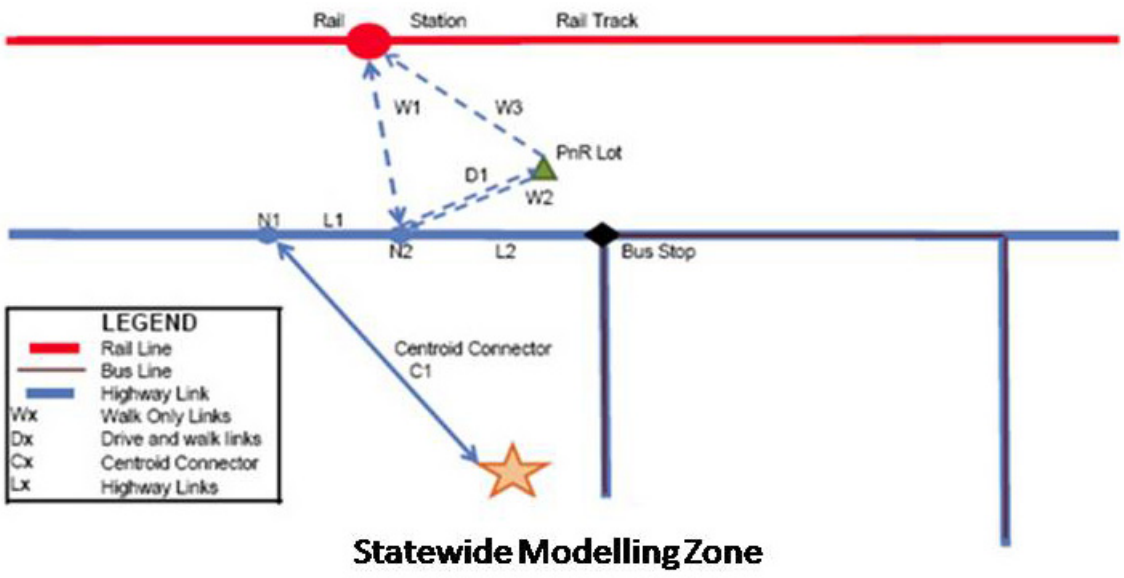
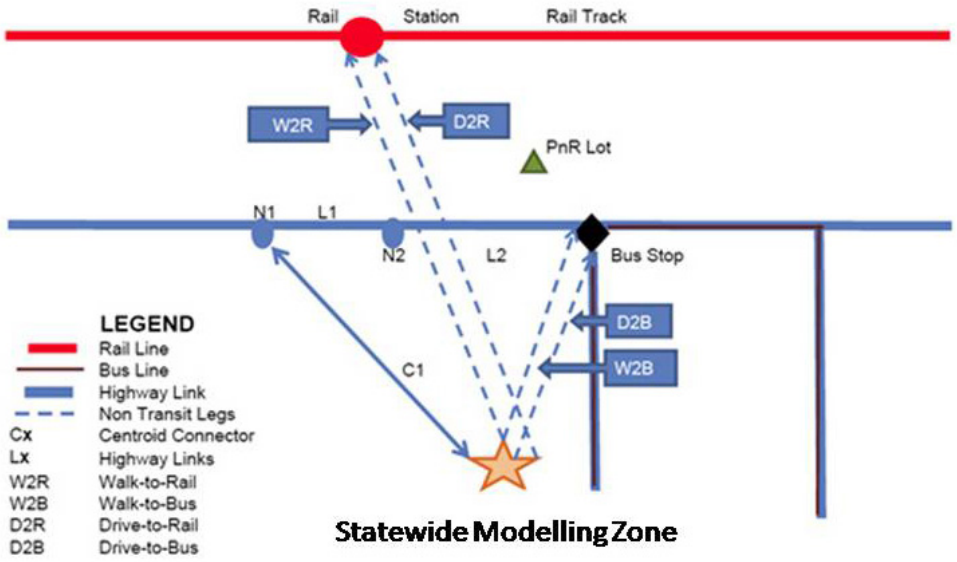


Figure B2-5: Transit Coding Diagram, Transit and Non-transit Legs



The Non-transit modes are summarized below.

MODE 11.Zonal Drive Access Legs: Connect the Zone Centroids with the nearby Park-n-Ride Lots. Unlike the Drive access Links whose purpose is to allow traffic to get on/off the roadway; legs connect a zone centroid to all the Park-n-Ride Lots within 10 mile distance. These PnR lots are then connected to the nearby stations/highway nodes via walk links.

MODE 12: Walk Transfer Legs: Hypothetical links that connect each line with nearby lines so that passengers can make transfers. These links derive their attribute values from the physical links that need to be traversed to establish connectivity.

MODE 13: Zonal Walk Access Legs: Similar to zonal drive access except they allow people to walk from the Zone Centroids to any of the nearby transit stop (within a mile of walking distance). These also derive their attribute values from the underlying network links.