**Attachment B**

# TOWN OF CARRBORO

NORTH CAROLINA

## MEMORANDUM

**DELIVERED VIA:** ☐ *HAND* ☐ *MAIL* ☐ *FAX* ☒ *EMAIL*

**DATE:** **January 19, 2010**

**TO:** **Steve Stewart, Town Manager**
**Mayor and Board of Aldermen**

**FROM:** **Patricia McGuire, Planning Administrator**
**Jeff Brubaker, Transportation Planner**

**RE:** **Chapel Hill and Carrboro 2035 Long Range Transit Plan – Recommended revisions**

### Background

The purpose of this report is to recommend revisions and provide additional information on aspects of the Chapel Hill and Carrboro 2035 Long Range Transit Plan relevant to Carrboro. It will not repeat a summary of the Plan's contents, which was presented in past agenda item attachments. Summary information can be found here: http://townofcarrboro.org/BoA/Agendas/2009/11_24_2009_B1A.pdf. Parenthetical references in the report refer to page numbers, sections, or figures or tables within the Plan.

### Recommended revisions

Recommended revisions are grouped by topic. Topics are based on aspects of the Plan and perceived deficiencies that have generated significant discussion during the review process. It is recognized that given the timeline for revisions, any major modifications to the Plan's analysis methodology, however warranted, are not likely to be feasible. Nonetheless, some revisions to the Plan language and recommendations can be made.

*Light Rail Transit in Carrboro*

Recommendation: The Plan should emphasize that provision of light rail or another higher-order transit service to Carrboro should continue to be analyzed in future transportation planning processes, including, but not limited to, any alternatives analysis for a major enhancement of transit service in the MLK corridor (such as in a Very Small Smarts application to the Federal Transit Administration) and the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC-MPO) 2040 Long Range Transportation Plan, scheduled for preparation beginning later this year.

Further analysis should determine if extending regional light rail service into Carrboro is feasible and cost-effective given the potential ridership of a Carrboro station. This should consider several variations of service to or through Carrboro, including, but not limited to:

- The service as described by Corridor 5A in the Long Range Transit Plan;
- Service that serves only downtown Carrboro as part of a regional light rail line and does not extend to Carolina North;
- Service through Carrboro as a part of wider commuter rail service. (The North Carolina Railroad is currently conducting such a feasibility study.)[1]

The analysis should reflect not only projected residential and employment densities for the first year of service but also other factors, such as the potential for Carrboro's significant bicycling mode share to increase the catchment area for light rail ridership and the influence of feeder bus service from dense areas near downtown Carrboro in contributing to ridership. "Bicycling," as bike planning experts John Pucher and Ralph Buehler point out, "supports public transport by extending the catchment area of transit stops far beyond walking range and at much lower cost than neighborhood feeder buses and park-and-ride facilities for cars."[2] The Plan's analysis methodology, partially based on the Triangle Regional Model, does not account for bicycle and pedestrian travel demand (p. 4-10). The reliance on vehicle trips for travel market estimates and the assumption of a uniform mode share for transit (12% – p. 4-12) in all TAZs mean that TAZs in walkable and bike-friendly areas appear to have been given no extra weight as transit trip generators compared with TAZs that due to their street patterns are not conducive to walking and biking. (See the Appendix for more explanation.)

One option for including these trips is an off-model adjustment, similar to the travel demand modifications the Plan performed to account for parking restrictions and costs at the UNC main campus and proposed for Carolina North. However, this may take significantly more time and funding than is allotted for plan revisions. This could potentially be an element of route evaluations in future short range transit planning activities.

In addition to the importance of residential density in making transit viable from a ridership perspective, many other factors affect ridership, such as employment density, presence of feeder bus services, parking availability and cost, and income.[3] For this reason, there is no "one-density-fits-all" value for every location. Increasing fuel prices tend to lead to increased transit ridership as well. Past studies have shown that for every 100% increase in fuel prices, there is about a 10-40% increase in transit ridership, although the response varies based on transit quality and cost, land use, and demographics.[4]

Furthermore, an analysis of ridership depends on what is considered the "station area". One study recommended that planning for transit-oriented development should take place within a 5-

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[1] For more information, see: North Carolina Railroad Company (2009). Letter from NCRR President Scott M. Saylor. http://www.ncrr.com/docs/SDGRidership100709.pdf.
[2] Pucher, John and Ralph Buehler. (2009). Integrating Bicycling and Public Transport in North America. *Journal of Public Transportation* 12, 3, 74-104. http://policy.rutgers.edu/faculty/pucher/PUCHER_BUEHLER.pdf.
[3] Transportation Research Board. (1996). *Transit and urban form*. TCRP Report 16. Washington, D.C.
[4] Maley, Donnie and Rachel Weinberger. (2009). Does Gas Price Fuel Transit Ridership? *Panorama*, University of Pennsylvania School of Design.

to 15-minute walk of the station (about ½ to ¼ miles).[5] However, an earlier report found that density within *2 miles* of a light rail station was a significant predictor of light rail ridership.[6] Carrboro's relatively strong bicycling and transit ridership market lends credence to using a larger catchment area in estimating future ridership.

