ITRE FY 2012 Task Order:

Evaluation of Optimal Fleet Type and Size for Community Transportation Systems

Project Final Report

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Table of Contents

I. Introduction

The North Carolina Department of Transportation, Public Transportation Division (NCDOT/PTD) provides state and federal capital funds for the purchase of vehicles by Community Transportation (CT) systems. Several vehicle types and configurations are available to CT systems through a state vehicle contract.

When determining the distribution of state and federal funds for vehicle purchases, NCDOT/PTD assesses whether a transit system should 1) reduce its fleet, 2) maintain its current fleet, 3) replace its fleet with different vehicle types, and/or 4) expand its fleet. However, there is not a comprehensive methodology that NCDOT/PTD can use as a basis for these determinations. Without such a methodology, it can be difficult for NCDOT/PTD to weigh the merits of requests for expansion/replacement vehicles and to assess where funding will be utilized most effectively. In addition, consultants assess vehicle fleets as part of the development and/or updating of Community Transportation Service Plans (CTSPs). This methodology also provides guidance to those consultants to increase consistency among fleet assessments that are conducted as part of the CTSP planning process.

The purpose of this project was to develop a tool, such as a spreadsheet, that can be used by the NCDOT/PTD, CT systems, and consultants when assessing CT system fleets. The assessment involves several interrelated activities:

- Reviewing the current fleet size to determine if vehicles are being used effectively or if more or fewer vehicles of a particular type may be warranted;
- Evaluating the mix of vehicles to determine if appropriate types of vehicles are in the fleet or if a different type of vehicle might be more appropriate; and
- Determining relative priorities for vehicle purchases at the statewide level, among all CT systems.

This report describes the activities that were conducted for this project, including:

- Literature Review—a review of the literature on many facets of vehicle fleets, including:
  1. Fleet Size and Mix Optimization
  2. Vehicle Allocation Methodology
  3. Small Transit Vehicle Research
  4. Small Vehicle Procurement Methods
  5. Small Vehicle Procurements by Other States
  6. Federal Small Vehicle Funding Programs

  This section includes a description of the methodology developed by Pam Hawley of the NCDOT/PTD to assess Community Transportation (CT) System fleets.

- Survey of Community Transportation Systems

- Potential factors affecting the numbers and types of vehicles operated by CT systems and indicators to measure/assess those factors, with results of an analysis of the relative performance of CT systems according to several potential indicators.

- Description of the tool developed to assess CT system fleet size and mix, including a description of the steps in its use.

II. Literature Review

The review of the literature compiled a variety of information relevant to the issue of determining the optimal size and mix of vehicle fleets for North Carolina Community Transportation (CT) systems. The review is organized into six main sections:

7. Fleet Size and Mix Optimization
8. Vehicle Allocation Methodology
9. Small Transit Vehicle Research
10. Small Vehicle Procurement Methods
11. Small Vehicle Procurements by Other States
12. Federal Small Vehicle Funding Programs

This chapter concludes by presenting a description of the methodology to assess fleet size and vehicle mix that was developed by Pam Hawley, of the NCDOT/PTD.

1. Fleet Size and Mix Optimization

Determining the optimal size and configuration of a vehicle fleet is the type of optimization/ maximization problem often addressed within the field of Operations Research. A search of Operations Research and related literature was therefore conducted. As a general rule, Operations Research methods tend to utilize very sophisticated and complex statistical, mathematical and computer-based procedures to determine optimal solutions. They also tend to be more theoretical, or academic, than practical, and are therefore not well-suited for regular use by the operating or administrative staff of small transportation agencies.

The Size and Composition of a Road Transport Fleet. J. Gould. Operations Research Society, March 1969. (Stable URL: http://www.jstor.org/stable/3008537)

This paper examines the issue as a simple fleet-size problem, one that can be formulated as a linear program. The basic problem addressed is how many vehicles should an organization have in order to meet a fluctuating work load. Gould refers to earlier work by Kirby[1] and Wyatt[2] that addressed this problem as a simple fleet-size problem. Using some relatively simple math, Kirby and Wyatt developed a method to determine the optimal fleet size. However, both authors assumed a homogenous fleet with only one type of vehicle, known demand that fluctuates seasonally, and the ability to augment the company's fleet with hired vehicles.

Gould points out that the approach used by Kirby and Wyatt becomes very cumbersome when used to address non-homogenous fleets having two or more types or sizes of vehicles. Gould therefore developed a linear programming model to address a more complex case study analyzed in his paper. In the case study, there were two types of vehicles, each type available in six different sizes.[3]

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[1] D. Kirby. *Is Your Fleet the Right Size?* Operational Research (1959).
[2] J. K. Wyatt. *Optimal Fleet Size*. Operational Research (1961).
[3] According to Wikipedia, linear programming is a "is a mathematical method for determining a way to achieve the best outcome (such as maximum profit or lowest cost) in a given mathematical model for some list of requirements

Gould uses the linear programming model to determine an optimum size for the fleet. The results, which were substantially implemented, recommended a smaller fleet and an emphasis on larger and more flexible vehicles. The author noted two simplifying assumptions that were made in the case study analysis:

1. Perfect knowledge of demand at the time when decisions on fleet size are made; and,
2. The type or size of load carried by the vehicles could only be changed once a month.

In spite of the simplifying assumptions, the math involved in the linear programming model used by Gould gets quite complex and requires extensive use of a computer.

Dynamic Optimization of Vehicle Fleet Size. R.H. Mole. Operational Research Society, March 1975. (Stable URL: http://www.jstor.org/stable/3007811)

Mole's paper extends previous work on the fleet-size problem. Like Gould (see above), Mole also cites and describes the earlier work done by Kirby and Wyatt. He also acknowledges the work of Gould in extending their work to fleets that are not homogenous. Mole's approach adds an ability to time the investment in new vehicles in response to demand trends that are in addition to seasonal fluctuations. However, his paper reverts to a situation where the fleet is homogenous.

Mole describes his method as a "dynamic programming model, based on a regeneration sequence…developed for the more general case where the optimum fleet size is time dependent." According to the author, the model can address vehicle obsolescence and is "computationally simple" (even though the paper includes page after page of complicated mathematical equations and explanations).

Because the model assumes an homogenous fleet, it does not appear to be useful for the NCDOT/Public Transportation Division project.

Minimum Cost Fleet Sizing for a University Motor Pool. William W. Williams and Oscar S. Fowler. The Institute for Operations Research and the Management Sciences (INFORMS), June 1980. (Stable URL: http://www.jstor.org/stable/25059911)

Williams and Fowler (professors at the University of Tennessee, Department of Management) were asked by University administrators to examine the cost-effectiveness of the school's motor pool operations. The request was motivated by continuing budget reductions and a leveling of enrollment at the University. A preliminary analysis involving a great deal of sophisticated data collection and statistical analysis led to a conclusion that the determination of an optimum fleet size would be hampered by difficulties in constructing meaningful cost equation estimates. It

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represented as linear relationships. Linear programming is a specific case of mathematical programming (mathematical optimization)." (More formally, linear programming is a technique for the optimization of a linear objective function, subject to linear equality and linear inequality constraints. Its feasible region is a convex polyhedron, which is a set defined as the intersection of finitely many half spaces, each of which is defined by a linear inequality. Its objective function is a real-valued affine function defined on this polyhedron. A linear programming algorithm finds a point in the polyhedron where this function has the smallest (or largest) value if such point exists.)

was decided that an analytical cost model driven by outputs of a fleet simulation model would be the most promising methodological approach.

After a comprehensive review of the literature (including Kirby, Wyatt, Gould, and Mole—see above), the authors determined that existing models and approaches were inadequate, largely due to the motor pool's time-dependent, interactive nature of vehicle dispatches and trip duration times. The authors decided that their cost estimation model needed to be able to:

- Accommodate day-to-day changes in load distributions over the planning period (usually one year)
- Limit fleet size capacity decisions to one time over the planning period
- Accurately represent, and provide the ability to observe, the dynamics of fleet behavior over time
- Allow sensitivity analysis in order to assess changes in cost coefficients
- Incorporate trends and other modifications in request and trip distributions

Two models were developed as follows:

1. *Fleet simulator model*. In a series of iterations, the model generates vehicle requests from probability distributions specific to the demand time series, trip duration times (derived from samples of appropriate functions), and vehicle mileage (based on trip-distance regressions). Fifteen years of simulated experience was generated for each of seven alternative fleet sizes.
2. *Cost model*. The total cost of owning and operating the fleet was separated into four components:
    a. Fleet overhead costs (administrative, etc.)
    b. Fleet ownership costs (the capital cost of vehicles and facilities)
    c. Fleet operation costs
    d. Reimbursement costs (amount paid to employees to use their personal vehicles when a motor pool vehicle is unavailable)

The results of the study led to a recommendation for an optimal fleet size of 80 vehicles, a reduction of about 40 percent from the current vehicle fleet.

Vehicle Fleet Composition. T. Etezadi and J. E. Beasley. The Journal of the Operational Research Society, January 1983. (Stable URL: http://www.jstor.org/stable/2581607)

The authors reviewed the relevant literature and briefly discuss a number of different approaches to various fleet size optimization methods. For example, they reviewed the early work done by Kirby and Wyatt, the linear programming approach (Gould), a simulation approach (Maskell), an integer programming formulation (Eilon, et al), dynamic programming (Mole), queueing theory (Parikh), and a linear programming method using various heuristics based on either the "savings" algorithm of Clarke and Wright, or the "giant tour" concept (a single vehicle trip that links the depot and all the customers together).

One of the conclusions reached by the authors was that simulation approaches could be prohibitively expensive because of the computer time involved in simulating a large number of options (especially when vehicle routes are not fixed). Their study was therefore intended to

develop a method of reducing the number of possible fleet options to a more manageable number before trying to simulate them. (Note: this report was published in 1983, a time when computer use was much more limited and expensive than it is today.)

They describe the approach they developed as a mixed-integer linear program. It can include constraints such as limiting the number of owned or leased vehicles, or limiting the total number of customers to the average number that can be served by each vehicle type. As usual, the method involves numerous complicated mathematical equations. The output from this step can then be examined in more detail using a simulation approach.

Analytical Model for Paratransit Capacity and Quality of Service Analysis. Liping Fu. 2003. (Also published in Transportation Research Record No. 1841.)

The paper describes an analytical model that could potentially be used by paratransit service planners to predict fleet requirements, system capacity and quality of service measures for specific operating conditions. The author describes the many difficulties of developing an analytical model that can handle all the complexities involved in paratransit operations (vehicles traveling from place to place in a stochastic (non-deterministic) environment; operations that require solving the routing and scheduling problem that are not amenable to optimal solutions; and the many variations in operating conditions such as service coverage, network typology, traffic congestion, fleet mix and spatial and temporal changes in travel demand). For this reason, simulation models have been favored, but simulations require large amounts of data, significant preparation efforts, and long computational time which is expensive, time consuming and unsuitable for parametric analysis. The author was therefore seeking a model that can be used by practitioners to provide quick solutions to their service planning and design problems.

Two earlier analytical models were reviewed—Wilson's empirical model (1971) and Daganzo's theoretical model (1978). However, both models assumed idealized operating conditions and were developed for demand-response systems in which all trips are demand trips that must be scheduled in real time. This made them unsuitable for today's more typical demand-response systems that usually require advance reservations.

The proposed model was calibrated based on a set of idealized conditions. However, a capability was added that allows for adjustments to be made for prevailing conditions. The idealized assumptions included:

1. A geometrically square service area with a uniform grid road network
2. The depot is located at the center of the service area
3. Random demand (as opposed to trip clustering)
4. Uniform service vehicles with an extremely large seating capacity
5. A standard scheduling process must be specified

As with earlier models, the proposed model involves some complicated equations and statistics.

The author identified and tested four factors that could cause results to differ from those that assume the idealized conditions.

1. *Shape of Service Area*. A service area that is elongated rather than relatively square may affect the recommended fleet size. After testing this, the author concluded that this is not a significant issue.
2. *Vehicle Seating Capacity*. The testing found that there is an upper bound beyond which vehicle capacity is no longer a constraint in the scheduling process, and that the smaller the service vehicles, the more vehicles that are required to meet the same demand. Moreover, it was observed that in practice most agencies use a mixed fleet of large and small vehicles and the impact of seating capacity on fleet size is therefore likely to be small.
3. *Trip Clustering*. Three conclusions were reached:
    a. Trip clustering did reduce fleet requirements and the reduction increased as the degree of clustering increased.
    b. However, unless the percentage of clustering (in both time and space) is high (e.g. over 50 percent), the reduction in fleet size should be small.
    c. Seat capacity could be important. For example, spatial trip clustering would have less effect on reducing fleet size when using a fleet of small vehicles than when using a fleet of large vehicles. However, in a fleet composed of both small and large vehicles, this effect is expected to be small.
4. *Scheduling Method and Algorithm*. Several different scheduling algorithms were tested to reflect the varying degrees of scheduling quality found in practice. This factor actually had a significant effect on the results when compared to the idealized base case.

An interesting concept that appeared both in this paper and Fu's subsequent paper (described below) is the importance of "quality of service" in determining fleet size. Two examples of quality-of-service factors are:

1. Rider pickup window. If the window is large, there is more flexibility in serving riders and less vehicles would be required.
2. Excess ride time. This factor is measured in comparison to the theoretical ride time if the vehicle were to go directly from point A to point B. If as a matter of policy the allowable excess in ride time is small (say 20 percent), then there is less flexibility in scheduling and a larger fleet would be required. If the allowable excess is large (say 100 percent), then fewer vehicles would be needed.

One of the hopes of the author was that the proposed model might provide a starting point for an analysis methodology that could be integrated into a future edition of the Transit Capacity and Service Quality Manual (TCSQM). This manual does not currently include a section for paratransit service.

Fleet Size and Mix Optimization for Paratransit Services. Liping Fu and Gary Ishkhanov. Transportation Research Record No 1884, Transportation Research Board, 2004.

The authors reviewed existing literature on the subject of fleet size and mix (FSM). Some research was useful but had the shortcoming of assuming either a fixed fleet mix or unlimited vehicle capacity. When the authors reviewed the research done in the Operations Research community, they concluded that they could find no existing research that deals specifically with the FSM problem as it relates to paratransit services. For example, they found that existing

algorithms deal exclusively with basic vehicle routing problems with no time constraints or precedence conditions (such as the need for pickup stops to precede drop-off stops).

