

Appendix A. Regional Bus Service Standards

Triangle Transit Short-Range Transit Plan

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**Triangle Transit Authority
Regional Bus Service Standards**

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Introduction: What Are Service Standards?

Service standards are performance goals set by a transit agency that define where transit service is performing at inadequate, adequate, or superb levels. By comparing the performance of individual routes to appropriate service standards, TTA staff can determine if a route is performing well or poorly in some dimension of the service. While there are many ways to measure performance against service standards, virtually all traditional transit service standards seek to answer one or more of these three questions:

- How many units of service are being provided? (units of measure: hours or miles)
- How many units of travel are being consumed? (units of measure: trips or passengers)
- How many units of cost are being incurred? (units of measure: dollars and cents)

Purpose: Why Have Service Standards?

The TTA Board and General Manager have set a goal of a 25% **Cost Recovery Ratio** for the TTA System, to be achieved by July 2006. In order to reach this goal, TTA staff will need to continually monitor the performance of TTA services to identify ways in which productivity can be improved on all routes. Having an established method of measuring performance and well-defined **indicators** that can be tracked over time will also allow TTA to make planning decisions based on solid data. By using service standards over a long period of time, TTA will be able to monitor changes in route performance, determine which operating practices lead to higher levels of ridership and revenue, and then apply those practices to areas of the system that are underperforming. Furthermore, having clearly-defined goals enumerated in a set of service standards will help guide TTA when the data gathered prompts staff and the Board to make difficult decisions. Finally, sharing information about performance data and service standards with the public will allow TTA to display greater transparency and accountability as a steward of public funds.

Key Service Evaluation Terminology

This document refers at several times to “indicators” and “standards,” and it is critical to understand the difference between the two. Each term is defined below as it is used in this document. *Additional terms pertaining to service standards that are not commonly used by non-transit experts are listed in the attached Glossary. These terms have been placed in **BOLD** upon their first appearance in the document.*

Indicator: An indicator is a measurable characteristic of some attribute of TTA service or local transportation phenomenon. The number of passengers per hour on an individual route is an indicator of transit service productivity. The average travel speed on I-40 at 5:00 P.M. is an indicator of the phenomenon of roadway performance. Indicators tell us “what is going on” by objectively quantifying and measuring the attributes of whatever it is we want to study.

Standard: A standard is a goal set by TTA staff to make judgments about where service is performing adequately and inadequately. An example of a standard would be: “All Routes that Have a University As Part of Their **Route Pattern** Carrying Less Than 10 Passengers per Hour Should Be Studied for Potential Adjustments or Improvements.” Standards tell us “what is good” by using indicators to set performance thresholds, which helps define whether service is performing superbly, adequately, fairly, or poorly. Some standards tell us

“how things should be” but do not use indicators. An example would be “All TTA Routes Will Follow the Same Route Pattern Throughout the Day.”

Service Evaluation Standards: An Overview

Earlier, staff noted that transit service standards seek to answer one or more of three primary questions:

- How many units of service are being provided? (units of measure: hours or miles)
- How many units of travel are being consumed? (units of measure: trips or passengers)
- How many units of cost are being incurred? (units of measure: dollars and cents)

These three questions are often addressed by transit agencies by examining one of these questions against another. For example, a transit agency may wish to know how many units of travel (i.e. trips) are occurring per every unit of service (i.e. hours) being provided. The indicators that are produced by comparing two of the above questions can be broadly divided into three categories: Service Effectiveness, Cost Effectiveness, and Cost Efficiency. The next section explains each of these terms, how they differ from each other, and why they are important to determining system performance.

A Note on “Effectiveness” Versus “Efficiency” – while these terms seem very similar, they refer to different measurements. Specifically, any time we are measuring passenger TRAVEL against another service attribute, we are talking about *effectiveness*. When we are not measuring passenger TRAVEL, our comparison is focused on TIME and MONEY, or DISTANCE and MONEY, where the relationship is expressed using the term *efficiency*.

SERVICE EFFECTIVENESS

What Is It: Service Effectiveness measures how much travel is obtained per unit of service. Imagine we have two buses, A and B, and each is in service for two hours. Bus A carries 40 passengers in that time period, and Bus B carries 20 passengers. We can then say that Bus A, carrying an average of 20 passengers per hour, has greater *service effectiveness* than Bus B, which only carries 10 passengers per hour.

Why Measure Service Effectiveness: This dimension of service evaluation is the one that is most focused on the ability to meet the customers’ needs. A 37-seat bus costs the same to run whether it carries 2 or 37 passengers. Identifying which routes, or portions of routes, or times of day that have the greatest Service Effectiveness allows us to figure out what it is about those routes that make them the most attractive ones, and then to try to, where possible, add those characteristics to other routes. We can say that the TTA route with the greatest Service Effectiveness is the route that meets the needs of the largest number of people per unit of service.

Examples of Service Effectiveness:

- Passengers Per **Vehicle Revenue Mile**
- **Unlinked Passenger Trips Per Vehicle Revenue Hour**

COST EFFECTIVENESS

What Is It: Cost Effectiveness measures how much cost is incurred per unit of travel. Imagine we have two buses, C and D, and each carries 50 passengers per day. The

operations manager has also determined that it costs \$100 per day to run either bus. On Bus C, each passenger pays the hypothetical fare of \$1. On bus D, which serves a senior citizens' center, each passenger pays a reduced fare of \$.50.