*Note: See attachments C and D, respectively, for Planning Board and Transportation Advisory Board recommendations on light rail service.*

*Climate Change*

Recommendation: In its technology evaluation, the Plan should include information and basic data on energy use, fuel consumption, and greenhouse gas emissions associated with various transit technologies.

Including environmental performance measures in a transit technology evaluation is necessary to convey the relative carbon footprints and air quality impacts of services. From a practical side, it is especially important in light of the U.S. DOT's recent announcement that it will give more weight to livability and the environment in evaluating New Starts applications.[7] This implies that transit technologies that lead to greater emissions reductions will be more likely to receive federal funds.

While a comprehensive greenhouse gas emissions analysis is not possible in such a short time frame, the Plan should draw on resources such as Oak Ridge National Laboratory's (ORNL) *Transportation Energy Data Book*, the American Public Transportation Association's (APTA) *2009 Fact Book*, and the Orange County Greenhouse Gas Emissions Inventory. For example, the *Transportation Energy Data Book* estimates the average energy intensity in 2007 of American light rail transit systems at 7,600 British thermal units (Btus) per passenger mile.[8] This figure, however, is influenced by downtown trolley systems – such as in Galveston, TX, and Kenosha, WI – that have the highest Btu/passenger mile but are not comparable in purpose or design to the regional light rail system envisioned for the Triangle. The five most energy-efficient systems reported in the estimate all have Btus/passenger mile below 3,000. For bus transit, ORNL estimates an average energy intensity of 4,315 Btu/passenger mile in 2007. This is less energy- intensive than the light rail average but more energy-intensive than the nine most efficient light rail systems in operation.

It is important to keep in mind that these are national average numbers, and every specific transit system will have different conditions which affect energy intensity. Furthermore, energy intensity says nothing directly about the *source* of the energy. The carbon footprint of a rail system is influenced by whether it uses diesel fuel or electricity and, if the latter, the power generation portfolio of the region (e.g. coal, natural gas, wind/solar, etc.).

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[5] Transportation Research Board. (2002). Transit-Oriented Development and Joint Development in the United States: A Literature Review. Washington, D.C.

[6] Transportation Research Board. (1996). *Transit and urban form*. TCRP Report 16. Washington, D.C.

[7] U.S. Department of Transportation. (2010). Obama Administration Proposes Major Public Transportation Policy Shift to Highlight Livability: Changes Include Economic Development and Environmental Benefits. Press release: January 13. http://www.dot.gov/affairs/2009/fta0110.htm.

[8] Oak Ridge National Laboratory. (2009). "Figure 2.2. Energy Intensity of Light Rail Transit Systems, 2007." *Transportation Energy Data Book* (Edition 28). http://www-cta.ornl.gov/data/tedb28/Spreadsheets/Figure2_02.xls.

It is essential that the Chapel Hill-Carrboro area and Triangle region in general make it a standard practice to include greenhouse gas emissions and other environmental performance measures as central components of all future transportation plans – including transit plans and regional transportation plans. This can be accomplished in part by capitalizing on new research and modeling capacity on GHGs, such as the eventual transition by all regional travel models to a new emissions model (MOVES) that offers a significantly more nuanced and accurate methodology for measuring GHGs from vehicle-miles traveled.

*Parking and Regional Transit Service*

Recommendation: The Plan should include additional language that compares the feasibility of regional transit service originating at more distant locations with the currently-recommended gateway node "intercept" park-and-rides.

The Plan does include some language that addresses this recommendation:

> For high investment gateway concepts on the east (utilizing US 15/501 and NC 54 roadways) investments outside the community boundaries into Durham are shown. It may be worth consideration to extend services into Durham rather than intercepting residents at the Chapel Hill boundary. (p. 3-10)

One example of regional service being introduced in a corridor that previously offered a park-and-ride near the Chapel Hill-Carrboro boundaries is the CH Transit PX express service from Pittsboro during peak hours. The CCX route currently serves the Chatham County Park-and-Ride lot.