The objective of this research was to develop a *practical* procedure for determining the optimal FSM for a given paratransit operating environment. A heuristic procedure was developed that maximizes the operating efficiency of a paratransit system. (The heuristic is basically a "greedy search" procedure or algorithm.[4])

The heuristic algorithm developed was called scheduling, matching, allocation and reduction (SMAR). It includes five sequential steps:

1. *Prepare representative cases*. The cases represent typical operating conditions of the system, including a trip database, travel time and speed estimates, and service constraints.
2. *Schedule trips with an idealized fleet*. For each case, trips are scheduled with an idealized fleet using vehicles with unlimited seating capacities for both ambulatory riders and those with wheelchairs. The scheduling process is constrained by time windows and ride time limits. The output is a set of routes, each of which is assigned a set of trips to be covered by the idealized vehicles.
3. *Distribute the routes by required vehicle size*. For each route, a loading profile can be established to show the number of riders on board over the vehicle trip duration. The maximum number of seats required for a vehicle to cover the route can then be determined.
4. *Match and allocate vehicles*. Some routes may need to be allocated to vehicles that do not match the exact seating needs.
5. *Reduce fleet size*. The logic used in the previous step may lead to the overuse of large vehicles. A three-step iterative subprocess is provided as a way to reduce the number of large vehicles.

A real-life example applying the proposed methodology to a paratransit system in Canada is described. The results showed a significant improvement in productivity when compared to the current fleet mix. When compared to an "ideal" fleet mix (that assumed unlimited fleet size and vehicle capacity), it came very close on several performance measures (riders per vehicle hour, average ride time, and average deadheading hours per vehicle).

Based on their research, the authors offered three observations:

1. Vehicle size has a significant impact on vehicle productivity and the number of vehicles required. As would be expected, larger vehicles can allow higher vehicle productivity and a smaller fleet size. However, there is a point beyond which larger vehicles don't make economic sense.
2. The optimal size of a vehicle fleet will depend on the level of travel demand. For example, if demand is high, it provides more opportunities for ridesharing and larger vehicles will make more sense.

[4] A "greedy" algorithm is any algorithm that follows the problem-solving heuristic of making the locally optimal choice at each stage of the process with the hope of finding the global optimum. Such algorithms will not always produce the optimum solution, but they will often get close. (Wikipedia)

3. In addition to the level of travel demand, another factor that influences vehicle size is the service constraint or policy in regard to maximum allowable ride time. If the maximum ride time is held low, then smaller vehicles may be more suitable.

The authors recognize that the method they developed is limited to optimizing operating efficiency (e.g. riders per vehicle hour). More research is needed to incorporate other important factors such as life-cycle cost that would recognize the capital and maintenance costs of different kinds of vehicles. In addition, the methodology used in the study was applied with a "semiautomatic" procedure. Development of software that could automate the process would therefore be useful.

2. Vehicle Allocation Methodology

In contrast to "optimization" studies, a different approach generally known as a vehicle allocation methodology has been developed. This section reviews four documents about this methodology.

***Fleet Management Study*.** Advanced Highway Maintenance and Construction Technology Research Center, University of California/Davis. Ongoing.

An extensive, ongoing study regarding fleet management practices was performed for the California Department of General Services and Department of Transportation (Caltrans) by the Advanced Highway Maintenance and Construction Technology Research Center (AHMCT) at the Univ. of California/Davis, and Mercury Associates, a fleet management consulting firm. The purpose of the study was to make strategic recommendations to improve vehicle asset management for California state agencies and lay the foundation for future fleet "right-sizing." (The results of this ongoing effort can be found at: http://www.ahmct.ucdavis.edu/index.php?title=FleetManagement)

There are four desired components or outcomes of the study effort:

1. *Vehicle Utilization Data*. A data collection strategy able to track vehicle mileage, hours, trips, and days used. Also, a data analysis infrastructure that can support a Vehicle Allocation Methodology.
2. *Vehicle Allocation Methodology*. Strategic-level decision-making criteria and processes for determining the optimal allocation of vehicles and similar assets.
3. *Organizational Model*. Organizational changes that would provide incentives for vehicle users to become partners instead of adversaries while holding all involved accountable for the assets they use and manage.
4. *Coordination and Communication*. Adequate coordination and communication among the various stakeholders in order to facilitate common understandings of the issues, stakes and alternatives involved.

There were a number of initial findings from the study effort. Some of these are listed below.

1. The federal government uses a methodology, not a formula.
2. Arbitrary usage thresholds do not work.
3. All states are seeking to reduce fleet costs.

4. California is already taking first steps towards a Vehicle Allocation Methodology.
5. Elements of a Vehicle Allocation Methodology are well known.
6. A first step is to associate vehicles with tasks.
7. A key issue to analyze is vehicle "criticality" vs. usage.
8. A vehicle classification system is necessary.
9. The data must be solid.
10. Current data collection methods are not sufficient.
11. An important result is a Table of Allocation (an agreement between the parties involved establishing the exact number of vehicles allocated to a specific location).
12. Reporting is as important as the data.
13. Resist focusing on individual vehicles; focus instead on the fleet.
14. Life-cycle analysis can significantly reduce costs (but there are barriers to this).
15. Effective fleet management is an ongoing process.

Based on the findings, a number of recommendations are made.

Primary Recommendations

Implement Federal Guidelines for a Vehicle Allocation Methodology

The study found federal fleet management guidelines to be "extensive, appropriate, and decisive." They resulted from extensive study and clearly represent best practices. They are therefore recommended for implementation in California.

One important federal guideline is GSA FMR Bulletin B-9—Motor Vehicle Management. Among other things, it states the following:

> What is the description of the subject methodology and resultant optimal vehicle allocation? An optimal vehicle allocation results not from a formula per se, but from a methodology which provides agency fleet managers with a standard way to document the objective criteria of a vehicle fleet for a specific or generic (where there are common characteristics) office/facility, program, occupational group, or other entity within an agency. Objective criteria would include, but not necessarily be limited to: number of vehicle users to include, where applicable, user/vehicle ratios; per vehicle mileage; trips per vehicle; mission; terrain; climate; and fleet condition and down-time. The input for the methodology typically is obtained by surveys and/or in-person interviews of stakeholders.

An example of this methodology is provided in an attachment to the Bulletin.

Use the Following Vehicle Allocation Methodology Template

A template for a Vehicle Allocation Methodology is recommended as follows:

1. Classify vehicles (possibly using NAFA Fleet Management Association classifications).
2. Classify the organizational units and tasks of each agency.
3. Associate vehicles with tasks.
4. Collect usage data for each vehicle (miles, hours, days, and trips)

5. Use data to identify vehicles and tasks that need close attention.
6. Determine "criticality" vs. usage for each focus vehicle; prepare business case.
7. Make a decision—rationalize the size and mix of the fleet.
8. Create Tables of Allocation authorizing the allocation of vehicles for each location.

After the initial right-sizing, continue to use the methodology to justify retention and purchase of new vehicles.

Regulations

Revise Minimum Use Standards to Cover Additional Types of Vehicles and Equipment
Until a Vehicle Allocation Methodology is implemented, existing minimum use standards should be revised to include additional types of vehicles and equipment.

Change Reporting Requirements so that Existing Vehicles are Considered for Elimination
Each agency should develop vehicle utilization reports and provide justification for retaining any vehicles that don't meet the usage standards. (Certain exceptions from the justification step are made for law enforcement, emergency response, etc. vehicles.)

Encourage Agencies to Use a Vehicle Allocation Methodology
Allow agencies to start taking their own steps toward a Vehicle Allocation Methodology. Change purchasing procedures to make it easier for agencies to acquire new vehicles (which can currently take up to two years). Perform annual reviews vs. vehicle-by-vehicle reviews.

Set the Stage for a Data Warehouse by Moving Toward a Uniform Classification System
A statewide data warehouse should be developed containing uniform information about all vehicles used by state agencies.

Prepare a Fleet Management Strategic Plan
The study points out that documentation regarding the federal guidelines is extensive, but is also scattered, poorly documented and often hard to access. California should therefore attempt to document this information in a more coherent and accessible manner.

Encourage Value Purchasing and Disposal
Guidelines and regulations should be developed that support and encourage value-based vehicle purchasing and disposal procedures based upon life-cycle costs. Currently, it is difficult or illegal to consider factors other than initial price, emissions, and fuel efficiency.

Infrastructure

Institutionalize the Change Process
Create a formal group to promote the change process and monitor best practices at other federal, industry and public organizations on an ongoing basis.

Create New Communication Channels
Create an open Website that articulates fleet management policy, proposes future directions, shares best practices, and encourages ongoing dialogue among various stakeholders.

Consider Funding Issues
Recognize that implementation of a Vehicle Allocation Methodology will cost money. Be prepared to allocate funds over a period of several years. There will be future payback but upfront funding will be needed to realize it.

Data Collection

Collect Basic Data for Now
At minimum, collect mileage, hours, trips and days used for each vehicle. In the future, additional information may be desired for purposes other than fleet management.

Use Electronic Data Collection
Manual collection of data is considered unreliable and unworkable. Conversely, electronic data collection is proven and affordable. (The study recommends using Radio Frequency Identifier technology in a "post" rather than "call" architecture.)

Pilot Projects

Create a Vehicle Allocation Methodology Pilot Project
A pilot project approach is recommended In order to test ideas and identify implementation issues.

Create an Automated Data Collection Pilot Project
Creation of a pilot project to test the Radio Frequency Identifier technology is also recommended.

Right-sizing your Fleet: Vehicle Allocation Methodology. A PowerPoint Presentation by GovEnergy (www.govenergy.gov). Phoenix AZ. August 3-6, 2008

This was a presentation to federal agencies. It reviewed some statistics of the federal vehicle fleet (642,233 vehicles; 5 billion miles traveled; fleet composed of 82% trucks, 17% sedans, 1% buses/ambulances; average age of 9.5 years; etc.), and the background of the methodology.

The vehicle allocation methodology basically began as a result of a 2002 request from the federal Office of Management and Budget (OMB) that all federal agencies review their fleet operations. FEDFLEET recommended that each agency develop a vehicle allocation methodology (VAM). GAO endorsed this recommendation in 2004. In 2005, GSA Bulletin FMR B-9: Motor Vehicle Management, was published. The purpose of the Bulletin was to:

- Document a structured VAM for agency fleets.
- Provide guidance on the development and maintenance of a VAM.
- Ensure that agency fleets are correctly sized and are appropriate for accomplishing agency missions.

A VAM is described as follows:

- Provides agency fleet managers with a standard way to document the criteria and optimal vehicle allocation of their fleet.
- Applies to office/facility, occupational group, or other entity within an agency.
- Uses objective criteria such as users per vehicle ratios, per vehicle mileage, trips per vehicle, mission, terrain, climate, fleet condition, and downtime.
- Is based on information typically gathered by surveys and in-person interviews.
- Requires establishment of a baseline list of vehicles—a Table of Equipment, or Table of Allowances.

A VAM is developed by:

- Writing a policy to define how vehicles will be allocated.
- Establishing a list of approved vehicles for every organizational unit.
- Developing written policies for future adjustments to fleet size.
- Creating procedures for determining what types of vehicles can be assigned.

Several methods of developing a VAM are provided:

- "Clean sheet of paper" method" (this is presumably akin to zero-based budgeting?).
- "Employee per vehicle" method.
- "Existing inventory" method:
    - Uses existing fleet as starting point.
    - Requires detailed fleet utilization study.
    - Right-sizes fleet based on utilization.
    - Determines size and composition of the fleet for each organizational unit.

For any of these methods, the classifications of vehicle use must be defined: e.g. driver only; transport people; carries tools and equipment; transports cargo; special purpose; etc.

The process of developing a VAM should include an assessment of alternatives (e.g. privately owned vehicles, contract shuttle services, etc.), and the unit's policy for determining which vehicles are mission-essential regardless of utilization.

A policy should be defined for making fleet size adjustments. For example, adding vehicles:

- Develop a realistic projection of usage in miles, hours, days, trips, passengers, loads, etc.
- Perform a needs analysis of vehicle types (sedans, SUVs, vans, buses, light and medium trucks, etc.)

To subtract vehicles:

- Simplify the process (of disposing of vehicles) and reward good management.
- Make it easy to re-acquire a vehicle if the mission changes.

Several desired outcomes of a VAM are described:

- A written policy and procedure.
- A decision tree—who in the agency should make decisions about vehicle types and fleet size.
- An allocation matrix by organizational unit that meets the agency's mission.

- A list of vehicles required by the agency—a Table of Allowances/Equipment.

It is recommended that VAMs be reviewed and updated every five years, or if the agency mission changes.

Effective Strategies for Increasing Fleet Utilization. Paul T. Lauria. Government Fleet, July/August 2003. (Note: the author is President of Mercury Associates, Inc., a fleet management consulting firm.)

The focus of this article is the unit within an organization that has responsibility for management of the organization's vehicle fleet. It applies to organizations that have a vehicle fleet that may include vehicles assigned to or "owned" by various departments, as well as vehicles that may be assigned to a centralized motor pool. Therefore, this situation is not the same as the focus of this study where the vehicles involved all belong to a public transportation agency and are used, to varying degrees, in transporting passengers from one place to another.

The process described in the article is referred to as "right sizing" (as opposed to downsizing). A right-sizing study should include three main components:

1. Development of a fleet inventory and vehicle usage data.
2. Identification of candidate vehicles for reassignment or disposal.
3. Negotiation of the disposition with the vehicle "owners," either by retention or disposal.

The first step is fairly straightforward--develop an inventory of the vehicles at issue and information as to their level of usage (e.g., miles driven per month or year). The next step involves deciding the criteria to be used to determine which vehicles should be considered for reassignment or disposal. For example, this might include any vehicles that are used less than 80 percent of an established minimum usage policy, or less than 50 percent of the average usage level of other vehicles of the same type. Once these vehicles have been identified, a survey should be conducted of the operators of those vehicles in order to obtain more detailed information regarding their usage and justification. The final step is to meet with the officials of any departments that are proposed to lose vehicles and gain their approval.

A typical component of an analysis such as this is to see if there are any vehicles that can be removed from departmental assignment and instead be reassigned to a centralized motor pool.

As important as the initial right-sizing assessment is, equally important is creating a process for the ongoing evaluation and management of vehicle needs. This should include utilization guidelines to be used in periodic vehicle assessments.

An interesting point made by the author is that once a vehicle is purchased, the incentive for departments to pay close attention to its usage becomes much less. The cost of the vehicle essentially becomes a "sunk cost." In certain situations it may be better to lease vehicles, or to institute a charge-back system so that users are charged for the cost of vehicle replacements.

Evaluation of Fleet Size and Composition and Utilization Management. Mercury Associates, Inc., September 2008.