Bus C receives \$50 in revenue, but incurs \$100 in costs, producing a 50% cost recovery ratio. Bus D receives \$25 in revenue, but also incurs \$100 in costs, producing a 25% cost recovery ratio. We can then say that Bus C, recouping one half of its operating cost through fares, has greater *cost effectiveness* than Bus D, which only recovers one quarter of its operating cost through fares.

Why Measure Cost Effectiveness: This dimension of service evaluation is the one that is most focused on the value we are getting for the dollars we invest in transit. Cost effectiveness indicators are, literally- the “bang for your buck” measures. As a public agency, citizens and politicians will want to see that TTA is spending money wisely, and people will want to know- “How much will it cost us to get the desired number of trips we want TTA to produce?” or “How many trips do we get for the money we invest in TTA?”

Examples of Cost Effectiveness:

- Cost Recovery Ratio
- Operating Cost Per Passenger Mile
- Operating Cost Per Unlinked Passenger Trip

COST EFFICIENCY

What Is It: Cost Efficiency measures how much cost is incurred per unit of service. Imagine we have two buses, E and F, and each operates for 12 Vehicle Revenue Hours each day. The route that Bus E follows is relatively straight and flat, and its first stop is 1 mile from the garage and its most distant stop is 5 miles from the garage. The route that Bus F follows winds through very hilly terrain on the outskirts of the city, and then brings people all the way back to a downtown transit center. Its first stop is 10 miles from the garage and its most distant stop is 20 miles from the garage at an elevation 800 feet above that of the city. While both buses serve passengers for the same number of daily hours, Bus F will burn significantly more fuel and brake pads driving up and down the hills. Additionally, the **deadhead** miles- miles traversed while not serving passengers, will add up. Assuming the transit agency operates 250 days a year, like TTA, by the end of the year, Bus F will have driven 4500 miles more than Bus E while covering the deadhead miles before and after completing a route. With the increased fuel and maintenance costs, we can clearly say that Bus F is less *cost effective* than Bus E.

Why Measure Cost Efficiency: This dimension of service evaluation is the one that is most focused on the productivity of our operations. The example above demonstrates that some bus routes can be significantly more expensive than others to operate. Knowing our cost structures on different routes helps us determine if there are operational decisions we can make to keep costs as low as possible while adhering to safety and operating rules. Additionally, while TTA may discern demand for service in an area, it is important to understand what that service might cost before providing. The more we study the cost efficiency of existing routes, the better we will be able to predict the cost consequences of adding new services or changing existing ones.

Examples of Cost Efficiency:

- Operating Cost Per Vehicle Revenue Hour
- Operating Cost Per Vehicle Revenue Mile

ENVIRONMENTAL SUPPORT

What Is It: Environmental Support measures the degree to which land use patterns and the policies that shape urban form in the region encourage or discourage the use of transit. TTA may run superb services that are always on time, but people may still not ride due to a variety of land use conditions and policies over which TTA has no jurisdiction.

Why Measure Environmental Support: Citizens of the Triangle are already investing in transit through vehicle registration taxes, but some of the most profound improvements to the regional transit system may have to do with investments not in the transit system itself, but in the environment in which it operates. Not many transit agencies measure this fourth dimension that addresses the important transportation-land use connection. However, by doing so, there is a strong likelihood that TTA will learn a great deal more about why its routes perform the way they do, and measuring Environmental Support will help TTA recommend targeted infrastructure investments to municipalities that will enhance the usefulness of transit in their communities. An example would be identifying streets in a town along TTA routes where sidewalks are not continuous so that the town could focus repairs or sidewalk installation on those streets.

Examples of Environmental Support:

Land Use Characteristics that Affect the Environmental Support of Transit (desired outcome)

- The quality and quantity of pedestrian facilities (more)
- The degree of interconnectivity among pedestrian facilities (more)
- The degree of separation of land uses (commercial/office, retail, residential, industrial, etc.) (less)
- The amount of free parking at major activity centers (less)
- The quality and quantity of bicycle facilities (more)
- Number of bicycle or pedestrian paths that connect to transit stops (more)
- Number of bicycle racks or lockers at or near transit stops (more)
- Walking distance from major residential areas to the transit system (less)
- Number of people living within a ½ mile walk of the system (more)

Policies that Affect the Environmental Support of Transit Include:

- Local, State, and Federal Gasoline taxes
- Required parking ratios for new buildings
- Costs of parking at major activity centers
- Road tolls
- Requirements or lack thereof for pedestrian amenities in new developments
- Requirements or lack thereof for placing public facilities (government offices, stadia, etc.) near transit routes or major transit stops

System Characteristics Standards: An Overview

In addition to the questions that service performance standards address, many transit agencies also use standards to define the nature of their transit system. Some questions that system characteristics standards seek to answer include:

- Where should we provide service? (units of measurement: square miles, density, population)
- When should the service operate? (units of measurement: daily service span)
- How should the benefits and costs of service provision be distributed? (units of measurement: **service hours** by county)
- Which processes ensure that service changes occur in a rational and just manner? (public involvement and other standards)

Establishing the Service Area and Service Jurisdiction

One of the most critical questions for any transit agency that must be answered before providing service is: Where are we allowed to put services? Within that area in which we are allowed to put services, where will they actually run? Accordingly, what is our sphere of influence?