This recommendation is made due to concerns about the number of parking spaces proposed in the Plan. The amount of parking spaces could have significant environmental impacts (e.g. stormwater), especially if they are provided through surface lots. Furthermore, like the analysis methodology in general, proposing over 20,000 new parking spaces assumes that in 2035 fuel prices or vehicle technology will be such that it will still be economically feasible to drive the distances associated with park-and-ride catchment areas.

**Next steps**

After the Plan is revised, it will be presented for Carrboro Board of Aldermen and Chapel Hill Town Council approval. A general timeline of the Plan's development over the past half-year is below:

- July 2009 – Draft of Plan released by Transit Study Policy Committee
- September- November 2009 – Presentation to Chapel Hill/Carrboro and UNC policy bodies
- October and November, 2009 – Series of public forums
- January 2010 – Board of Aldermen recommended revisions
- February 2010 – Chapel Hill Town Council Public Forum/revisions
- March 2010 – Consideration for approval by legislative bodies

The Long Range Transit Plan is the basis for the Short Range Transit Plan, developed by Chapel Hill Transit, which will be community-wide, corridor-specific, and reviewed and updated regularly. The

Short Range Plan will include a one-year implementation plan, annual and operating costs, and marketing plans. This planning process will be another opportunity for Carrboro residents to weigh in on the future of transit service in the area. This participation will be critical especially at the beginning, when the vision, goals, objectives, and methodology are determined. Ensuring that the Plan addresses climate change mitigation, environmental protection, and livability – as presented in *Carrboro Vision 2020* and other policy statements established by the Town – must be accomplished early in the planning process.

In terms of continuing to seek light rail or another higher-order transit service in Carrboro, the MPO will begin initial steps on the 2040 Long Range Transportation Plan process this year.

**North Rail Corridor (C5A): why it is not recommended in the plan**

*For a more detailed analysis, see the Appendix.*

1. **Lack of a direct connection with Carolina North**

The technology evaluation section of Chapter 4 does not include 5A. The explanation for this was that it did not connect to future development at Carolina North:

> Only corridors that included a branch service to Carolina North were analyzed because of the importance of the new development and the desire to create a link with the main UNC campus. Thus, *options without Carolina North were summarily dismissed at this point in the analysis*. (p. 4-17 – emphasis added)

Although C5A passes adjacent to the Carolina North tract, Carolina North development will be more heavily oriented towards Martin Luther King Blvd.

2. **Relatively small travel market size and cost**

As Table 1 indicates, the evaluation projects the 2035 travel market in C5A to be 78,400 trips, the lowest market size of any corridor considered in the Plan. By contrast, the parallel C1 along MLK Blvd. is projected to have a market size of 163,800 trips, 109% higher than C5A. One factor for C5A's relatively low market size is that, being a freight rail corridor, it is not open for passenger travel. Therefore it does not facilitate travel between TAZs along or near it. At the same time, it does provide relatively close access to core destinations such as UNC and Carolina North (although, as noted above, the orientation of Carolina North is planned to primarily be along MLK Blvd.). Thus C5A can be expected to capture some of the Walk, Feeder, and Park-and-Ride trips originating in TAZs close to it.

| Gateway Service-- High Investment Corridors | Estimated Market Size 2035* | | | |
|---|---|---|---|---|
| | PnR Market | Walk Market | Feeder Market | Total Market |
| C1--MLK | 6,700 | 55,700 | 101,400 | 163,800 |
| C2A--US15/501, Franklin | 20,100 | 64,200 | 112,600 | 196,900 |
| C2B--US15/501,Franklin, Estes | 20,700 | 67,500 | 119,000 | 207,200 |
| C3A--US15/501, Fordham | 18,700 | 62,800 | 108,400 | 189,900 |
| C3B--US 15/501, Fordham, Estes | 21,800 | 71,600 | 117,100 | 210,500 |
| C4A--NC54 to downtown | 17,300 | 54,600 | 93,500 | 165,400 |
| C4B--NC54, MLK Blvd. | 14,100 | 63,700 | 101,200 | 179,000 |
| C5A--North Rail (parallel MLK) | 4,900 | 25,100 | 48,400 | 78,400 |
| C5B--Fixed Guideway Corridor | 9,700 | 76,200 | 98,200 | 184,100 |
| C5C--5A + 5B | 12,100 | 95,500 | 127,400 | 235,000 |
| *Includes auto and transit trips, does not include walk and bike. | | | | |