This was a study done by Mercury Associates for the County Administrator, Hillsborough County, Florida. Because the county was experiencing various budget pressures, Mercury Associates was asked to examine the county's vehicle fleet and make recommendations for improved policies and procedures for managing it. The county fleet of almost 3000 vehicles included many vehicles assigned to specific county departments as well as other vehicles assigned to a centralized motor pool. Approximately 2400 of these vehicles were selected for further analysis as part of this study.

In addition to looking at utilization of an owned fleet, other vehicle options were explored, specifically renting some vehicles when needed instead of buying them, and encouraging employees to use their personal vehicles instead of county vehicles (with a sufficiently high mileage reimbursement rate to motivate them to do so).

An important point made in the study is to not use any vehicle utilization guidelines or standards that are developed as hard and fast rules to determine whether vehicles are to be retained or removed from the fleet. Instead, they should be used as performance "indicators" that serve as a signal for Fleet Management and user departments to sit down and determine reasons for low utilization and options for achieving lower costs.

As indicated in the review of the previous article (***Effective Strategies for Increasing Fleet Utilization)***, this situation is not analogous to the issue at hand (a paratransit fleet). Therefore, details of this study report are not described further here.

3. Small Transit Vehicle Research

Two studies are reviewed in this section: one that describes a methodology for analyzing the costs of operating small vehicles, and one that looks at advanced small transit vehicle technology.

Analyzing the Costs of Operating Small Transit Vehicles: Users Guide. TCRP Report 61, Transportation Research Board. 2000.

This project was aimed at developing a tool designed for transit planners and others making decisions about the purchase of small transit vehicles (30 ft. or less) for different service and operating environments. A computer model based on MS Excel was developed—the Small Transit Vehicle economics (STVe) model. The model allows the user to determine whether it makes economic sense to invest in a particular type of vehicle based on user-defined inputs. It looks at key financial factors such as capital, operating and maintenance costs, and useful life. It discusses, but does not incorporate, certain non-quantifiable, non-financial factors such as ride quality, public acceptance, visual impact, route flexibility, adequacy of maintenance and storage facilities, training needs, and fleet standardization. Nor does it incorporate certain other factors such as extending vehicle life (e.g. through a major maintenance overhaul), salvage value, tire cost, fuel type, lease vs. purchase, or low-floor vehicles.

Although the concept is quite good, the actual model has a number of shortcomings that limit its usefulness in determining the optimal fleet size and mix of the vehicle fleets of rural transit systems. For example:

- The model does not consider the ancillary costs of vehicle operators, nor the issue of whether the selection of larger vehicles would result in the need for fewer vehicles with the concomitant implications for number of operators needed or service frequencies. The model assumes that the same number of vehicles will be required regardless of vehicle size.
- The model examines the future cost differences of different classes of small vehicles but only from the perspective of the "owner" of the transit agency. It does not include the perspective of the state or federal funding agencies. (The report does indicate that the interests of state and federal governments could be accommodated by the model.)
- It is intended to compare different vehicle types and determine which type is most economical, not to provide specific information on the operating and capital costs for specific types of vehicles.
- It only allows three types of service to be examined:
    - CBD (Central Business District) service
    - Arterial service
    - Commuter service

  (The report suggests using the arterial option as the closest analogy for paratransit service. Arterial service is defined as a distance of two miles with two stops per mile and a top speed of 40 MPH.)

In spite of these shortcomings, this 1999 report does provide some useful information. For example, the vehicle typology and approximate vehicle costs it identified are summarized in the table below.

Table 1: Vehicle Typology and Costs

Vehicle Type	Est. 1999 Purchase Cost
Category 1—Van Standard vans have front engines with rear-drive. Most vans have a separate body and frame, and they are built on a chassis intended for commercial use. To provide wheelchair accessibility, vans are equipped with a lift or ramp as well as a raised roof with a taller door unit that provides easier entry. With modifications for wheelchair access and securement, total passenger capacity—which includes one wheelchair position—is 10 to 11 passengers. The useful life of a van is projected at 4 years.	$30.000
Category 2—Van Cutaway, Single Wheel The chassis and partial cab are obtained from a truck manufacturer and a specialist body builder places a bus body on the chassis, integrating the bus body with the front of the cab, retaining the short hood. With a single wheel in the rear, these vehicles are somewhat lighter and shorter than cutaways described in Category 3. These vehicles have a total passenger capacity of 13. Useful life is considered 4 years.	$36,000
Category 3G—Van Cutaway, Dual Wheel, Gasoline Vehicles in this class are similar to those in Category 2; however, there are two wheels on the rear axle. This allows models with longer lengths, which also result in heavier vehicle weights.	$42,000

Vehicle Type	Est. 1999 Purchase Cost
Total passenger capacity, including ADA-mandated wheelchair positions, is assumed to be 18. While the useful life of vehicles in this category ranges from 4 to 5 years, the model considers the useful life to be 5 years. Vehicles in this category are fueled with gasoline.	
Category 3D—Van Cutaway, Dual Wheel, Diesel These vehicles have basically the same appearance and passenger capacity as those in Category 3G above; however, they are diesel fueled rather than gasoline. Use of diesel affects both maintenance and operations. Again, while the useful life of vehicles in this category ranges from 4 to 5 years, the model considers the useful life to be 5 years.	$48,000
Category 4—Purpose Built, Front Engine Vehicles in this category are purpose built, medium-duty. Models within this category vary in price, length, and weight. Total passenger capacity is 22. The useful life of vehicles within this category ranges from 5 to 7 years. The model has assumed a useful life of 6 years.	$77,500
Category 5—Purpose Built, Rear Engine These vehicles are similar to those in Category 4; however, they have engines in the back of the bus. Useful life is considered to be 7 years in the model.	$120,000
Category 6—Medium-Duty, Low-Floor Front Engine Vehicles in this category are purpose built, medium-duty with a lowered floor to improve accessibility for passengers. In this category, engines are in the front. Total passenger capacity is assumed to be 20. The useful life is 7 years.	$130,000
Category 7—Heavy-Duty, Low-Floor Front Engine These are purpose built, heavy-duty, low-floor vehicles, with engines in the front. A major difference with vehicles in this category is life expectancy; the heavy-duty vehicles of Category 7 have a useful life of 12 years.	$200,000
Category 8—30-Ft, Heavy-Duty Bus Vehicles in this class are essentially shorter versions of traditional 40-ft transit buses, with a useful life of 12 years. Recently, more 30-ft low-floor buses are coming on the market, but no actual operating data were available to evaluate the low-floor version of the 30-ft bus.	$275,000

To provide an idea of the factors the model considers, the inputs to the model include the following:

1. Average number of vehicle miles expected to be incurred by each candidate vehicle.
2. Percentage of total annual miles or time that candidate vehicles will be used in the following types of services: CBD, arterial or commuter.
3. Minimum turning radius that candidate vehicles must have in order to navigate roadway conditions in the area.
4. Total purchase cost of the candidate vehicle type including a supply of spare parts, maintenance training, and warranty coverage.
5. The maximum number of passengers the candidate vehicles must accommodate at one time including the minimum number of wheelchair positions required by ADA.
6. The average hourly wage and benefit rate for mechanics who will maintain the vehicles.
7. The percentage of the purchase price that will be funded by the transit agency or local government.
8. The expected cost per gallon of fuel that the vehicles will use.
9. The desired rate of interest to be used to estimate the time value of money.

The model then calculates for each vehicle class an "equivalent annual cost" (capital, operating and maintenance cost), and the first year operating and maintenance cost.

Advanced Small Transit Vehicle Technology Study. Del Peterson and Michael Molloy. Small Urban and Rural Transit Center. 2007.

(Note: this study project was primarily intended to facilitate improvements in small vehicle design and performance. It has only tangential implications for fleet size and mix.)

This study was a project to examine the state of small transit vehicles (less than 30 feet in length). Named the Advanced Small Transit Vehicle (ASTV) Development Program, this paper represents Phase I of a planned two-phase effort. Based on input from transit industry stakeholders, it was intended to meet five objectives:

1. Outline Transit Provider Concerns
2. List Available Vehicles and Technologies
3. Analyze Small Vehicle Market
4. Examine Developing Technologies
5. Recommend Phase II Plan

The study looked at three basic classes of small transit vehicles:

1. Vans
2. Cutaway buses
3. Small transit buses

The table below compares some of the key features of each vehicle type.

Table 2: Comparative Features of Vehicle Types

	Vans	**Cutaways**	**Small Transit Buses**
Length	• Less than 20’ • Nominal length 17’	• 19’-29’ • Nominal length 23’	• 25’-29’ • Nominal length 27’
Capacity	• 11-15 passengers • Nominal capacity 12	• 14-30 passengers • Nominal capacity 17	• 22-30 passengers • Nominal capacity 25
Average Capital Cost	• $33,000	• $65,000	• $180,000
Fuel	• Usually gasoline	• Gas or diesel	• Usually diesel • Some hybrids
Other	• More maneuverable • Less comfortable for passengers • Higher rollover risk	• Bodies are mounted on a truck chassis • Usually the “workhorses” of rural systems • Some reliability issues	• Longer useful life • Good reliability

The study also examines market conditions, developing technologies, transit agency perspective, manufacturer outlook, cost-benefit factors, life-cycle costing, and ASTV feasibility. Some selected findings, conclusions and/or observations from the study are provided below:

- Capital cost seems to be a secondary concern when compared to maintenance cost. This is probably due to the fact that FTA provides 80 percent of the capital requirement.
- As for ITS technology, AVL/CAD and obstacle detection devices are favored. On-vehicle audio and video surveillance systems are less important on most rural systems.
- Gasoline hybrid engines are becoming more popular as is the use of biofuels and CNG.
- Low-floor vehicles are entering the market but are cost-prohibitive for many transit providers.
- Lifts and ramps have become more advanced, thereby decreasing dwell times.

The study cites an interesting survey conducted by Hemily and King in 2002. The survey of 63 transit agencies found that vehicle reliability and high maintenance costs were the most frequently cited and highest-ranking concerns with regard to small buses. The table below summarizes the survey results.

Table 3: Summary of Survey Results

Issue/Concern	% Cited	% Cited as Most Important
Capital cost of vehicle	17	3
Customer acceptance	39	14
Maintenance costs	**42**	13
Operator acceptance	33	6
Safety	12	2
Vehicle reliability	**53**	**25**
Other	33	16

Issues of customer concern included poor ride quality, noise, fumes, single door, and crowding. The study points out that ride quality depends largely on the bus's suspension system. Most small buses use leaf spring suspension but air suspension, which provides improved ride quality, is becoming more available.

In regard to wheelchair use, most drivers believe that the side wheelchair door is the only realistic option for most rural communities. Rear loading will not work because there are seldom curb cuts that allow access from the rear when the bus is parked properly. It was also noted that Q'Straint makes a new wheelchair tie-down that allows for full circular motion that eases the tie-down process for drivers.

The study also looked at cost-benefit data for various ITS technologies that might be used on small passenger vehicles such as CAD terminals, GPS, electronic fareboxes, automatic passenger counters, and radios. Although such technologies add to the cost of the vehicles, there can be off-setting gains from increased operating efficiencies.

Transit agency representatives and small bus manufacturers both believe that there is a market for small buses that incorporate advanced technologies. Two technologies are of particular interest: hybrid propulsion systems and buses with a low-floor chassis. These will, of course, increase the cost of small buses. The study provides some life-cycle cost estimates comparing conventional cutaway buses with both hybrid and low-floor cutaways. The study estimates that any low-floor, alternative-fuel small passenger vehicle is going to cost at least $125,000. At that price, the benefit most needed to justify the higher cost would be a greatly increased useful life (on the order of three times longer than current small vehicles).

The study concludes that the idea of advanced technologies in small transit vehicles is beginning to take hold. The initial higher cost will be a barrier, but increased production volumes should start to bring the cost difference down. In addition, the increasing cost of energy will provide an incentive to begin transitioning to hybrid propulsion systems.

4. Small Vehicle Procurement Methods

This study examined various centralized vs. decentralized methods used by states to procure small vehicles.

Centralized versus Decentralized State Procurement of Paratransit Vehicles for the Federal Section 5310 Program. Research Results Digest 315. May 2007.

This study examined different methods used by states to procure paratransit vehicles under FTA's Section 5310 Program. The different methods included:

1. *A Centralized "Turn-Key" State Process*. In this option, the state has complete responsibility for paratransit vehicle purchases. The state notifies applicants of the grant award and then handles all aspects of procurement directly.
2. *Grant Recipient Purchase via Central State-Procured Contract*. The state retains responsibility for procurement but the grant recipient takes responsibility for placing a vehicle order and inspecting the vehicle on delivery.
3. *Dual Process*. Grant recipients have the option to purchase vehicles through either a centrally procured contract or a decentralized procurement process.
4. *A Decentralized Third-Party Consortium Process*. Two or more grant recipients form a consortium to purchase vehicles, the state DOT designates a lead agency to conduct the procurement, or a third-party agency procures vehicles on behalf of grant recipients.
5. *A Decentralized Independent Process*. The grant recipient develops its own vehicle specifications and with state oversight performs all steps in the procurement process.

The table on the following page summarizes the issues related to each alternative from the state perspective.

	Procurement Process				
	Centralized		Dual Process	Decentralized	
Issues	**Turn-Key**	**State-Procured Contract**		**Third-Party Consortium**	**Independent**
Oversight and Regulatory Compliance	Eliminates need for oversight of recipients' independent procurement processes resulting in greater compliance	State must dedicate resources to provide some oversight and assistance to grant recipients to ensure compliance	Eliminates the need for oversight of most grant recipients; however, oversight is required to ensure compliance from some recipients	State must dedicate resources to provide oversight and assistance to third-party or lead agencies to ensure compliance	Requires careful oversight of every recipient's independent process to ensure compliance
State Resources	Requires state DOT or a central procurement agency to conduct procurement, which may require more state resources than monitoring compliance		Requires sufficient resources to both conduct procurement and monitor compliance from some recipients	Absolves state of responsibility for conducting procurement process, but requires resources to monitor compliance of procuring recipients	
Vehicle Quality	Provides improved vehicle quality through the in-plant inspections, allows monitoring of vehicle quality across large purchases, and provides leverage to ensure that the vendor or manufacturer makes warranty repairs when required		Provides ability to monitor quality of vehicles across large purchases, but independent recipients will bear this responsibility for their vehicles	Greater grant recipient responsibility for monitoring vehicle quality and approaching vendor or manufacturer regarding vehicle repairs	
Vehicle Price	Large purchasing pools likely result in lower prices per unit		Most recipients benefit from purchasing power of pool	Price may be lower than independent procurement, but higher than centralized process	Likely the least price-advantageous approach

	Procurement Process				
	Centralized		Dual Process	Decentralized	
Issues	**Turn-Key**	**State-Procured Contract**		**Third-Party Consortium**	**Independent**
In-Plant Vehicle Inspection	Direct purchase of more than 10 vehicles by state requires in-plant inspection	Direct purchase by grant recipients generally absolves the state of responsibility for conducting in-plant inspections (which have generally been credited with improving the quality of vehicles}			

The study identifies a number of key questions that states may want to ask themselves when choosing a procurement option:

1. Does a centralized or decentralized process make the most of available state resources?
2. Are grant recipients, lead agencies, or third-party procurers capable of conducting the procurement process?
3. What is the state's record of compliance with federal regulations governing paratransit vehicle procurements?
4. How many vehicles will be purchased annually?
5. To what degree should Section 5310 grant recipients be able to customize vehicles?
6. To what degree should vendors interact with grant recipients and/or the state government?
7. What process will minimize vehicle cost and maximize quality?