The service jurisdiction is usually the area of a region in which transit services can be provided by the transit agency's chartering documents. In TTA's case, Wake, Durham and Orange counties are in the service jurisdiction while Chatham, Johnston and Alamance county are not. The portions of Durham County that are within ½ mile of TTA routes are considered to be part of the service area. Defining the service area as such helps focus marketing and researching efforts on the areas of the region most likely to use existing services.

Determining Service Span

Transit agencies must also determine when services should operate- from time A in the morning until time B at night. Some transit agencies specify a minimum service span as one of their service standards, others do not.

Equity in Service Provision

System characteristics that deal with equity are also of great importance to transit agencies. Civil rights guidelines stipulate that transit services be provided in an equitable manner among communities with varying socioeconomic backgrounds and racial composition. System characteristics standards can determine whether or not minority-population communities are being served as well as non-minority communities. Equity can also be studied from the point of view of those who pay for services, more specifically- do those who contribute a certain portion of the funds for TTA services receive a reasonably proportional amount of service in return? These equity standards may be further developed by the TTA Board.

Rational and Fair Service Adjustments

While performance standards help guide service evaluation by identifying high and low-performing routes as targets for changes, having policies which describe the *process* by which routes can be introduced, altered, or eliminated ensures that decisions are made on a rational

and equitable basis. These types of standards are particularly useful for ensuring public participation in the process of planning and adjusting service.

TTA Service Performance Indicators

To assess the performance of its transit service, TTA will use the following indicators:

- Unlinked Passenger Trips Per Vehicle Revenue Hour
- Cost Recovery Ratio
- Operating Cost Per Unlinked Passenger Trip
- Subsidy Per Passenger Trip
- Unlinked Passenger Trips Per Vehicle Revenue Mile

Before explaining why these particular indicators were chosen for TTA, the following paragraphs provide an overview of which indicators are used throughout the transit industry, and why they are useful.

Which Indicators Have Other Agencies Used to Develop Standards, and Why Do They Use Them?

In preparing this document, staff reviewed the service standards of other agencies for guidance. Here are some findings:

Several agencies, including agencies as diverse as Milwaukee and Chapel Hill Transit used “Unlinked Passenger Trips Per Vehicle Revenue Hour” as an indicator to develop absolute minimum standards of productivity for operating a route. For example, Milwaukee will not operate a route carrying fewer than 22 passengers per hour.

The Maryland Mass Transit District (MTD), which encompasses bus service, light rail in Baltimore, and the Baltimore/Washington Corridor MARC Commuter Rail, state in their evaluation policy: “Staff shall use as the critical performance measure for service evaluation: Unlinked Passenger Trips Per Vehicle Revenue Hour. This measure is a direct indicator of service effectiveness and a strong indicator of cost effectiveness (e.g. hours are the primary determinant of cost effectiveness, and passengers are the primary determinant of fare revenue). Further passengers per hour is directly measurable with a high level of accuracy.”

A study conducted by Booz Allen Hamilton for TTA listed the following potential indicators:

- Cost Recovery Ratio
- Operating Cost Per Unlinked Passenger Trip
- Operating Cost Per Vehicle Revenue Mile
- Unlinked Passenger Trips Per Vehicle Revenue Mile
- Unlinked Passenger Trips Per Vehicle Revenue Hour
- Subsidy Per Passenger
- Peak Load Factor

The recent 5-Year Transit Plan completed by Urbitrans for Raleigh’s Capital Area Transit used Cost Recovery Ratio, Unlinked Passenger Trips Per Hour, Unlinked Passenger Trips

Per Mile, and Operating Cost Per Unlinked Passenger Trip as their 4 major indicators for analysis.

Why Will TTA Use the Indicators Listed at the Beginning of This Section?

TTA staff agrees with the rationale supplied above by Maryland MTD, and of the indicators listed at the beginning of this section, staff recommends that the primary indicator of TTA route performance be Unlinked Passenger Trips per Vehicle Revenue Hour.

The individual rationales for tracking other indicators are as follows:

Cost Recovery Ratio- With the goal of the TTA Board of a 25% Cost Recovery Ratio, tracking this figure is imperative to measure progress. It is also a primary way to measure whether or not our fare policy is working in an appropriate manner.

Operating Cost Per Unlinked Passenger Trip- Like Cost Recovery Ratio, this helps measure “bang for the buck.” However, this measure also helps demonstrate whether or not more costly services with long deadhead periods are worth the number of trips they attract.

Subsidy Per Passenger- There are times when knowing the subsidy per passenger along with the Cost Recovery Ratio has important ramifications. A route where the Cost Recovery Ratio and Subsidy per passenger are both declining means two things: more people are riding, but the bus is taking in less revenue. This can occur during promotional periods when many free passes are distributed. Subsidy per rider helps specify routes with poor Cost Recovery Ratios that may improve when a promotional period ends. Also, if cost recovery is stagnant, falling subsidy per passenger (perhaps due to more people riding but mostly using passes) is a way to show that TTA is increasing the value of taxpayer money invested in the system.