**Table 1. 2035 estimated travel market sizes for High Investment Corridors (Table 4-1 in the Long Range Transit Plan).**

Despite the connection C5A provides, its projected 2035 transit ridership – which in the plan evaluation is a linear function of its 2035 estimated market size – is much lower than other corridors.

| Gateway Service-- High Investment Corridors | Transit Trips |
|---|---|
| C1--MLK | 10,530 |
| C2A--US15/501, Franklin | 13,494 |
| C2B--US15/501,Franklin, Estes | 14,154 |
| C3A--US15/501, Fordham | 13,032 |
| C3B--US 15/501, Fordham, Estes | 14,721 |
| C4A--NC54 to downtown | 11,433 |
| C4B--NC54, MLK Blvd. | 12,372 |
| C5A--North Rail (parallel MLK) | 5,052 |
| C5B--Fixed Guideway Corridor | 13,254 |
| C5C--5A + 5B | 16,734 |

**Table 2. 2035 estimated High Investment Corridor transit ridership (Table 4-3 in the Long Range Transit Plan).**

Land use is a related factor. The corridor, which extends from Cameron Ave. to north of Eubanks Rd., includes adjacent land uses that are either undeveloped – such as Carolina North Forest – or low density residential. This is somewhat understandable as freight rail corridors do not generate adjacent residential land uses like roads do. Land use along C5A thus limits the Walk market of C5A to 25,000 and the Feeder market to 48,000, significantly lower than the other corridors (Table 1).

C5A's low projected ridership is less cost-effective especially given the Plan's assumed capital costs for light rail compared to lower-order transit technologies. As Table 3 shows, vehicle cost, operations and maintenance, and average capital cost are significantly higher for rail technologies than for bus technologies.

Table 4-6: Basic Operational and Cost Assumptions for Technologies

| Characteristics | Light Rail | Streetcar | BRT busway | BRT arterial | Express Bus (Limited stop) |
|---|---|---|---|---|---|
| **Stop Spacing** [mi/stop] | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 |
| **Signalized intersections** [signals/mile] | 0 | 2 | 1 | 2 | 3 |
| **Vehicle Cost** [$ M/veh] | $3.5 | $3.0 | $0.8 | $0.8 | $0.5 |
| **Average Capital Cost** [$ Millions/mile][2] | $40 | $28 | $22 | $9 | $0.5 |
| **O&M Cost** [$ / rev veh-hr][3] | $230 | $230 | $80 | $80 | $80 |

[1] Includes inter-stop time time, traffic signal delays, dwell time, layover
[2] Includes track in both directions, stations, electrification, signals, public space, control center, maintenance facility
[3] Minimums, O&M cost increases marginally as rail options operate with more than one car and bus options operate with articulated buses

**Table 3. Basic Operational and Cost Assumptions for Technologies (Table 4-6 in the Long Range Transit Plan)**

It should be kept in mind that capital costs vary for light rail as well as bus service, so a single dollar figure for any per-mile capital cost estimate will not fit all transit systems. According to a 2000 Government Accountability Office study of 13 light rail systems, average capital cost was $34.8 million per mile, about $5 million less than the Plan's estimate, but costs ranged from $12.4 million (Sacramento, CA) to $118.8 million (Buffalo, NY) per mile. The same study found that converting an existing lane to BRT arterial is significantly less expensive than building either a new busway or simply a new BRT-only lane: "Bus Rapid Transit capital costs averaged about $13.5 million per mile for busways, $9.0 million per mile for buses on HOV lanes, and $680,000 per mile on city streets".[9] These BRT cost variations are relevant to the type of BRT that would be implemented in the MLK corridor.

### 3. Use of the freight rail corridor

Norfolk Southern owns most of the freight rail corridor. Passenger rail service in the corridor will be possible only after Norfolk Southern agrees to allow it along the segments it owns. Other considerations with respect to the legal status of the freight corridor should be kept in mind, but it is beyond the scope of this report to address them.

[9] Government Accountability Office. (2001). Mass Transit: Bus Rapid Transit Shows Promise. September, GAO 01-984. http://www.gao.gov/new.items/d01984.pdf.