5. Small Vehicle Procurements by Other States

This section focuses on specific procurement methods used and vehicle types procured by several different states.

Specialized Transportation Program: FY 2010-2011 Vehicle Catalogue and Selection Guide. Ohio Department of Transportation, Office of Transit.

This well-prepared document has a useful section in regard to "Selecting the Proper Vehicle." The section has two parts:

1. Considerations in Selecting the Proper Vehicle
2. Available Vehicles

In terms of considerations for selecting a vehicle, the important factors to consider are broken into primary and secondary issues. There is a helpful discussion regarding each factor. Based on the questions that are asked (see below), suggestions are made for the types of vehicles that may be appropriate given certain conditions.

Primary Issues

1. Accessibility. Do you need an accessible vehicle?
2. Capacity. What are your capacity needs?

3. Road Conditions. On what type and condition of roads will the vehicle operate?
4. Service Type. What type of service will the vehicle be used to provide?
5. How much will the vehicle cost?

Table II.1 (p.9) provides a summary of the various capacity configurations available for each vehicle type. This table could be very useful in helping to select an appropriate vehicle based on the number of wheelchair positions and ambulatory seats needed.

Secondary Issues

1. Commercial Driver's License (CDL). Will drivers need a CDL?
2. Client Comfort. What level of comfort do your clients need?
3. Vehicle Storage. Can you store and clean a large vehicle?

As for available vehicles, the document identifies five vehicle types available under the program.

1. Standard minivan
2. Modified minivan
3. Converted van
4. Light transit vehicle, narrow body
5. Light transit vehicle, wide body (22' or 25')

On pages 16 and 18, there are excellent tables that provide key data for each of the vehicle types. Pages 21-46 provide a great deal of useful descriptive information about each vehicle type (including general description, vehicle summary, standard vehicle equipment, floor plans, etc.).

Rural Transit Planning Guidelines: User's Guide. Prepared for Halifax Regional Municipality by ENTRA Consultants. February 2008.

This document provides a description of sample vehicles with relevant specifications as follows:

Table 4: Specifications for Sample Vehicles

Vehicle Type	Make	Model	Price (New)	Capacity	Max. Age
Minivans	Dodge	Sprinter	$60,000-$80,000	10	4
	GM/Chrysler/Ford	Varies	$60,000-$80,000	3	4
Small Buses	Turtle Top	Odyssey	$125,000-$145,000	24	8
	ElDorado	Aerolite	$125,000-$145,000	13	8
Big Buses	Turtle Top	Odyssey XL	$155,000-$175,000	37	8
	ElDorado	Aero Elite	$155,000-$175,000	33	8

Notes:

1. Capacity is based on configuration to accommodate mobility device(s).
2. Pictures of the vehicles are provided in the document.

DGS Contract Procurement Checklist for Section 5310, 5311 and ACT 26 Community Transportation Programs. Pennsylvania Department of Transportation (PennDOT). 5/4/2011.

This document includes an attachment listing the vehicles that can be ordered under PennDOT's community transportation vehicle procurement process. The vehicles are described in the table below.

Table 5: Description of PennDOT Vehicles

1. Paratransit 9,000 pound GVWR raised roof van (converted van type passenger vehicle—Ford chassis)
2. 23 foot transit bus, 14,050 pound GVWR vehicle (Ford chassis)
3. 25 foot transit bus, 14,500 pound GVWR vehicle (Ford chassis)
4. Paratransit cutaway cab and chassis bus, 11,500 pound GVWR vehicle (Ford chassis)
5. Paratransit narrow body dual rear wheel bus, 11,500 pound GVWR vehicle (Ford chassis)
6. Fiberglass body, 23 foot transit bus, 14,500 pound GVWR vehicle (Ford chassis)
7. 23 and 25 foot transit bus, 14,200 pound GVWR vehicle (Chevy chassis)
8. 29 and 31 foot transit bus, 25,500 pound GVWR vehicle (Freightliner chassis)
9. 29 and 31 foot transit bus, 23,500 pound GVWR vehicle (International/3200 chassis)
10. 27 foot transit bus, 19,500 pound GVWR vehicle (Freightliner chassis)
11. Grand accessible minivan with rear entry
12. Grand accessible minivan with side entry

2011-12 Administrative Guide, Section 5311—Metropolitan Transportation Planning Program. Georgia DOT.

This document has limited relevance for fleet size and mix. However, the following information from the document may be helpful.

1. GDOT requires that all Section 5311 systems have, at minimum, one wheelchair equipped vehicle available for service. GDOT further requires that each Section 5311 provider meet the current demands of the disabled population, and if one lift-equipped vehicle is not sufficient to meet that demand, then additional lift-equipped vehicles must be provided.
2. Vehicles should be utilized to produce 500 one-way passenger trips per vehicle month, or be operated a minimum of 120 hours per month, or 1000 vehicle miles per vehicle per month, on average.
3. Vehicles to be replaced must be at least five years in age or have 100,000 miles by June 30.
4. Appendix H of the document provides price information for vehicles for 2009, 2010, 2011 and 2012. Only the 2012 prices are shown in the table below.

Table 6: Vehicle Prices

Type Vehicle	Price
ADA Minivan	$37,800
Standard Van	$27,000
Conversion Van	$41,800
Conversion Van w/Lift	$44,000
Shuttle Van	$43,300
Shuttle Van w/Lift	$46,700
Shuttle Bus	$47,300
Shuttle Bus w/Lift	$53,200

Note: for the last three vehicles, add $27,000 for a diesel engine

State Management Plan. South Carolina DOT. November 2010.

This document also has limited relevance for fleet size and mix. However, the following information from the document is useful.

Table 7: Useful Life of Vehicles

Vehicle Type	Age of Vehicle	Mileage	Example
Minivan or standard transit van	4 years	100,000	--
Light duty small vehicle (16-28 feet)	5 years	150,000	Cutaway
Light duty medium bus (approx. 25-35 feet)	5 years	150,000	Goshen Eldorado
Medium duty medium bus (approx. 25-35 feet)	7 years	200,000	Goshen Eldorado Thomas
Heavy duty small bus/trolley (approx. 30 feet)	10 years	350,000	Goshen Eldorado Thomas Bluebird
Heavy duty large bus/trolley (approx. 35-40 feet)	12 years	500,000	Orion Gillig MCI

State of Tennessee Management Plan. Tennessee DOT. 10/17/2008.

This document has two items of interest:

1. *Vehicle type*—"successful" applicants typically purchase:
    a. Raised-roof rear lift conversion van
    b. 13 passenger mini-bus w/o lift

c. 8 passenger and 2 wheelchair mini-bus
d. 12 passenger and 2 wheelchair mini-bus
e. 24 passenger bus w/o lift

2. *Useful life*:
    a. Conversion vans—the first of either 4 years from the in-service date of the vehicle or 100,000 miles.
    b. Cutaway mini-buses or small passenger buses—the first of either 5 years or 125,000 miles.

State Management Plan. Virginia Department of Rail and Public Transportation. April 2009.

This document also has limited relevance for fleet size and mix, but provides information on the useful life of several types of vehicles.

Table 8: Useful Life of Vehicles

Vehicle Type	Useful Life
Vans	Minimum of 4 years or 100,000 miles
Body on chassis vehicles	Minimum of 4 years or 100,000 miles
Light duty bus	Minimum of 4 years or 150,000 miles
Transit coach	Minimum of 12 years

Guidelines for Developing a Four Year Capital Plan. Ohio Department of Transportation (ODOT).

This short document has two items of interest:

1. Fleet size and spare ratio:
    a. A system with a peak-hour operating requirement of 1-10 vehicles is allowed up to two back-up vehicles. A system with a peak hour fleet of 11 or more is allowed a spare ratio of 20 percent of its fleet.
    b. Allowable fleet size = peak hour requirement + spare(s).
    c. Peak hour requirement refers to the maximum number of revenue vehicles used on a regular basis during the busiest parts of the day (typically 7-9 AM and 3-5 PM).
2. Accessible vehicles: ODOT requires that, at a minimum, 50 percent of the fleet must be accessible.

6. Federal Small Vehicle Funding Programs

There are two primary federal funding programs that provide funding for the purchase of small transit vehicles:

1. FTA Section 5310 Program
2. FTA Section 5311 Program

FTA Section 5310 Program—Transportation for Elderly Persons and Persons with Disabilities

This program, which provides funding for the acquisition of vehicles (among other things), is intended to improve mobility for elderly individuals and individuals with disabilities (in both urbanized and non-urbanized areas). The program requires coordination with other federally-assisted programs and services. Projects funded from the program must be derived from a locally-developed, coordinated public transit-human service transportation plan. A key objective is to provide states with funding to assist private non-profit agencies in the purchase of vehicles and related equipment.

There are several provisions that relate specifically to vehicles.

1. Examples of eligible vehicles include buses and vans.
2. Section 5310 vehicles do not have to comply with FTA useful life standards for vehicles, vehicle replacement requirements, or the requirement to use the straight line depreciation method for determining fair market value and FTA reimbursement. Instead, states are permitted to use their own requirements and standards.
3. Vehicles are first to be used for Section 5310 program-related needs. Then to meet other transportation needs of elderly persons and persons with disabilities, other federal program or project needs, and finally for other local transportation needs.
4. The grant recipient must use the vehicle in the project or program for which it was acquired as long as it is needed, even if the project no longer receives federal funding.
5. Vehicles can be used to serve the general public on an incidental basis if such service does not interfere with transportation services for older adults and people with disabilities.
6. If the original grant subrecipient no longer needs the vehicle for the purpose for which it was acquired, it can be transferred to another subrecipient. If no longer needed for Section 5310 purposes, it can be used in other FTA-sponsored activities, and then for activities sponsored by other federal agencies.
7. Vehicles can be used for meal delivery, but only if such use does not interfere with the provision of service to transit passengers.
8. Section 5310 vehicles may be leased to other entities such as local government authorities or agencies, other private non-profit agencies, or private for-profit operators. However, they must be operated on behalf of the Section 5310 subrecipient and provide transportation to the subrecipient's clientele as described in the grant application.
9. Vehicles must be procured in a way that complies with certain federal requirements (requirements that don't seem germane to the purposes here).

Federal Section 5311 Program—Formula Grants for Other Than Urbanized Areas

A key FTA goal is "to ensure that all Americans, including those who live in rural and small urban areas, have access to transit to meet basic mobility needs." The Section 5311 Program is intended to address this goal. It differs from the Section 5310 Program in that it is aimed at general public riders in non-urbanized areas, while Section 5310 is aimed at elderly and disabled riders in both non-urbanized and urbanized areas. Section 5311 funds can be used for capital expenses as well as for other purposes such as operating expenses.

As for vehicle purchases:

1. Eligible vehicles include buses, and vans or other paratransit vehicles.
2. In some localities where the operator provides service in both urbanized and non-urbanized areas (and which therefore receive both Section 5307 and Section 5311 funds), a reasonable basis must be developed for allocating the capital expenses between the urbanized and non-urbanized portions of the funding.
3. FTA allows states to use, manage and dispose of vehicles (and other equipment) in accordance with state laws and procedures. Similar to the Section 5310 Program, vehicles do not have to comply with FTA useful life standards for vehicles, vehicle replacement requirements, or the requirement to use the straight line depreciation method for determining fair market value and FTA reimbursement.
4. States can transfer vehicles to any subrecipient eligible to receive funds from the Section 5311 program as long as the current possessor of the vehicle consents, and as long as the vehicle will be used in accordance with Section 5311 requirements.
5. Because of similarities between Sections 5310 and 5311, states are encouraged to consider both resources and plan for their use in a complementary way.

Description of Hawley Fleet Assessment Methodology

Pam Hawley (NCDOT/PTD) has developed a methodology for analyzing the fleet size at rural public transportation systems. It consists of the following steps.

1. An Excel spreadsheet is compiled of all the vehicles assigned to a system using information from the Public Transportation Management System (PTMS). As needed, the list is modified to account for any vehicles that will be replaced during the analysis year. Annual vehicle mileage information is added. (Vehicle mileage is from odometer readings.)
2. Vehicle trip information is obtained from Vehicle Utilization Data (VUD) files for the April sample week. One day is chosen for analysis—the best/highest use day. This information shows the hours that each vehicle is in use on that day. (Note: it is sometimes found that vehicles that presumably have been replaced are still in use.) The information is analyzed to determine the number of vehicles actually being used to provide service in the AM and PM peak hours. This is considered to be the maximum number of vehicles needed by that system. See Illustration 1.
3. This information is then consolidated in a spreadsheet used to make an optimal fleet size determination (see Illustration 2). The spreadsheet considers:
    a. The existing fleet by major class of vehicles (e.g. minivan, conversion van, various lengths of LTVs, with or without lifts, etc.).
    b. The number of underutilized vehicles (an arbitrary annual mileage of less than 20,000 is used in this determination).
    c. The number of vehicles in fair/poor condition (these vehicles have exceeded their useful life).
    d. The total number of vehicles used during the day to deliver service.
    e. The number of vehicles used to deliver peak service.
    f. The number of vehicles with lifts (PTD has a policy that at least 50 percent of the fleet should be lift-equipped).

g. The appropriate number of spare vehicles needed for each vehicle class (usually 20 percent of the peak vehicles needed).

(Note that Illustration 1 includes data from OpStats in Row 4, Columns 1-9. This information appears to be for informational purposes only.)
This analysis results in a recommended fleet size. The results are then discussed with the transportation system director before a final decision is made by NCDOT/PTD.
There are some shortcomings to this model:

1. It does not consider vehicle costs—either capital or operating. It only looks at the size of the fleet and the types of vehicles needed.
2. It does not consider the number of passengers carried.
3. Making a determination of the optimal fleet size based on only one day of vehicle trip data seems risky.