Unlinked Passenger Trips Per Vehicle Revenue Mile- The length of TTA’s routes tend to make these numbers extremely small, and thus, hard to compare to other systems. However, this metric is very helpful in determining the numbers of Vehicle Miles Traveled (VMT) by TTA passengers, and the potential air quality benefits that accrue to the region by those passengers not driving.

Of the indicators recommended by Booz Allen Hamilton, TTA will not track Peak Load Factor, since none of our buses are near capacity, nor will TTA track Operating Cost Per Vehicle Revenue Mile, since TTA Bus Operations Staff have stated that hours, not miles, are the primary determinant of cost for TTA.

Which Environmental Support Indicators Will be Used?

Every effort should be made to evaluate the performance of the environment within the **service area** using several of the following characteristics. The indicators below will be measured (where possible) at the Census tract level along TTA routes.

The following two indicators were chosen because they describe the quality of the pedestrian environment immediately adjacent to the route. All transit trips incorporate walking at some point, so the pedestrian environment is important to the success of transit.

- Miles of Sidewalk per mile of roadway directly on the route
- Interruptions in the Sidewalk network per mile directly on the route

This indicator was chosen to identify areas of transit dependency. Those without cars will show a far greater propensity to ride transit than those who can choose to drive.

- Vehicle ownership along the route

These two indicators related to land use planning were chosen to help describe the urban form along the route. Research has shown that areas with mixed-use development near transit stops support transit use because of the ability to conduct multiple errands on foot.

- Land use patterns or zoning along the route (from municipal planning departments)
- Residential Density along the route

Other indicators that may be useful include:

- Miles of Sidewalk per miles of streets within a ½ mile walk of the system (as the crow flies)
- Number of ticket and pass sales outlets within ½ mile walk
- Number of paid parking spaces within ½ mile walk
- Number of grocery stores within ½ mile walk

*Nota Bene: we would prefer to measure the ½ mile walk according to actual sidewalk availability, but this is currently very difficult to do. Until better data is available, “as the crow flies” distance will have to suffice.

Finally, while TTA staff will work diligently to acquire this data, other public agencies may not have it to share in the first place. For example, Durham currently lacks a single geographic resource for its sidewalk network. Hopefully, as TTA explains the value of this data to partner agencies, its maintenance will receive higher priority and TTA will be able to conduct more precise analyses.

For now, recognizing the limits of data availability, TTA will focus the study of environmental support variables on areas in close proximity to major transit stops, and other stops that have the potential to be major stops. Wherever possible, TTA will identify stops that have strong environmental support to use as successful examples for municipalities to emulate as they plan land uses in conjunction with the transportation system.

TTA Service Performance Standards

The most important measurements taken by TTA are those that evaluate system and route performance. Each route will be measured using the five indicators described earlier, with the primary indicator being Unlinked Passenger Trips per Vehicle Revenue Hour.

After these indicators have been measured, the following averages will be determined for each indicator.

- Systemwide Performance Averages
- **Peak Period** (6:00-8:45 A.M. ; 3:15-6:15 P.M.), Daytime (9:00 – 3:00 P.M.), Evening (6:30 – 10:30 P.M.), or Weekend Averages

Once the averages have been calculated, each route will be classified as Low-Performing, Average, or High-Performing for each indicator. Each classification is defined below.

- **Low-Performing:** Indicator value is less than 75% of system or category average
- **Average:** Indicator value is equal to or greater than 75% of system or category average but less than or equal to 125%
- **High-Performing:** Indicator value is greater than 125% of system or category average

This type of evaluation quickly identifies the weakest portions of the TTA system, and allows staff to respond with appropriate actions.

Actions to Address Low-Performing Routes

Routes that are Low-Performing according to one or two indicators:

- These routes should be studied to find small adjustments that may improve timing, reliability, or access to new or existing geographic areas, while generally preserving the format and major destinations of the route.
- These routes should be targeted by specific marketing actions, including referral incentives (i.e. T-shirt giveaways, \$15 mall gift certificate, etc. when you introduce a new rider to TTA and the new rider buys a monthly pass) to raise awareness of the route among employers, employees, and other beneficiaries near the route.

Routes that are Low-Performing according to three to five indicators:

- These routes are a significant drain on TTA's resources and should be studied to find potential major adjustments, re-routings, or time changes that may improve performance.
- If the route has been low-performing across three or more indicators for 9 months or more, TTA should strongly consider elimination of the route.

Actions to Address High-Performing Routes

Routes that are High-Performing according to 1 or more indicators:

- These routes demonstrate TTA's value to the community, and consistently attract riders. Therefore, TTA should place principal stops on these routes at the top of the list for passenger amenity improvements such as shelters, passenger information systems, benches, trashcans, etc.
- Marketing programs tied to these routes should concentrate on leveraging the loyal riders of these routes to attract new riders. Programs such as referral incentives should be considered, "Why Transit Works For Me" stories on TTA website, etc.
- Any changes to these routes should be small and focus on delivering the same product passengers like in a more reliable, comfortable, or attractive manner.