## Appendix: Background on the Long Range Transit Plan's methodology for analyzing corridor travel markets

The Plan (Ch. 3) calculates 2035 travel demand using projections from the Triangle Regional Model (TRM). The TRM's unit of analysis is the traffic analysis zone (TAZ), but the Plan aggregates TAZs into larger zones to create an abstracted hub-and-wedge model with two rings and a core. The outer ring represents areas in Orange, Durham, Wake, Chatham, and other outlying counties. The inner ring represents areas in and around the Chapel Hill-Carrboro planning area. The core represents zones with major destinations: Carolina North, UNC, and downtown Chapel Hill and Carrboro.

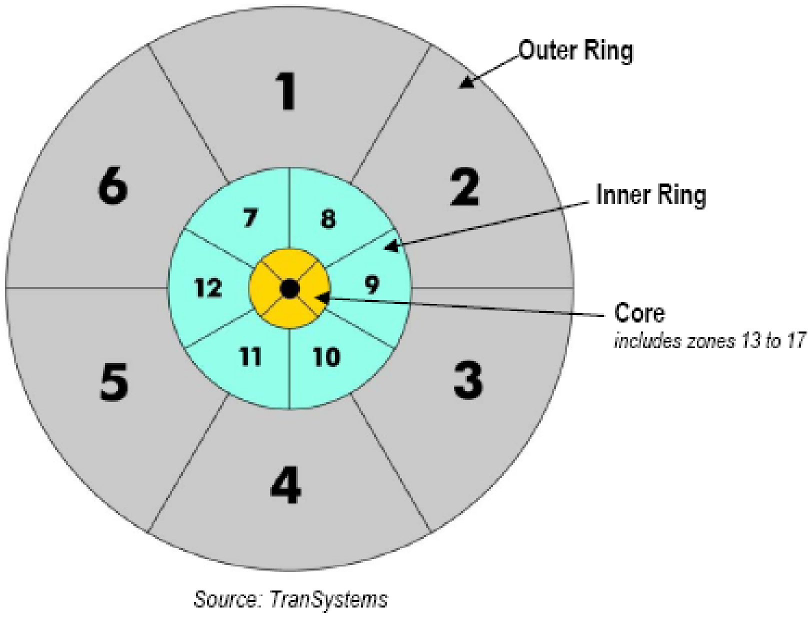


**Figure 1. Simplified TAZ structure (Figure 3-2 in the Long Range Transit Plan)**

The Plan also relies on existing 2035 population and employment density estimates of individual TAZs in the core area to identify enhancements to local bus service.

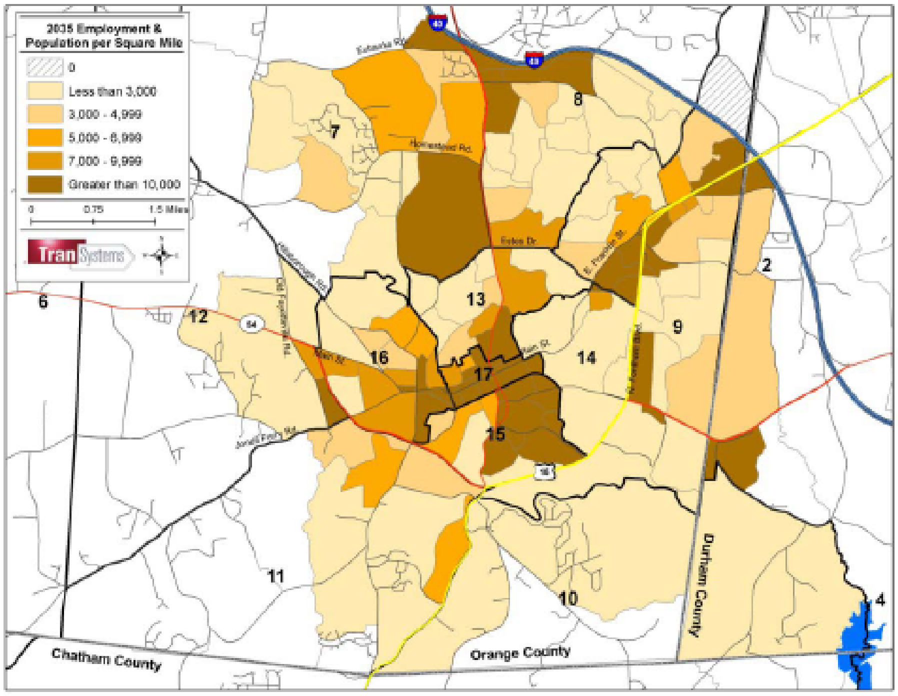


**Figure 2. Combined 2035 Projected Population and Employment Densities (Figure 3-13 in the Long Range Transit Plan)**

The Plan identifies gateway nodes and corridors based on the travel demand projected by this simplified model between and within the various wedges. The gateway nodes are points where vehicle traffic is "intercepted" via park-and-rides and travelers take transit for the rest of the trip. Gateway corridors are routes leading from the nodes to the core destinations such as Carolina North, UNC, and downtown Chapel Hill and Carrboro. The North Rail Corridor is 6.8 miles long and also serves both UNC and Carolina North without branched service (p. 4-5, 4-7).