A complicating factor is that Community Transportation Service Plans (CTSPs) are now receiving more weight in terms of fleet size decisions. For example, if a CTSP calls for expansion vehicles in future years, this and not the recommendation of a NCDOT/PTD Mobility Development Specialist takes precedence. A weakness of this approach is that CTSPs have been criticized as taking the total number of vehicles dispatched on a day as a base, then simply adding to this if additional vehicles are determined to be needed in the future. (Ms. Hawley believes that only the number of vehicles needed to provide peak service should be the base.) Ms. Hawley has indicated that this tool is not currently being used by many (or any) of the PTD MDS staff. This is due to staff turnover, other priorities, and a lack of time to train new staff in how to use the model. She also notes that "With the infusion of 5310/16/17 funded vehicles, the transit systems can choose to 'dedicate' these 10/16/17 vehicles to one type customer or service purpose. Before this, all the vehicles in a fleet were utilized in the most efficient way. Now that the systems can dedicate vehicles to a single type service or customer type, it means the vehicles will be used less efficiently and performance outcomes will suffer. It also means that it will be nearly impossible to 'calculate' an appropriate fleet size."

Illustration 1: Vehicle Fleet Data from PTMS, Other

	Fleet ID	Year	Make	VIN Number	Short VIN	Vehicle Type	10-1-2009 Mileage	10-1-2010 Mileage	Annual Mileage	Monthly Mileage
1	0549	2006	CRYSLER	1A4GP45R86B610549	0549	MINIVAN-No Lift	56,921	68,345	11,424	952
2	0875	2009	Ford	1FTDS34L99DA40875	0875	Lift Equipped Van-Rear	5,137	41,421	36,284	3,024
3	2558	2010	Ford	1FDEE3FL1ADA52558	2558	20 ft. LTV-Side	0	7,829	7,829	**NEW**
4	2559	2010	Ford	1FDEE3FL1ADA52559	2559	20 ft. LTV-Side	0	9,230	9,230	**NEW**
5	2561	2010	Ford	1FDEE3FL1ADA52561	2561	20 ft. LTV-Side	0	7,668	7,668	**NEW**
6	3924	2007	Ford	1FTSS34L67DA63924	3924	Lift Equipped Van-Side	69,387	94,344	24,957	2,080
7	3944	2008	Ford	1FT2S34LX8DA63944	3944	Lift Equipped Van-Side	40,871	63,272	22,401	1,867
8	3945	2008	Ford	1FT2S34L18DA63945	3945	Lift Equipped Van-Side	42,984	73,977	30,993	2,583
9	3946	2008	Ford	1FT2S34L38DA63946	3946	Lift Equipped Van-Side	49,577	79,691	30,114	2,510
10	5110	2007	Ford	1FDXE45SO7DA65110	5110	25 ft LTV Lift Eauipped -Side	6,455	9,512	3,057	255
11	5436	2010	Ford	1FDEE3FL2ADA55436	5436	20 ft. LTV-Side	0	8,535	8,535	**NEW**
12	5551	2006	FORD	1FTSS34L16HA75551	5551	Lift Equipped Van-Side	99,220	122,931	23,711	1,976
13	5552	2006	FORD	1FTSS34L16HA75552	5552	Lift Equipped Van-Side	83,031	118,032	35,001	2,917
14	5553	2006	Ford	1FTSS34L16HA75553	5553	Lift Equipped - to Minivan 2011	131,469	157,440	25,971	2,164
15	6679	2002	Dodge	2B7LB31Z 12K126679	6679	Conversion Van- to 20ft LTV 2011	130,731	151,109	20,378	1,698
16	6739	2002	Dodge	2B7LB31Z 42K126739	6739	Conversion Van- to 20ft LTV 2011	108,040	128,700	20,660	1,722
17	8092	2010	Ford	1FTDS3EL2ADA48092	8092	Lift Equipped Van-Rear	0	4,079	4,079	**NEW**
18	8093	2010	Ford	1FTDS3EL2ADA48093	8093	Lift Equipped Van-Rear	0	4,665	4,665	**NEW**
19	8094	2010	Ford	1FTDS3EL2ADA48094	8094	Lift Equipped Van-Rear	0	3,665	3,665	**NEW**
20	9532	2006	Ford	1FTSS34L96DA49532	9532	Lift Equipped - to Minivan 2011	104,138	104,397	259	22
21	9936	2009	Ford	1FTDS34L99DA39936	9936	Lift Equipped Van-Side	11,887	49,191	37,304	3,109
22	9949	2009	Ford	1FTDS34L79DA39949	9949	Lift Equipped Van-Side	4,613	22,915	18,302	1,525
23	9951	2009	Ford	1FTDS34L59DA39951	9951	Lift Equipped Van-Side	5,476	29,711	24,235	2,020

Illustration 2: Vehicle Fleet Assessment Tool

Name of Transit System													
	1	2	3	4	5	6	7	8	9				
	Fleet Size Reported on OPSTATS	Peak Vehicles Reported on OPSTATS	Annual Service Mileage (Transit Only)	Total Transit Service Miles % Up/Down	Total Transit Passenger Trips % Up/Down	Passenger Trips per Mile (M-F)	Passenger Trips per Hour (M-F)	Number of Denials	Number Out-of-County Trips				
OPSTATS													
	10	11	12	13	14	15	16	17	18	19	20	21	
Vehicle Type	7-1-2011 Fleet Mix	Number of Lift Vehicles in Fleet	Number of Under-utilized Vehicles	Number of Vehicles in Fair/Poor Condition	Used during day to deliver service	Used to deliver peak service	**MDS determined Vehicle Allowance based on use**	**Spare Needs based on vehicle type - No ratio**	Fleet Size Projection #2 (Col 16 + Col 17)	7-1-2011 Fleet Mix (Column 10)	**Excess(-) or Needed(+) Vehicles**	Met useful life but not being replaced in FY11	
Minivan									0	0	**0**		
Standard									0	0	**0**		
Conversion									0	0	**0**		
Center Aisle									0	0	**0**		
Lift Van									0	0	**0**		
20ft LTV									0	0	**0**		
22ft LTV									0	0	**0**		
25ft LTV									0	0	**0**		
28ft LTV									0	0	**0**		
Alt Vehicle									0	0	**0**		
Bus									0	0	**0**		
Total	0	0	0	0	0	0	0	0		0	**0**	0	
% Lift Vehicles of Fleet		#DIV/0!			Projection No. #1 Calculation					% 10\2008 fleet met useful life		#DIV/0!	
					22	23	24	25					
					#Vehicles used during the day	Peak Vehicles	Spares based on Peak 1 to 5 ratio	**Fleet Size Projection #1**	**Fleet Size Projection #2**				
							0	**0**	**0**				

Illustration 2 (Cont'd)

Name of Transit System	0

Fleet Size	##
Beginning Fleet Size	0
Fleet Size Projection #1	0
Fleet Size Projection #2	0
Fleet Size After Recommended Changes	0
Final Fleet Size Post Discussion	

						Specialist's Recommendation				
System Veh ID	Abbrev VIN#	Has met useful life?	Not to be replaced in FY09?	Vehicle Type	Any excess vehicles of this type?	Replace Y/N	Transfer Y/N	Dispose Y/N	Expand Y/N	Comments
Expansion Request										
Expansion Request										
	Change in Fleet					0	0	0	0	

III. Survey of Community Transportation (CT) Systems

A survey of Community Transportation (CT) systems was conducted to develop a methodology and to provide guidance for determining appropriate fleet size and vehicle type mix. The survey sought input from CT systems on factors that they considered important when selecting new vehicles to add to their fleet, either to replace existing vehicles or to expand their fleet.

The survey was conducted in August 2011. The survey was emailed to CT system managers, and was to be completed and submitted electronically using Survey Monkey. Thirty-four responses were submitted from the 79 CT systems, resulting in a response rate of 43 percent.

A copy of the survey questionnaire is included as Appendix A. A summary of the responses is provided, with all responses listed in Appendix B.

Summary of Responses

The survey asked respondents to provide their opinions on several aspects of the decision-making process involving the purchase of new vehicles for their fleets, including:

1. The importance of 11 factors that could be involved in the decision to purchase new vehicles. Respondents could also add up to two additional factors that they considered to be important when making that decision.
2. The importance of nine factors that could be involved in the decision to purchase a minivan or a conversion van. Respondents could also add up to two additional factors that they considered to be important when making that decision.
3. The importance of 10 factors that could be involved in the decision to purchase a conversion van or a Light Transit Vehicle (LTV). Respondents could also add up to two additional factors that they considered to be important when making that decision.
4. The types of vehicles that have been most useful in meeting service needs. Respondents could also add up to two additional types of vehicles that they had found to be useful.
5. The types of vehicles that have had the fewest/least severe problems. Respondents were then asked to briefly describe the problem(s) that had occurred most often or had been the most severe, listing the type of vehicle for each such problem.
6. The frequency of transporting non-ambulatory and ambulatory passengers on a shared-ride basis.
7. The frequency at which all wheelchair stations on a vehicle are typically filled at the same time.
8. Types of vehicles not available for purchase on the state contract that would be useful to consider adding to the contract.

To analyze responses to the first three of these questions, scores were assigned to five levels of importance, ranging from a score of 1 for “Most Important” to 5 for “Least Important.” Similarly, for the fourth question, scores were assigned to five levels of usefulness, ranging from 1 for “Most Useful” to 5 for “Least Useful.” For the fifth question above, scores were assigned to the number of problems or the degree of problem severity, ranging from 1 for “Least

Problems" to 5 for "Most Problems." For responses to each of these questions, the average score was calculated for each factor and then the factors were ranked. The rankings for each of these questions are provided in the following tables. Other responses are listed after each table.

Table 9: Importance of Factors in Vehicle Purchase Decisions

Factor	Rank
Reliability	1
Durability	2 (tie)
Quality of Lift	2 (tie)
Seating Capacity	4
Cost of Maintenance	5 (tie)
Type of Service in Which Vehicle Is Operated	5 (tie)
Operating Cost	7 (tie)
Passengers' Convenience in Accessing Seats	7 (tie)
Ease of Maintenance	9
Purchase Price	10
Same Type of Vehicle as Existing Fleet	11

Other responses included:

- CDL requirement for the driver
- Wheelchair layout
- Security system availability
- Local match funding availability
- Number of miles on vehicle
- NCDOT Capital Expenditure Reimbursement Ratio
- Purchases are subject to state contract and approved DOT funding authorizations; and choices are limited to contract items and funding
- No control over color, size, model, wheelchair

Table 10: Importance of Factors in Deciding Between a Minivan and Conversion Van

Factor	Rank
Seating Capacity	1 (tie)
Type of Service in Which Vehicle Is Operated	1 (tie)
Reliability	1 (tie)
Durability	4
Cost of Maintenance	5 (tie)
Operating Cost	5 (tie)
Ease of Maintenance	7
Purchase Price	8
Same Type of Vehicle as Existing Fleet	9

Other responses included:

- Wheelchair capability
- Whether or not the minivan is wheelchair accessible
- Safety

- Door access
- Not allowed to replace a minivan with a different type of vehicle

Table 11: Importance of Factors in Deciding Between a Conversion Van and LTV

Factor	Rank
Seating Capacity	1
Reliability	2 (tie)
Durability	2 (tie)
Passengers' Convenience in Accessing Seats	4 (tie)
Operating Cost	4 (tie)
Cost of Maintenance	4 (tie)
Type of Service in Which Vehicle Is Operated	7 (tie)
Ease of Maintenance	7 (tie)
Purchase Price	9
Same Type of Vehicle as Existing Fleet	10

Other factors noted by respondents included:

- Floor layout for wheelchairs
- Prefer vehicles that have wheelchair access for the majority of the fleet
- Door access
- State contract and funding authorizations

Note that for each of these questions, "Reliability" and "Durability" were ranked as being among the most important factors. Also, "Ease of Maintenance," "Purchase Price," and "Same Type of Vehicle as Existing Fleet" consistently ranked as the least important factors.

Note that the responses in the following table regarding the most useful types of vehicles list three vehicles with lifts as being the most useful, and three other vehicles without lifts as being the least useful. Respondents preferred Conversion Vans with a rear lift to Conversion Vans with a side lift. Also, the 25' LTV with four wheelchair stations was seen as more useful than the same vehicle with two rear wheelchair stations or with two forward wheelchair stations. Respondents saw the 28' LTV with two rear wheelchair stations as more useful than the 28' LTV with six wheelchair stations or the 28' LTV without a lift. Both the lift-equipped 22' LTV and the lift-equipped 20' LTV were seen as more useful than any of the larger LTVs.

Note that one respondent perceived a 25' LTV with a low floor and two forward wheelchair stations as being useful.

Table 12: Most Useful Types of Vehicles to Meet Service Needs

Vehicle	Rank
22' LTV—Lift	1
Conversion Van—Rear Lift	2
20' LTV—Lift	3
Conversion Van—12 passenger, no lift	4 (tie)
25' LTV—Lift, 4 WC stations	4 (tie)

Vehicle	Rank
25’ LTV—Lift, rear WC stations	6 (tie)
28’ LTV—Lift, 2 rear WC stations	6 (tie)
Minivan	8
25’ LTV—Lift, Front WC stations	9 (tie)
22’ LTV—w/o Lift	9 (tie)
28’ LTV—Lift, 6 WC stations	11
Conversion Van—Side Lift	12
25’ LTV—w/o Lift	13
20’ LTV—w/o Lift	14
28’ LTV—w/o Lift	15

Other responses included:

- No one type vehicle can meet all needs.
- 25’ LTV Low Floor 2 forward wheelchair stations
- If vehicles will not operate at full capacity as a result of providing preferred service to Medicaid clients, future vehicle types will change to meet those needs

Respondents indicated that in general, vehicles without lifts experienced fewer and/or less severe problems than vehicles with lifts, as shown in Table 13. Comments from some respondents cite problems with lifts as being among the most common/most severe.

Table 13: Types of vehicles with the fewest/least severe problems

Vehicle	Rank
Minivan	1
22’ LTV—w/o Lift	2
20’ LTV—w/o Lift	3
Conversion Van—w/o lift	4
22’ LTV—Lift	5 (tie)
28’ LTV—w/o Lift	5 (tie)
25’ LTV—Lift, 4 WC stations	7
Conversion Van—Rear Lift	8
28’ LTV—Lift, 6 WC stations	9 (tie)
28’ LTV—Lift, 2 rear WC station	9 (tie)
25’ LTV—w/o Lift	11 (tie)
Conversion Van—Side Lift	11 (tie)
20’ LTV—Lift	11 (tie)
25’ LTV—Lift, Front WC station	14
25’ LTV—Lift, rear WC station	15

Other responses included:

- Issues with lift equipment – electrical switches, components, leaking hatches
- Weight of lift equipment on Conversion Van puts greater strain on drivetrain components, and increases tire wear. Lift-equipped LTV’s put less strain on the drivetrain, but those vehicles have greater tire wear, with less mileage for tires, as well as

greater fuel consumption. Greater operating safety (better stability, etc.) of LTV's outweighs the higher operating costs.