Absolute Versus Relative Standards

At this time, it is difficult to find peer services in the U.S. for TTA. Our multi-centered region and wide service area do not allow for many useful comparisons to other bus operators to adopt absolute standards. Additionally, many TTA routes do not currently meet the minimum operating standard for agencies in more monocentric regions. Therefore, for the next few years, TTA should work from relative standards to improve existing routes. As benchmarking improves from the application of the service standards, it will be easier for TTA to develop appropriate absolute standards.

Difficulty of Deadhead Miles on Regional Services

Another facet of TTA service that supports the current use of relative standards is the large number of **deadhead** miles covered by TTA services, which as commuter routes, cover much longer distances than most transit systems. Unlike DATA or CAT, with one garage located near the airport and some routes that begin 30 or 40 miles away, TTA is sure to have routes that travel thousands of miles annually that cannot generate revenue in order to provide revenue miles across the region. In comparisons within the TTA system and against other systems, TTA should track revenue and deadhead miles separately by route in order to determine what types of cost savings can come from reduced deadhead miles, and compare cost recovery ratios to systems with similar amounts of deadhead miles.

TTA Service Change Standards

The selected indicators will be measured at the system, route, and **route segment** level. Route segment-level analysis will be used to evaluate minor route pattern or timing changes. If over 25 percent of an existing route's pattern, measured in route-miles, are to be changed in this process— TTA should hold at least one public meeting to gather input on comment on how this change would affect riders and the community. Changes in which less than 25 percent of a route pattern is changed at one time can be made by TTA staff without a public meeting.

How Will TTA's Routes be Classified for Comparison Purposes When Examining Whether or not Routes Should be Changed?

Comparing diverse services to each other is not the best method of performance evaluation, as commuter routes that only run 5 hours daily are very different from buses that run from 6 A.M. to 10 P.M. Therefore, all TTA routes will be classified according to the following characteristics to make comparisons to "peer" routes as well as comparisons to systemwide averages:

- Peak Period, Daytime, Evening, or Weekend Routes (see previous page for hours)
- New Routes (operating less than 6 months) or Regular Routes (operating 6 months or more)

Different times of day exhibit different travel patterns, and services that run at the same time can also be grouped together. As it is deemed necessary by staff, new categories may be developed for further route classification.

Based on the comparison of routes to their peers and the TTA system, TTA staff will recommend changes to improve the Service Effectiveness, Cost Effectiveness, or Cost Efficiency (or any combination thereof) of each route.

TTA System Characteristics Standards

Each year, the TTA Board approves the total number of **service hours** to be provided in the coming fiscal year. Hours of annual service should reflect a commitment to providing quality service within and between Triangle communities. Hours of service should also be supported by a financial plan for providing service that is based on sustainable and predictable revenues that moves the Authority closer to its farebox recovery ratio goal.

- In terms of regional equity, regional bus service provision in individual counties should reasonably reflect the counties' percentages of vehicle registration revenue contributed to the TTA General Fund. Recommended indicators to determine regional equity include total service hours, peak period service hours, and **service span** in each county. TTA should also consider the cost and productivity of services provided in each county.

- While TTA provides both fixed-route and demand response services, other non-traditional services may be appropriate in certain portions of the **service jurisdiction**, and should be given the greatest consideration in areas where TTA staff analysis projects traditional fixed-route transit service to yield low cost recovery ratios. Some non-traditional service concepts TTA may consider are listed below (locations where implemented in parentheses).
 - Evening General Public Dial-A-Ride (Lubbock, TX)
 - Volunteer Driver Trip Reimbursement (Riverside County, CA)
 - Deviated Fixed-Route Services (Healdsburg, CA)
 - Flex-Route within Specified Corridor (Potomac/Rappahanock Transit, VA)
 - Feeder Services (Monterey, CA)
 - On-call Shared Taxi (Linz, Austria)
 - Postal Bus (Colfax, WA)
 - School Bus-Based Public Transit (Mason County, WA)

- TTA should also regularly evaluate its services in terms of compliance with Title VI regulations in order to ensure that minority and socioeconomically disadvantaged populations are treated equally in the provision of TTA service. Specific measures that should be used to help determine TTA compliance with Title VI are specified in the Urban Mass Transit Administration Circular 4702.1, pages III-3 to III-8 under "Program Specific Requirements."

Most importantly, TTA will evaluate Title VI compliance by developing appropriate Geographic Information System (GIS) maps to analyze service provision. UMTA 4702.1 specifies "maps of demographic and transit service profile of the service area, including service level overlay, minority population overlay, population and racial distribution charts; vehicle load, vehicle assignment, and headway data; data on distribution of transit amenities; and access to the transit system (measured in minutes needed to walk to access the system)"

In addition to the maps specified above, as many of the following indicators as possible will be used to further assess TTA's compliance with Title VI. The primary method for most of these indicators involves comparing predominantly minority census tracts with predominantly non-minority census tracts, and looking for disparities to see if there areas in

which TTA is not distributing resources and service in an equitable manner. The additional indicators are:

- Impact on minority communities and minority-owned businesses during and after construction for transit
- Environmental impacts such as noise, air, or water pollution
- Impacts that may be felt in minority communities including increased traffic, amount of available parking
- Description of any relocation program to mitigate impacts of construction projects
- Load factor (number of seats on bus divided by number of passengers carried at peak hour) comparison of minority and non-minority census tracts
- Vehicle assignment comparison (age of vehicle, level of repair, types of vehicles assigned) of minority and non-minority census tracts
- Vehicle headway comparison (time between buses) in minority and non-minority census tracts
- Distribution of amenities comparison (benches, shelters, etc.) in minority and non-minority census tracts
- Transit access comparison (distribution of transit service, number of people within ½ mile walking distance to the system) in minority and non-minority census tracts

Additional System Characteristics Priorities

TTA operates across a three-county region with many other transit providers. Every effort should be made to integrate services effectively with those of other systems to minimize transfers across the region.