Chapter 4 is an evaluation of service technologies for the identified gateway corridors. The evaluation estimates 2035 travel market sizes for each corridor. The estimation uses a market segmentation (p. 4-10) approach by defining three submarkets:

- Walk – trips with origins and destinations within 1/3 mile of the corridor
- Feeder – trips with origins between 1/3 mile and 2 miles of the corridor and destinations within 1/3 mile
- Park-and-Ride – trips with origins within 6 miles of the gateway node (except for trips already counted in the walk and feeder markets) and destinations within 1/3 mile

For obvious reasons, the Park-and-Ride market only counts areas that are farther away from the destination than the gateway node (p. 4-11).

Two aspects of this evaluation should be noted here. First, since the TRM has yet to incorporate bicycle and pedestrian travel demand, the evaluation – which uses TRM data – does not include it either (p. 4-10). The market size is solely based on 2035 projected trips via auto or transit. Secondly, the submarkets appear to be based on spatial distance from the corridor, not network distance or road segment characteristics. Thus, TAZs close enough to a corridor to be included in the "Walk" market (i.e., within 1/3 of a mile), may or may not have direct pedestrian connections to the corridor that are 1/3 of a mile or less. In other words, there appears to be no distinction between a TAZ with substantial sidewalk connectivity and one with barriers to travelers wishing to walk to the corridor to catch the transit service. The evaluation assumes a 12% transit share for the Walk and Park-and-Ride submarkets, and a 3% transit share for the Feeder submarket.

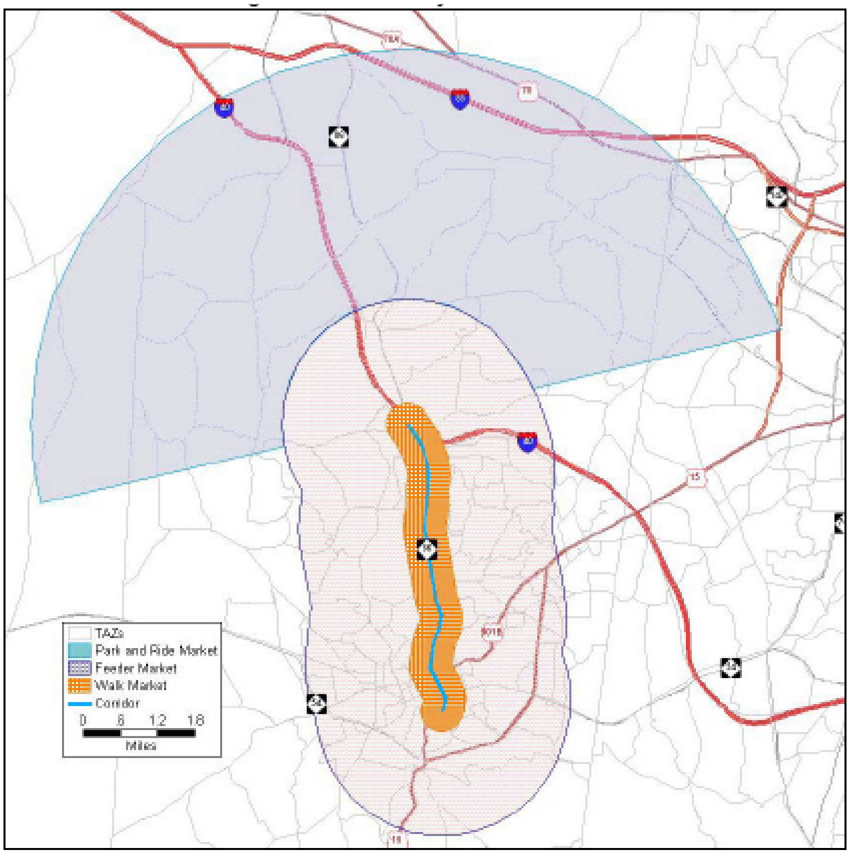


**Figure 3. Example of a gateway service market structure (Figure 4-14 in the Long Range Transit Plan)**