- Conversion van with rear lift: A/C and lift problems
- Many more problems with Fords than with Dodges or LTV's
- 20' LTV—floor layout with rear side by side wheelchair stations is impractical for the size of today's wheelchairs
- 20' LTV with Side Lift: wiring harness and air conditioning issues
- 22' LTV with Lift: Electrical, A/C, and brake problems
- 25' LTV with Lift: Mechanical and lift problems, and lack of parts available at a reasonable cost
- 25' LTV with Rear Lift: A/C, battery, charging system problems

Most responding CT systems indicated that they transport both ambulatory and non-ambulatory passengers on a vehicle at the same time, with 48 percent of respondents indicating that occurred 75-100 percent of the time. Another 32 percent indicated that that practice occurred between 50 and 75 percent of the time, resulting in approximately 80 percent of respondents indicating that both types of passengers are transported at the same time.

However, respondents indicated that all wheelchair stations are not typically filled at one time. Seventy-one percent of respondents indicated that all wheelchair stations were filled less than 50 percent of the time (35.5 percent indicated 0-25% of the time and 35.5 percent indicated 25-50 percent of the time. Only 13 percent indicated that all wheelchair stations were typically occupied 75-100 percent of the time.

Fourteen respondents provided information on other types of vehicles that they believed would be useful to add to the state contract, including:

- Minivans able to transport passengers in wheelchairs (five respondents);
- Conversion vans with greater passenger capacity (14 passengers; and a lift-equipped van with seats for more than eight passengers) as well as a Center Aisle Van;
- LTVs with a low floor (22', 25', and 28');
- LTV with more than 2 wheelchair stations (presumably 20', or 22', as that option exists for the 25' and 28' vehicles)
- 20' LTV with a higher floor and better wheelchair layout
- Vehicles without half step at an angle to the floor—safety issue
- 4-Wheel-Drive or All-Wheel-Drive (no particular vehicle type specified)
- A vehicle meeting Head Start program requirements also useable by the general public

One respondent stated that they have not been allowed to replace conversion vans with 22' LTVs, which would be a good option for them.

IV. Potential Factors Affecting the Numbers and Types of Vehicles Operated by Community Transportation Systems

Many factors influence the optimal number and types of vehicles to be operated by Community Transportation (CT) systems. This chapter describes an analysis that was conducted of factors with the potential to influence fleet size and mix. The chapter:

- Lists factors that influence fleet size and/or mix;
- Lists indicators that could be used to assess those factors;
- Provides the results from an analysis of the relative performance of CT systems according to several indicators. The analysis focused on systems performing more than one Standard Deviation better or poorer than both all CT systems, and systems in their peer group; and
- Concluded that a simpler means of analysis was warranted, to reduce the time and effort required to conduct the analysis.

Potential Factors Influencing Fleet Size and Mix

The project assessed the feasibility of using many factors, to develop a short list of those that would provide an ideal assessment. Table 14 lists the potential factors that were compiled, categorizing the factors as to those that influence fleet size, fleet mix, and both fleet size and mix.

Table 14: Factors Influencing CT System Fleet Size and Mix

Factors Influencing Fleet Size	Factors Influencing Fleet Mix	Factors Influencing Both Fleet Size and Mix
Service area size	Fleet Standardization	Service Area Characteristics: • Terrain • Roadway width • Sharpness of curves • Population density
Vehicle utilization	Fuel Type	Travel demand: • Level of demand • Trip density • Out-of-service area demands • Scheduling practices • Scheduling efficiency
	CDL Requirement	Service constraints/policies: • Wait time window • Drop-off time window • On-vehicle time limits • Mixing passengers on runs

Factors Influencing Fleet Size	Factors Influencing Fleet Mix	Factors Influencing Both Fleet Size and Mix
	Vehicle characteristics: • Weight capacity • Maneuverability capabilities/constraints • Ride quality	Life-cycle costs: 1. Vehicle purchase costs 2. Operating costs: • Driver salaries/benefits • Fuel • Insurance premiums • Driver training 3. Maintenance • Routine functions • Parts including tires • Mechanic training
	Facility capabilities: • Lifts, bay size/arrangement, etc. • Storage space • Doorway height/ width, etc.	Maintenance capabilities: • In-house vs. contracted • Training • Parts inventory • Special tools required
		Mix of ambulatory and non-ambulatory passengers
		Trip duration
		Vehicle Characteristics: • Durability • Reliability • Expected years of service • Dimensions

As the table shows, there are many quantitative measures that could be used. The focus of the assessment was to determine quantitative, rather than qualitative measures that could be used to develop a methodology to structure CT system vehicle fleet size and mix. The factors were selected to assess CT systems' fleet sizes and mixes, as described in the following section.

Measures to Assess Vehicle Fleet Size and Mix

A constraint in determining measures to assess fleet size and mix is the need to use measures that can be calculated from readily available data, such as NCDOT/PTD annual operating statistics, Vehicle Utilization Data (VUD), or U.S. Census data. Information that was compiled for each CT system included the following:

- Number of vehicles in each CT system's active fleet (NTD 2011 data)
- Service area population (2010 data)
- Service area land area—total county land area minus water area such as ocean inlets and sounds
- Annual passenger trips (Fiscal Year 2011)
- Annual service miles (FY 2011)
- Annual service hours (FY 2011)

Several measures were calculated from these data, including:

- Passenger trips per vehicle—annual passenger trips divided by the number of vehicles in the active fleet
- Average miles per vehicle—annual service miles divided by the number of vehicles in the active fleet
- Average hours per vehicle—annual service hours divided by the number of vehicles in the active fleet
- Vehicles per 10,000 population—the number of vehicles in the active fleet divided by 10,000 population in the service area. Using 10,000 population instead of total service area population results in values for this indicator that are more easily understood, as the values range from 0.2 to 13.2.
- Vehicles per 100 square miles of service area—the number of vehicles in the active fleet divided by 100 square miles of service area. Similar to the previous calculation, using 100 square miles instead of total service area results in values that are easier to comprehend. Values range from 0.98 to 8.99.
- Vehicles per 10,000 passenger trips—the number of vehicles in the active fleet divided by 10,000 passenger trips. Again, using 10,000 passenger trips results in values that are more easily understood. Values range from 0.6 to 7.9.
- Service area population density—service area population divided by service area land area
- Trip density—the number of annual passenger trips divided by the service area population density
- Vehicles per trip density—number of vehicles in the active fleet divided by the number of annual passenger trips per square mile of service area.

Refer to Appendix C for calculations for each of these measures individually, and to Appendix D for summary information.

In addition to these statistics, Vehicle Utilization Data (VUD) will be examined to determine the degree to which CT systems utilize their fleets on both an overall basis, and by vehicle type. This examination will be conducted in two ways—looking at all systems together, and looking at systems within peer groups used to compare annual operating statistics.

Other types of information that would be useful for assessing vehicle fleet size and mix, but for which some data are not available include:

- Life-cycle costs of various vehicles available for purchase through the state procurement. Calculation of these costs would require, in addition to purchase prices, detailed information on operating costs including:
  - Average driver cost for each type of vehicle
  - Fuel cost per gallon
  - Average fuel economy (by vehicle type)
  - Average annual insurance premium per vehicle (by vehicle type)
  - Average annual maintenance costs per vehicle (by vehicle type, including tires)
- Out-of-service area demand—the percentage of out-of-service area trips to total trips operated. Calculation of this measure would require data on the number of annual out-of-service trips; however, that data are not available.

Relative Performance of CT Systems by Various Indicators

Community Transportation (CT) systems' performance was calculated according to several indicators in an effort to determine if there may be a correlation between the numbers and types of vehicles operated by a CT system and its performance.

Rather than provide complete results for all systems, this section provides information on systems that were more than one standard deviation from the mean for each indicator. Those systems demonstrated either superior or poor performance—in short, they are the outliers who performed with excellence or performed poorly. By focusing on those systems, it may be possible to determine particular circumstances that could contribute to either superior or poor performance. The systems with values for indicators that were more than one standard deviation above and below the average are listed in the following tables.

Analysis of All 5311-Reporting Systems as a Group

This section provides information on CT systems from an overall perspective, looking at all 5311 reporting systems together. Table 15 provides information on systems that performed better than most, achieving scores more than one standard deviation above the mean. Table 16 provides information on systems that performed worse than most, with scores more than one standard deviation below the mean.

Table 15: Systems with Values Greater Than One Standard Deviation Better Than the Mean

Passenger Trips per Vehicle [1]		Average Miles per Vehicle [2]		Average Hours per Vehicle [2]	
System	**Value**	**System**	**Value**	**System**	**Value**
Wake County	7,648	Wake County	85,352	Lenoir County	3,266
Lenoir County	7,135	Lenoir County	54,158	Wake County	2,571
Orange County	7,100	Alleghany County	47,156	Wilson County	2,473
Davidson County	6,111	Duplin County	44,958	Durham County	2,471
Swain County	5,895	Ashe Co. Transp. Auth. Inc.	41,418	Orange County	2,268
Mitchell County	5,836	Wilson County	41,133	Goldsboro/Wayne Transp. Authority	2,225
Richmond County	4,992	Anson County	39,928	Davidson County	2,156
Transylvania County	4,811			Carteret County	2,146
				Union County	2,075
				Lincoln County	1,959
Overall Averages	**3,458**		**28,365**		**1,467**

1: Analysis for this factor excludes Guilford County and Mecklenburg County, as they are outliers with significantly higher values for this indicator.
2: Analysis for this factor excludes Guilford County, as it is an outlier with a significantly higher value for this indicator.

Table 15 (continued): Systems with Values Greater Than One Standard Deviation Better Than the Mean

Vehicles per 10,000 Population		Vehicles per 100 Square Miles of Service Area		Vehicles per 10,000 Passenger Trips		Vehicles per Trip Density (Trips per Svc. Area Sq. Mile)	
System	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**
Guilford County	0.2	Hyde County	0.98	Guilford County	0.6	Guilford County	0.04
Mecklenburg Co. DSS	0.3	Bladen County	1.03	Mecklenburg Co. DSS	0.9	Mitchell County	0.04
Wake County	0.5	Beaufort County	1.21	Wake County	1.3	Mecklenburg Co. DSS	0.05
Durham County	0.6	Pender Adult Svcs. Inc.	1.26	Lenoir County	1.4		
		Sampson County	1.38	Orange County	1.4		
		Robeson County	1.58	Davidson County	1.6		
		Brunswick County	1.65	Swain County	1.7		
		Guilford County	1.70	Mitchell County	1.7		
		Swain County	1.70	Richmond County	2.0		
		Duplin County	1.72				
		Transylvania County	1.85				
		Choanoke Public Transportation Auth.	1.86				
		Craven County	1.91				
		Columbus County	1.92				
Overall Averages	**3.4**		**3.65**		**3.2**		**0.19**

Table 16: Systems with Values Greater Than One Standard Deviation Worse Than the Mean

Passenger Trips per Vehicle [1]		Average Miles per Vehicle [2]		Average Hours per Vehicle [2]	
System	**Value**	**System**	**Value**	**System**	**Value**
Clay County	1,272	Western Carolina Comm. Action Inc.	11,502	Bladen County	556
Alleghany County	1,597	Yancey Co. Transp. Auth.	13,093	Hyde County	814
Pender County	1,941	Bladen County	14,739	Transylvania County	828
Pitt County	2,066	Durham County	14,948	Jackson County	906
Columbus County	2,130	Cabarrus Co. Transp. Svcs.	15,820	Graham County	929
Moore County	2,163	Transylvania County	16,115	Stanly County	939
Washington County	2,166	Stanly County	16,676	Sampson County	939
		Jackson County	16,930	Wilkes Transp. Authority	954
				Yancey County Transp. Auth.	965
				Martin County	972
				Cabarrus Co. Transp. Svcs.	976
Overall Averages	**3,458**		**28,365**		**1,467**

1: Analysis for this factor excludes Guilford County and Mecklenburg County, as they are outliers with significantly higher values for this indicator.
2: Analysis for this factor excludes Guilford County, as it is an outlier with a significantly higher value for this indicator.

Table 16 (continued): Systems with Values Greater Than One Standard Deviation Worse Than the Mean

Vehicles per 10,000 Population		Vehicles per 100 Square Miles of Service Area		Vehicles per 10,000 Passenger Trips		Vehicles per Trip Density (Trips per Svc. Area Sq. Mile)	
System	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**
Clay County	13.2	Gaston County	8.99	Clay County	7.9	YVEDDI	0.68
Alleghany County	10.7	Cabarrus County	8.29	Alleghany County	6.3	KATA	0.52
Hyde County	10.4	Lee County	6.67	Pender Adult Svcs. Inc.	5.2	CPTA	0.45
Graham County	10.1	Alamance County	6.60	Pitt County	4.8	Pender Adult Svcs. Inc.	0.44
Gates County	7.4	Clay County	6.52	Columbus County	4.7	Tar River Transit	0.44
Martin County	7.3	Buncombe County	6.4	Moore County	4.6	Columbus County	0.41
Avery County	7.3	Cleveland County	6.03	Washington County	4.6	CARTS	0.40
Washington County	6.8	Durham County	5.94	Martin County	4.5	Sampson County	0.34
Polk County	6.8	Polk County	5.89				
Yancey County	6.7	YVEDDI	5.70				
Swain County	6.4	Rowan County	5.67				
Mitchell County	6.4						
Overall Averages	**3.4**		**3.65**		**3.2**		**0.19**

Comments on Overall Statistics:

1. **Guilford County** appears to perform well as a result of having an extremely small fleet—not only in absolute terms, but also in proportion to the population of its service area. However, it is likely an **outlier**, and **should be removed from the analysis**.
2. **Wake County** also appears to provide a high number of Passenger Trips per Vehicle, with a high number of Average Miles per Vehicle. This is likely a result of having a large percentage of trips are provided by contractors.
3. **Lenoir County** should also be checked, to learn more about any peculiarities that that system may have with its operations.
4. **Orange County** and **Davidson County** have superior numbers of Passenger Trips per Vehicle. This is likely a result of those systems operating fixed routes as part of their service.
5. **Swain, Mitchell, and Richmond Counties** also have superior numbers. Determine potential causes for that performance. However, Swain and Mitchell Counties possess a relatively high numbers of Vehicles per 10,000 Population. It appears that although they have comparatively large fleets, they utilize their vehicles to a high degree, or they may make a lot of long out-of-county trips.
6. **Clay County** appears to be performing poorly. It makes the fewest Passenger Trips per Vehicle, has the greatest number of Vehicles per 10,000 Population.
7. **Alleghany County** also makes few Passenger Trips per Vehicle, and has the second-greatest number of Vehicles per 10,000 Population.
8. **Pender, Pitt, Columbus, Moore,** and **Washington Counties** also made significantly fewer Passenger Trips per Vehicle than other systems.
9. **Hyde and Graham Counties** had higher numbers of Vehicles per 10,000 Population than most other systems. This is likely a result of their having relatively low service area populations, so that even a small fleet results in those statistics.