Furthermore, TTA's services do not exist in a vacuum— transit service tends to be most successful where land use decisions support the use of transit through a variety of factors, including but not limited to urban design, pedestrian amenities, parking pricing, and other policies related to the built environment. Therefore, in distributing service, TTA should seek to provide service to jurisdictions that have encouraged transit-supportive development patterns before providing service to jurisdictions that have not done so.

TTA Service Area/Service Jurisdiction Standards

- TTA's service jurisdiction for Regional Bus service is defined by the three governmental units that empowered the Authority to operate regional transportation services in the Triangle region: Orange, Durham and Wake counties. Any existing or proposed service that operates within the limits of these three counties shall be considered to be operating within the service jurisdiction.
- The complete operation of a route within the service jurisdiction is a necessary, but not sufficient condition to initiate a new fixed route regional bus service. If part or all of a proposed route travels on roads outside the presently defined service jurisdiction, it cannot be initiated without a decision by the TTA Board to expand the service jurisdiction.
- Within the service jurisdiction, TTA defines its service area as all the area within ½ mile of all existing TTA fixed route bus service.

TTA Service Evaluation Frequency

How often will service be evaluated?

TTA staff will evaluate fixed-route performance on a routine and ongoing basis in a format similar to the reports the board currently receives. However, staff will also prepare two reports of a more detailed nature throughout the year. One of these two performance reports will be an Annual Report- an extensive look at TTA services as part of the Route Planning and service change recommendations process, which will measure route performance at the route segment level- the most detailed analysis we can currently perform. The second report will be more detailed than the monthly versions, but will only analyze data at the route level.

In order to implement service changes in mid-August prior to the opening of college classes, the following schedule makes sense:

2003-2004 Service Year

September 8, 2003	New Service Implemented
December 2003	Semi-Annual Report on Individual Route Performance
January to April 2004	Route Planning Committee conducts detailed segment-level analysis of all routes
April 2004	Annual Report and Fall service recommendations
May 2004	TTA Board Adopts Service Changes
August 16, 2004	New Service Implemented

2004-2005 Service Year

August 16, 2004	New Service Implemented
November 2004	Semi-Annual Report
January to April 2005	Route Planning Committee conducts detailed segment-level analysis of all routes
April 2005	Annual Report and Fall service recommendations
May 2005	TTA Board Adopts Service Changes
August 15, 2005	New Service Implemented

TTA Service Introduction Standards

In addition to studying the performance of existing services, TTA should have standards that dictate whether or not a new service should be initiated. In the past, new fixed-route services have been rolled out with little research to determine whether or not the conditions in a specific portion of the Triangle warrant fixed-route bus service. These mistakes can best be avoided by requiring standards to introduce new services. Currently, TTA provides fixed-route bus service throughout the Triangle and deviated fixed-route shuttle service within Research Triangle Park.

Density Analysis

Transit is usually supported by a concentration of employment or population. In terms of density, new fixed-route service should not be initiated unless:

- All the municipalities with stops on the route have a population density of over 1600 people per square mile

— OR —

- All the municipalities with stops on the route have a population density of over 1350 people per square mile AND one portion of the route accesses one of TTA's current top trip attractors according to the Triangle Regional Model (RTP, Duke Hospital, UNC, NCSU, Downtown Durham, Downtown Raleigh), or future top trip attractors.

Demand Analysis

In addition to traversing areas of notable density, potential new routes should exhibit:

- Demand expressed in terms of requested travel through the TTA customer service line or website
- Demand expressed in terms of attendance and comments at public meetings held about the potential route

New Service Requests

Requests for new service should be routed to planning staff to study whether the potential service warrants holding public hearings to gather more information. If staff analysis suggests a proposed service merits further study, staff should project the costs, revenues, and ridership of new service based on the best empirical information available.

Recognizing that certain portions of the service jurisdiction are far more supportive of fixed-route transit than others due to a variety of variables, a locality should not receive fixed-route bus service simply because it is included within the service jurisdiction. However, all localities within the service jurisdiction should be considered for appropriate transit service concepts when conditions in the Service Introduction standards are met.

Provision for Key Destinations

In addition to the circumstances described above, new service concepts may be studied by staff in areas designated "Key Destination" by the TTA Board, even if those areas do not meet the qualities described above. Key Destinations may include county seats, hospitals, universities, and other educational centers. Service to Key Destinations that would not meet the criteria described above for new service introduction could then be initiated by the TTA Board after reviewing staff studies of the proposed Key Destination-oriented service.