The measure "Vehicles per Trip Density" was not used in the analysis of transit systems by peer group due to the large variance in values, and the large value for the Standard Deviation (0.13) compared with the mean for all systems (0.19). Applying the 0.13 STD would result in only three systems being more than one STD below the mean, and only nine systems being more than one STD above the mean. That would result in only 12 of the 73 systems demonstrating significant variance from the average of all systems. Also, there are no distinct outliers that could be excluded from the analysis. Therefore, this measure will not be included in the analysis by peer group.

Analysis by Peer Group

The following series of tables provides information by peer group, listing transit systems and their associated values that are more than one Standard Deviation from the mean. No information is provided for Peer Group 1, as comparable information was not available for Wave Transit, which resulted in information available for only four transit systems in that group. A minimum of five systems are

necessary to provide meaningful statistical information using the Mean, and Standard Deviation. Also, two of the Group 1 systems, those operating in Guilford and Mecklenburg Counties, have statistical data that contains outliers, and would skew a statistical analysis. For those reasons, information for Peer Group 1 is not included in this analysis.

Peer Group 2

Transit systems in this peer group include: Alamance County Transportation Authority, Cabarrus County Transportation Services, Davidson County, Gaston County, Goldsboro/Wayne Transportation Authority, Iredell County, Lee County, Onslow United Transit System, Orange County, Pitt County, Rowan County, Union County, and Wilson County.

Table 17 provides Peer Group 2 transit systems' data that was more than one Standard Deviation above or below the Mean. Depending on the factor, such data can be considered to demonstrate relatively greater or lesser utilization of fleet vehicles. With Passenger Trips per Vehicle, Average Miles per Vehicle, and Average Hours per Vehicle, higher values should show greater utilization of the fleet. Conversely, with Vehicles per 10,000 Population, Vehicles per 100 Square Miles of Service Area, and Vehicles per 10,000 Passenger Trips, lower values should show greater utilization of fleet resources.

Table 17: Systems, by Peer Group, with Values More Than One Standard Deviation from the Mean—Peer Group 2

Passenger Trips per Vehicle		**Average Miles per Vehicle**		**Average Hours per Vehicle**		**Vehicles per 10,000 Population**		**Vehicles per 100 Square Miles of Service Area**		**Vehicles per 10,000 Passenger Trips**	
HIGHEST UTILIZATION—values more than one Standard Deviation better than the mean											
System	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**
Orange Co.	7,100	Wilson Co.	41,133	Wilson Co.	2,473	Onslow Co.	1.0	Onslow Co.	2.5	Orange Co.	1.4
Davidson Co.	6,111	Goldsboro/Wayne	37,215	Orange Co.	2,268	Davidson Co.	1.0			Davidson Co.	1.6
				Goldsboro/Wayne	2,225						
GROUP MEAN	**4,022**		**28,344**		**1,782**		**1.6**		**5.1**		**2.7**
LOWEST UTILIZATION—values more than one Standard Deviation worse than the mean											
System	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**
Pitt Co.	2,066	Cabarrus Co.	15,820	Cabarrus Co.	976	Lee Co.	2.9	Gaston Co.	9.0	Pitt Co.	4.8
		Davidson Co.	19,127	Lee Co.	1,315			Cabarrus Co.	8.3	Alamance Co.	3.7
		Pitt Co.	20,091							Cabarrus Co.	3.7

Comments on Peer Group 2:

1. **Orange** and **Davidson Counties** each demonstrated superior statistics for three factors. Orange County had the greatest Passenger Trips per Vehicle, and operated the fewest Vehicles per 10,000 Passenger Trips. Orange County had the second greatest number of Average Hours per Vehicle for the peer group. Davidson County had the second greatest number of Passenger Trips per Vehicle, Average Hours per Vehicle, and second fewest number of Vehicles per 10,000 Passenger Trips. Both of these systems operate fixed-route service, which contributed to these superior statistics. Further investigation of the demand-response portion of their service would be required to determine how well that type of service performs.
2. **Wilson County,** the **Goldsboro/Wayne Transportation Authority**, and **Onslow United Transit System** each demonstrated superior statistics for two factors. Wilson County had the greatest Average Miles per Vehicle, and Average Hours per Vehicle. Onslow County had the fewest Vehicles per 10,000 Population, and fewest Vehicles per 100 Square Miles of Service Area. Goldsboro/Wayne had the second greatest Average Miles per Vehicle, and the third greatest Average Hours per Vehicle. Further investigation of these systems would be required to determine the degree to which fixed-route and/or ADA paratransit service may impact their statistics.
3. **Cabarrus County** had significantly worse than average statistics for four indicators. It had the lowest Average Miles per Vehicle, and Average Hours per Vehicle, the second highest number of Vehicles per 100 Square Miles of Service Area, and the third highest number of Vehicles per 10,000 Passenger Trips. These statistics suggest that this system may be over-capitalized in its fleet, or that a different vehicle mix may be warranted.
4. **Pitt County** and **Lee County** each had significantly worse than average statistics for two indicators. Pitt County had the fewest Passenger Trips per Vehicle, and the greatest number of Vehicles per 10,000 Passenger Trips. Lee County had the most Vehicles per 10,000 Population, and the second lowest Average Hours per Vehicle. These statistics suggest that these systems may be over-capitalized in their fleets, or that a different vehicle mix may be warranted.

Lesson: Check the extent to which a transit system may operate fixed-route service, as that type of service can result in a relatively high number of passengers per vehicle, and correspondingly, a relatively low number of vehicles per 10,000 passenger trips.

Peer Group 3

Transit systems in this peer group include: Buncombe County – Mountain Mobility, Carteret County, City of Rocky Mount (Tar River Transit), Dare County, Harnett County, Johnston County Council on Aging, Inc., Kerr Area Transportation Authority, Lenoir County, Lincoln County, Moore County, Person County, Randolph County Senior Adult Association, Inc. (Randolph-Montgomery), Richmond Interagency Transportation, Inc., Robeson County, Rockingham County Council on Aging, Scotland County, Stanly County, Transportation Administration of Cleveland County, Inc., Western Carolina Community Action, Inc. (Henderson County), and Yadkin Valley Economic Development District, Inc. (YVEDDI).

Table 18 shows statistics that were more than one Standard Deviation from the Mean for Section 5311 recipients in Peer Group 3.

Table 18: Systems, by Peer Group, with Values More Than One Standard Deviation from the Mean—Peer Group 3

Passenger Trips per Vehicle		Average Miles per Vehicle		Average Hours per Vehicle		Vehicles per 10,000 Population		Vehicles per 100 Square Miles of Service Area		Vehicles per 10,000 Passenger Trips	
HIGHEST UTILIZATION—values more than one Standard Deviation better than the mean											
System	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**
Lenoir Co.	7,135	Lenoir Co.	54,158	Lenoir Co.	3,266	Robeson Co.	1.1	Robeson Co.	1.6	Lenoir Co.	1.4
Richmond Co.	4,992	Carteret Co.	38,891	Carteret Co.	2,146	Johnston Co.	1.4	Dare Co.	2.1	Richmond Co.	2.0
						Randolph-Montgomery	1.6	Randolph-Montgomery	2.1	Robeson Co.	2.2
								Richmond Co.	2.3		
GROUP MEAN	**3,407**		**28,966**		**1,573**		**2.5**		**3.9**		**3.2**
LOWEST UTILIZATION—values more than one Standard Deviation worse than the mean											
System	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**
Moore Co.	2,163	Henderson Co.	11,502	Stanly Co.	939	YVEDDI	4.5	Buncombe Co.	6.4	Moore Co.	4.6
		Stanly Co.	16,676	Person Co.	1,002	Person Co.	3.8	Cleveland Co.	6.0	YVEDDI	4.3
		Person Co.	18,605					YVEDDI	5.7	Tar River Transit	4.2
								Lincoln Co.	5.4		

Comments on Peer Group 3:

1. **Lenoir County** had superior statistics for four factors. The system had the highest Passenger Trips per Vehicle, the greatest Average Miles per Vehicle, the greatest Average Hours per Vehicle, and the fewest Vehicles per 10,000 Passenger Trips. Further investigation would be required to determine if, and if so to what extent operation of fixed-route service may have contributed to these statistics.
2. **Robeson County** and **Richmond County** each had statistics that were better than the others in this peer group for three factors. Robeson County had the fewest Vehicles per 10,000 Population, the fewest Vehicles per 100 Square Miles of Service Area, and the third fewest Vehicles per 10,000 Passenger Trips. Richmond County had the second greatest Passenger Trips per Vehicle, the second fewest Vehicles per 10,000 Passenger Trips, and the third fewest Vehicles per 100 Square Miles of

Service Area. Further investigation would be required to determine if, and if so to what extent operation of fixed-route service may have contributed to these statistics.

3. **Carteret County** and the **Regional Coordinated Transit System (RCATS)** (operating in Randolph and Montgomery Counties) each had superior statistics for two factors. Carteret County had the second highest Average Miles per Vehicle, and the second highest Average Hours per Vehicle. RCATS had the third fewest Vehicles per 10,000 Population, and the third fewest Vehicles per 100 Square Miles of Service Area.
4. **Person County** and the **Yadkin Valley Economic Development District (YVEDDI)** each had inferior statistics for three factors. YVEDDI had the most Vehicles per 10,000 Population, the second highest Vehicles per 10,000 Passenger Trips, and the third highest number of Vehicles per 100 Square Miles of Service Area. Person County had the second lowest Average Hours per Vehicle, the second highest Vehicles per 10,000 Population, and the third lowest Average Miles per Vehicle. These statistics suggest that these systems may be over-capitalized in their fleets, or that a different vehicle mix may be warranted.
5. **Moore County** and **Stanly County** each had poor statistics for two factors. Moore County had the fewest Passenger Trips per Vehicle, and the greatest number of Vehicles per 10,000 Passenger Trips. Stanly County had the lowest number of Average Hours per Vehicle, and the second lowest Average Miles per Vehicle. These statistics suggest that these systems may be over-capitalized in their fleets, or that a different vehicle mix may be warranted.

Peer Group 4

Transit systems in this peer group include: Albemarle Regional Health Services (Inter-County Public Transportation Authority—ICPTA), Anson County, Beaufort County, Bladen County, Brunswick County, Caswell County, Chatham Transit Network, Choanoke Public Transportation Authority (CPTA), Columbus County, Craven County, Duplin County, Gates County, Greene County, Hoke County, Hyde County Private Non-Profit Transportation Corporation, Inc., Macon County, Martin County, Mountain Projects (Haywood County), Pender Adult Services, Inc., Rutherford County, Sampson County, Washington County, and Wilkes Transportation Authority.

Table 19 shows statistics that were more than one Standard Deviation from the Mean for Section 5311 recipients in Peer Group 4.

Table 19: Systems, by Peer Group, with Values More Than One Standard Deviation from the Mean—Peer Group 4

Passenger Trips per Vehicle		Average Miles per Vehicle		Average Hours per Vehicle		Vehicles per 10,000 Population		Vehicles per 100 Square Miles of Service Area		Vehicles per 10,000 Passenger Trips	
HIGHEST UTILIZATION—values more than one Standard Deviation better than the mean											
System	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**
Hoke Co.	4,505	Duplin Co.	44,958	ICPTA	1,712	Brunswick Co.	1.3	Hyde Co.	1.0	Hoke Co.	2.2
CPTA	4,425	Anson Co.	39,928	Duplin Co.	1,624			Bladen Co.	1.0	CPTA	2.3
Beaufort Co.	3,956	Gates Co.	35,270	Rutherford Co.	1,574			Beaufort Co.	1.2	Beaufort Co.	2.5
				Haywood Co.	1,551			Pender Co.	1.3		
GROUP MEAN	**3,044**		**28,214**		**1,225**		**3.9**		**2.4**		**3.5**
LOWEST UTILIZATION—values more than one Standard Deviation worse than the mean											
System	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**
Pender Co.	1,941	Bladen Co.	14,739	Bladen Co.	556	Hyde Co.	10.4	Hoke Co.	4.4	Pender Co.	5.2
Columbus Co.	2,130	Martin Co.	18,083	Hyde Co.	814	Gates Co.	7.4	Rutherford Co.	4.1	Columbus Co.	4.7
Washington Co.	2,166	Washington Co.	18,786			Martin Co.	7.3	Wilkes Co.	4.0	Washington Co.	4.6
Martin Co.	2,247	Sampson Co.	19,645			Washington Co.	6.8	Martin Co.	3.9	Martin Co.	4.5
		Wilkes Co.	21,534								

Comments on Peer Group 4:

1. **Beaufort County** had superior statistics for three factors. The system had the third highest Passenger Trips per Vehicle, Vehicles per 100 Square Miles of Service Area, and the third lowest number of Vehicles per 10,000 Passenger Trips.
2. **Duplin County** and the **Choanoke Public Transportation Authority (CPTA)** each had superior statistics for two factors. Duplin County had the highest Average Miles per Vehicle, and the second highest Average Hours per Vehicle. CPTA had the second highest Number of Passenger Trips per Vehicle, and the second lowest number of Vehicles per 10,000 Passenger Trips.
3. **Hoke County** demonstrated mixed statistics with two positive statistics and one negative statistic. The system had superior statistics for two factors—the highest Passenger Trips per Vehicle, and the lowest Vehicles per 10,000 Passenger Trips—but also had the greatest Vehicles per 100 Square Miles of Service Area. The latter statistic may be a result of a significant portion of Hoke County being part of Fort Bragg, and off limits to transit vehicles.
4. **Martin County** had inferior statistics for five factors. The system had the second lowest Average Miles per Vehicle, the third highest Vehicles per 10,000 Population, the fourth lowest number of Passenger Trips per Vehicle, the fourth highest Vehicles

per 100 Square Miles of Service Area, and the fourth highest Vehicles per 10,000 Passenger Trips. These statistics suggest that this system may be over-capitalized in its fleet, or that a different vehicle mix may be warranted.