New Route Performance Standards

Furthermore, a new service will be judged by "new route" performance standards to determine whether a route is Low-Performing, Average, or High-Performing during its first 6 months of existence. New Route Performance Standards will be set at 75 percent of the regular performance standards. After the introductory 6 month period, the new route will be judged by the regular standards.

There may be circumstances in which it makes sense for TTA to contract with another public or private entity to provide services in a portion of the service jurisdiction. All such arrangements must be approved by the TTA Board and should meet any performance criteria developed by staff to ensure that contracted services can be evaluated and monitored as closely as those that are operated by TTA.

TTA Service Elimination Standards

Continued poor performance by routes drags down the financial health of TTA and should be addressed. Wherever possible, routes should be considered for changes prior to being eliminated. However, there are times when the only sensible course of action is to discontinue a service, provided the following conditions are met:

- Any route active for more than 6 months that is low-performing against the system average for three of the five indicators can be considered for elimination
- Any route that is not a demonstration service requires at least one public meeting in the jurisdiction where the service will be eliminated prior to service termination. Staff should conduct the public meeting prior to recommending elimination to the TTA Board. After the public meeting, staff will examine the feasibility of other alternatives that may improve ridership, including the potential of new routings, different stop locations, or other strategies. The costs, benefits, and ridership impacts of these alternatives will be included with any service elimination recommendation.
- If TTA proposes to eliminate more than 25% of the service hours on a route, or eliminates a number of trips on a route that affect more than 25% of the route's ridership, TTA will hold a public hearing for public comment on the proposed change.

TTA Special Events/Demonstration Services

A new service concept may be introduced for less than 20 operating days as a demonstration service. A demonstration service is not subject to the regular standards for introduction or elimination. Demonstration services allow TTA to explore service concepts without a large commitment of funds to a concept for which it is particularly difficult to project ridership. Such services are most likely to be special events services to sporting events, seasonal services, or heavy travel days at the airport.

Research Underway: TTA Service Quality Indicators

In addition to standards of productivity and cost, TTA should find ways to measure and address the customer experience. This fall, TTA will conduct market research to determine which service attributes are most important to customer satisfaction. Once these service attributes are identified, TTA can begin to develop indicators and later on, standards to measure service quality.

Some potential indicators of Service Quality Include:

- Percentage of Buses Considered "On Time" at Timepoints
- Number of Missed Transfers, by # of Passengers Inconvenienced, Per Vehicle Revenue Hour
- Standard Deviation (in minutes) of time of arrival at individual stops
- Frequency of buses being washed externally
- Frequency of buses being swept internally
- Number of Buses Per Route Held For More Than 5 Minutes Each Day at RTP Transfer Center
- Number of Times that Wheelchair Lifts Function Improperly/Do Not Function
- Indicators derived from safety data

The market research should be complete by December 2003, at which point, staff will report the consultant's findings to the Board and make recommendations on which indicators and standards should be used to measure service quality.

Sample Analysis Using Proposed Indicators and Standards

The chart on the following page shows how current TTA services perform according to the 5 proposed indicators, and how they would be classified (red = low-performing; green = high-performing; other = average) using the proposed standards

TTA Route Performance By Indicator Under Proposed Standards
(sorted by Cost Recovery Ratio)

Route Segments	Age of Route in Years (09/17/03)	Performance Indicators				
		Passengers per Trip	Passengers per Hour	Recovery Ratio	Net Cost per Passenger	Subsidy per Rider
410 - Hillsborough and Duke	2 (Eliminated)	1.5	1.8	3%	\$ 28.98	\$ 28.10
202 - North Raleigh (Leesville Rd.) / RTP	1	2.0	2.4	4%	\$ 21.89	\$ 21.00
302 - Raleigh/Cary/Aviation Pkwy/RTP	3	5.4	5.1	8%	\$ 9.80	\$ 8.92
453 Durham/Chapel Hill Express	1 (Eliminated)	3.3	5.3	9%	\$ 9.21	\$ 8.32
311 - Apex and RTP	2	4.4	5.4	9%	\$ 9.04	\$ 8.15
301 - Raleigh/Western Blvd/Cary/RTP	10	6.4	5.5	9%	\$ 8.92	\$ 8.03
102 - Garner and Raleigh	3	3.9	5.7	9%	\$ 8.63	\$ 7.74
452 Chapel Hill/RTP Express	1 (Eliminated)	3.1	6.5	11%	\$ 7.40	\$ 6.52
150 Raleigh/RTP Express	1 (Eliminated)	3.5	7.1	12%	\$ 6.76	\$ 5.88
201 - North Raleigh and RTP	10	8.4	7.2	12%	\$ 6.62	\$ 5.74
107 - Raleigh and RTP	10	5.7	7.7	13%	\$ 6.14	\$ 5.25
412/413 Chapel Hill and RTP	10	5.6	7.8	13%	\$ 6.03	\$ 5.15
412/413 Chapel Hill and Durham	10	5.8	8.2	13%	\$ 5.71	\$ 4.82
402/403 Chapel Hill and Durham	10	5.1	8.4	14%	\$ 5.54	\$ 4.65
402/403 Chapel Hill and RTP	10	6.8	10.1	17%	\$ 4.44	\$ 3.56
412/413 Durham and RTP	7	6.0	10.3	17%	\$ 4.35	\$ 3.46
451 Durham/RTP Express	1 (Eliminated)	4.9	10.4	17%	\$ 4.30	\$ 3.42
402/403 Durham and RTP	7	7.9	11.7	19%	\$ 3.71	\$ 2.82
105 - Raleigh and RTP	10	8.3	11.9	20%	\$ 3.64	\$ 2.75
Fixed Route Subtotal		6.0	8.1	13%	\$ 5.76	\$ 4.88

Route is performing **BELOW 50%** of system average for indicator
Route is performing **ABOVE 150%** of system average for indicator

TTA Service Standards Glossary

Cost Recovery Ratio: Also referred to as the Farebox Recovery Ratio. This is a measure of how much money a transit service recovers in fares compared to the cost of providing service. If it costs \$100 per hour to provide bus service on a route, and on average, 25 people per hour paid a \$1 fare to ride, that route would recoup \$25 in fares for every \$100 spent in operations. $\$25/\100 yields a 25% Cost Recovery Ratio.

Deadhead: Refers to either vehicle miles or vehicle hours on the bus when the driver is on his or her way from the garage to the route, or vice versa, and is not serving passengers. Routes with greater deadhead miles are more expensive to run because they must travel further before having a chance to gain revenue. The TTA 102 Garner route is a good example of a bus with high deadhead miles.

Indicator: An indicator is a measurable characteristic of some attribute of service or local transportation phenomenon. The number of passengers per hour on an individual route is an indicator of transit service productivity. The average travel speed on I-40 at 5:00 P.M. is an indicator of the phenomenon of roadway performance. Indicators tell us “what is going on” by objectively quantifying and measuring the attributes of whatever it is we want to study.

Peak Period: A peak period is a time of day when the vast majority of commuters are traveling to and from work. These times of day are usually when transit services experience their greatest ridership demands, and consequently, their maximum level of operation. At TTA, the morning, or A.M. Peak period is 6:00 to 8:45 A.M. The evening peak period is 3:15 to 6:15 P.M.

Route Pattern: A route pattern is the series of turns followed by a fixed-route bus over and over again throughout the day. Currently, one of TTA's buses goes to Durham Tech at some times of day but not at others. This route has a changing route pattern. The Apex Route, which makes the same turns at all times, has an unchanging route pattern.

Route Segment: Routes are broken down into smaller pieces called segments for analysis purposes. Currently, TTA's 400-series routes that travel among RTP, Chapel Hill, and Durham consist of certain segments to track ridership. Examples include RTP to UNC Hospital, UNC Hospital to Downtown Durham, etc. A segment on the Raleigh Route might be Moore Square to RTP. Most routes are segmented at major stops, or at other logical points along the route. Usually the segmentation occurs at the route endpoints, unless the route is circular instead of bidirectional.

Service Area: The specific physical locations in which an agency actually supplies transit service, and the land 1/2 of a mile from the actual roads traveled by the buses.

Service Hours: Also called "revenue hours" or sometimes "platform hours," service hours describes the hours of operation in which buses can actually pick up or drop off passengers.

Service Jurisdiction: The area of the region in which the agency has the authority to provide services and the ability to appropriate funds to pay for services.

Service Span: The hours of the day in which service is provided. Service operated from 6 A.M. to 6 P.M. constitutes a service span of 12 hours. Service operated from 6 A.M. to 10 P.M. constitutes a service span of 16 hours.

Standard or Service Standard: A service standard is a goal set by TTA staff to make judgments about where service is performing adequately and inadequately. Standards tell us “what is good” by using indicators to set performance thresholds, which helps define whether service is performing superbly, adequately, or inadequately. An example of a standard would be: “All evening routes should carry at least 10 Passengers Per Vehicle Revenue Hour.” Any evening bus carrying fewer 10 passengers every hour would be considered to be “inadequate” or “low-performing.”

Occasionally, standards tell us “what is good” but do not use indicators. An example would be “All TTA Routes Will Follow the Same Route Pattern Throughout the Day.”

Unlinked and Linked Passenger Trips: Passenger trips are often referred to as "linked" or "unlinked," in terms of explaining whether or not a passenger's travel involves a transfer. An "unlinked" passenger trip is one that is counted without any regard to whether or not transfers occurred. A linked trip only occurs when a transfer takes place.

Vehicle Hour: Can refer to any hour of bus operation, from the time it leaves the garage until it returns in the evening.

Vehicle Mile: Can refer to any mile of distance traveled, from the moment the bus leaves the garage until it returns in the evening.

Vehicle Revenue Hour: Refers to an hour of bus operation when the bus is in active service and can pick up or drop off passengers. Time spent driving from the Garage to the first stop on the route, or from the last stop at the end of the day to the garage are NOT Vehicle Revenue Hours.

Vehicle Revenue Mile: Refers to a mile of distance traveled when the bus is in active service and can pick up or drop off passengers. Miles traveled driving from the Garage to the first stop on the route, or from the last stop at the end of the day to the garage are NOT Vehicle Revenue Miles.