5. **Washington County** had inferior statistics for four factors—the third lowest Passenger Trips per Vehicle, the third lowest Average Miles per Vehicle, the third highest Vehicles per 10,000 Passenger Trips, and the fourth highest Vehicles per 10,000 Population. These statistics suggest that this system may be over-capitalized in its fleet, or that a different vehicle mix may be warranted.
6. **Columbus County, Hyde County** and **Wilkes County** each had inferior statistics for two factors. Columbus County had the second lowest Passenger Trips per Vehicle, and the second highest Vehicles per 10,000 Passenger Trips. Hyde County had the greatest Vehicles per 10,000 Population, and the second lowest Average Hours per Vehicle. Wilkes County had the third highest Vehicles per 100 Square Miles of Service Area, and the fifth lowest Average Miles per Vehicle. These statistics suggest that this system may be over-capitalized in its fleet, or that a different vehicle mix may be warranted.
7. **Bladen County** and **Pender County** each demonstrated mixed statistics, with each having two inferior and one superior statistics. On the negative side, Bladen County had the lowest Average Miles per Vehicle, and the lowest Average Hours per Vehicle. However, on the positive side, Bladen County also tied for the fewest Vehicles per 100 Square Miles of Service Area. Pender County's poor statistics included the lowest Passenger Trips per Vehicle, and the highest Vehicles per 10,000 Population. However, Pender County also had the fourth lowest number of Vehicles per 100 Square Miles of Service Area, a superior statistic. Both of these counties are large in land area, which may have contributed to their good scores on vehicles per 100 square miles of service area.

Lesson: Check the size of a transit system's service area. Unusually large or small service areas may strongly impact the "Vehicles per 100 Square Miles of Service Area" factor.

Peer Group 5

Transit systems in this peer group include: Alleghany County, Ashe County Transportation Authority, Inc., Avery County Transportation Authority, Cherokee County, Clay County, Graham County, Jackson County, Madison County Transportation Authority, Mitchell County Transportation Authority, Polk County Transportation Authority, Swain County Focal Point on Aging, Inc., Transylvania County, and Yancey County.

Table 20 shows statistics that were more than one Standard Deviation from the Mean for Section 5311 recipients in Peer Group 5.

Table 20: Systems, by Peer Group, with Values More Than One Standard Deviation from the Mean—Peer Group 5

Passenger Trips per Vehicle		Average Miles per Vehicle		Average Hours per Vehicle		Vehicles per 10,000 Population		Vehicles per 100 Square Miles of Service Area		Vehicles per 10,000 Passenger Trips	
HIGHEST UTILIZATION—values more than one Standard Deviation better than the mean											
System	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**
Swain Co.	5,895	Alleghany Co.	47,156	Ashe Co.	1,868	Transylvania Co.	2.1	Swain Co.	1.7	Swain Co.	1.7
Mitchell Co.	5,836	Ashe Co.	41,418	Alleghany Co.	1,749	Jackson Co.	3.2	Transylvania Co.	1.9	Mitchell Co.	1.7
GROUP MEAN	**3,406**		**25,208**		**1,269**		**6.9**		**3.8**		**3.5**
LOWEST UTILIZATION—values more than one Standard Deviation worse than the mean											
System	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**	**System**	**Value**
Clay Co.	1,272	Yancey Co.	13,093	Transylvania Co.	828	Clay Co.	13.2	Clay Co.	6.5	Clay Co.	7.9
Alleghany Co.	1,597			Jackson Co.	906	Alleghany Co.	10.7	Polk Co.	5.9	Alleghany Co.	6.3
						Graham Co.	10.1				

Comments on Peer Group 5:

1. **Swain County** had superior statistics for three factors—the highest Passenger Trips per Vehicle, the lowest Vehicles per 100 Square Miles of Service Area, and the lowest Vehicles per 10,000 Passenger Trips.
2. **Ashe County** and **Mitchell County** each had superior statistics for two factors. Ashe County had the highest Average Hours per Vehicle, and the second highest Average Miles per Vehicle. Mitchell County had the second highest Passenger Trips per Vehicle, and the second lowest number of Vehicles per 10,000 Passenger Trips.
3. **Alleghany County, Transylvania County,** and **Jackson County** each had mixed statistics. On the superior side, Alleghany County had the highest Average Miles per Vehicle, and the second highest Average Hours per Vehicle. However, the system had the second highest number of Vehicles per 10,000 Population. These counties may have unusually small populations, and if they have many long-distance trips, that could explain those statistics. Transylvania County had superior statistics with the lowest number of Vehicles per 10,000 Population, and the second lowest number of Vehicles per 100 Square Miles of Service Area. However, Transylvania County had the lowest Average Hours per Vehicle, which may be a result of their contracting

out some trips. Jackson County, while having the second lowest number of Vehicles per 10,000 Population (superior), also had the second lowest Average Hours per Vehicle (inferior). Again, this may be a result of an unusually small county population and having many long-distance trips.

4. **Clay County** had poor statistics for four factors. The system had the lowest Passenger Trips per Vehicle, the highest number of Vehicles per 10,000 Population, the highest number of Vehicles per 100 Square Miles of Service Area, and the highest number of Vehicles per 10,000 Passenger Trips. These statistics suggest that this system may be over-capitalized in its fleet, or that a different vehicle mix may be warranted.

Lesson: Check to see the extent to which trips are contracted, as well as the types of trips that are contracted. If relatively long-distance trips are contracted, that can result in having relatively few vehicles providing service (as contracted vehicles are not counted in a fleet) with relatively few average hours per vehicle.

The appendices provide complete data and calculations for all systems, for each measure.

Conclusion from this Analysis

Although this analysis provided some valuable insights into CT system fleet sizes and mixes, it was very cumbersome to conduct. It required compiling a large amount of data, and calculating many indicators both at the statewide and the peer group levels. If this analysis were to be conducted on an annual basis, it would require substantial time and effort, which could tax the capabilities of NCDOT/PTD staff. For that reason, ITRE sought a simpler means of analysis that would provide a more useable tool for the NCDOT/PTD.

V. Tool Developed to Assess Community Transportation System Fleet Size

This chapter provides an overview and explanation of the tool, discussion of how the tool may be applied to prioritize vehicle purchases at the statewide level as well as among CT peer groups, and the procedures used to compile data for use with the tool.

Overview of the Tool

The tool is a spreadsheet file comprised of three components—(1) a Comparative Mileage Assessment, (2) a Comparative Passenger Trips per Hour Assessment, and (3) Adjustment Factors. The primary components are the Comparative Mileage Assessment and the Comparative Passenger Trips per Hour Assessment. Both of those components contain several spreadsheets used to compile and analyze data.

The Comparative Mileage component assesses **relative vehicle use** based on **average annual mileage for each type of vehicle**. The Comparative Passenger Trips per Hour component assesses **relative productivity** based on **average passenger trips per hour for each type of vehicle**.

The Adjustment Factors component adjusts the priority for replacement or expansion of a particular type of vehicle by assessing other factors, such as the number of vehicles reported in poor/fair condition, the number of vehicles that have met their useful life, and the number of vehicles with relatively high annual maintenance costs, and. Additional guidance is provided on other factors that may influence the need, prioritization, or selection of vehicle type for purchase.

The primary inputs to the tool are average annual mileage for each vehicle type and average passenger trips per hour for each vehicle type. Both inputs involve compiling data at the statewide level for all vehicle types, then compiling data within peer groups for all vehicle types.

The process first categorizes vehicles according to type (center-aisle van, conversion van, lift-equipped van, minivan, 20' LTV, etc.). Next, the vehicles within each category are compared using average annual mileage and passengers per hour at two levels—all CT systems operating each type of vehicle; and within peer groups.

The statewide level of analysis provides a method for NCDOT/PTD to prioritize purchases of each type of vehicle among all CT systems. The peer group level of analysis compares CT systems that experience similar degrees of opportunity in providing transportation services. The peer groups are identical to those used to benchmark CT systems' performance on annual operating statistics[5]. Those five peer groups include CT systems that share similar abilities to

[5] See Cook, Thomas J., Collins, D., and Monast, K., "*Benchmarking Guidebook for North Carolina Community Transportation Systems*," prepared by ITRE for the North Carolina Department of Transportation , revised and updated August 2010.

perform based on the degree of impact they face from four geographic and demographic factors that are outside of their control including:

- Geographic factors—Range of Elevation and Highway Density
- Demographic factors—Population Density and Rural Population Ratio

The use of comparative ratings of CT systems' relative fleet use and productivity enables prioritizing replacement and/or expansion vehicles to CT systems that make the greatest use of, and have the highest productivity of each type of vehicle within their fleets.

The average annual vehicle mileage component utilizes data, by type of vehicle, from the Public Transportation Management System (PTMS). The average annual passengers per hour component utilizes data, by type of vehicle, from Vehicle Utilization Data (VUD) statistics. VUD statistics are collected during two weeks each year. This analysis combined the data from both weeks to help offset any anomalies that may have occurred during either week of the data collection.

Explanation of the Tool

The tool utilizes a series of spreadsheets to compile and calculate data from PTMS and VUD, culminating in one spreadsheet with summary information for each CT system, as shown below.

Figure 21: Example of CT System Spreadsheet Tool

Example System — **Peer Group 4**

Vehicles			Comparative Mileage Assessment				Comparative Pass. Trips per Hour Assessment				Adjustment Factors					
Vehicle Type	Number (adjusted PTMS)	No. of Lift Vehicles (adjusted PTMS)	Average Annual Mileage	Combined Rating--Avg. Ann. Mileage	Minimum Adequate Mileage	Adequate Vehicle Utilization (mileage)	Pass. Trips per Hour (VUD)	Combined Rating--Pass. Trips per Hour	Minimum Adequate Pass/Hr	Adequate Vehicle Utilization (Pass/Hr)	No. in Poor/Fair Condition	% in Poor/Fair Condition	No. Met Useful Life (adj. PTMS)	% Met Useful Life	No. with Maintenance Cost > Twice Median	% with High Maintenance Cost
Minivan	1	0	20,789	4	19,000	Yes	1.02	4	1.00	Yes	0	0%	0	0%	0	0%
Standard/Ctr Aisle Van	3	0	7,618	1	19,000	No	3.52	7	1.75	Yes	3	100%	0	0%	0	0%
Conversion Van	1	0	28,517	6	19,000	Yes	2.12	4	1.75	Yes	0	0%	0	0%	0	0%
Lift Van	4	4	22,013	3	19,000	Yes	2.16	6	1.50	Yes	1	25%	0	0%	0	0%
20 ft LTV																
22 ft LTV	1	1	3,315	1	21,000	No	1.96	2	2.00	No	1	100%	0	0%	0	0%
25 ft LTV																
28 ft LTV																
Bus																
Total	10	5									5	50%	0	0%	0	0%

Percent Lift-Equipped	50%
Percent in Poor/Fair Condition	50%
Percent Met Useful Life	0%
Percent with High Maintenance Cost	0%

Useful Life:
Vans -- 115,000 miles / 6 years
LTVs -- 145,000 miles / 7 years

This example will be used throughout the discussion of the tool. An explanation of each column in the spreadsheet follows. The columns are grouped into four general categories of information:

- Vehicles
- Comparative Mileage Assessment
- Comparative Passenger Trips per Hour Assessment
- Adjustment Factors

Vehicles

This section of the tool has information on the numbers of each type of vehicle and the numbers of each type of vehicle equipped with a lift operated by the CT system. Data are based on the PTMS, adjusted to eliminate vehicles not used in revenue service as well as vehicles that were not in service for the entire analysis year. This analysis focuses on the use of the various types of vehicles in a CT system fleet, not on any individual vehicle.

Figure 22: "Vehicles" Section of the Tool

Vehicles		
Vehicle Type	**Number (adjusted PTMS)**	**No. of Lift Vehicles (adjusted PTMS)**
Minivan	1	0
Standard/Ctr Aisle Van	3	0
Conversion Van	1	0
Lift Van	4	4
20 ft LTV		
22 ft LTV	1	1
25 ft LTV		
28 ft LTV		
Bus		
Total	10	5

Vehicle Type—lists the types of vehicles operated by CT systems—Minivans, Standard/Center Aisle Vans, Conversion Vans, Lift Equipped Vans, 20-foot Light Transit Vehicle (LTV), 22-foot LTV, 25-foot LTV, 28-foot LTV, and Transit Bus. The analysis found that there were an insufficient number of CT systems operating Sedans, Head Start Buses, and Sport Utility Vehicles (SUVs) to include them in the analysis.

Number (adjusted PTMS)—the number of each type of vehicle in operation, adjusted to eliminate vehicles used primarily/only in non-revenue service. These are identified by one or more of the following means:

- "Vehicle Use" codes: "A"—Administrative Vehicle; "S"—Service Vehicle; or "H"—Head Start only. This left only vehicles coded "R"—Revenue Service, or "B"—Backup Vehicle. In this analysis using FY 2009-2010 data, this criterion eliminated 37 vehicles.
- Vehicles with an odometer reading of "0" (or no reading) at the start date (in this case, 10/1/2009). These vehicles were purchased during the analysis year, and were not in service for a full year. This criterion eliminated an additional 224 vehicles.
- Noted as a "Service Vehicle" under Vehicle Type. This eliminated one additional vehicle.

- "Primary Source of Funding" = "Local," i.e., state and/or federal funds were not used for the purchase of the vehicle(s). This criterion eliminated 29 additional vehicles.
- Three additional vehicles were eliminated as a result of entries in the "Comments" field that indicated the vehicles were not in revenue or backup service.

Number of Lift Vehicles (adjusted PTMS)—the number of lift-equipped vehicles from the PTMS after having been adjusted as described above. Note that the percent of the total fleet that is equipped with a lift is provided below the main table.

Comparative Mileage Assessment

This section provides information on the relative use of each type of vehicle, as measured by annual mileage from the PTMS. ***The Combined Ratings—Average Annual Mileage are the basis for determining the level of use for each type of vehicle operated by a transit system. Types of vehicles with high levels of use merit priority for replacement.***

Figure 23: "Comparative Mileage Assessment" Section of the Tool

Vehicles	Comparative Mileage Assessment			
Vehicle Type	Average Annual Mileage	Combined Rating--Avg. Ann. Mileage	Minimum Adequate Mileage	Adequate Vehicle Utilization (mileage)
Minivan	20,789	4	19,000	Yes
Standard/Ctr Aisle Van	7,618	1	19,000	No
Conversion Van	28,517	6	19,000	Yes
Lift Van	22,013	3	19,000	Yes
20 ft LTV				
22 ft LTV	3,315	1	21,000	No
25 ft LTV				
28 ft LTV				
Bus				

Average Annual Mileage—the average (mean) annual mileage for each type of vehicle. The values are calculated by adding the annual mileage for each vehicle of a particular type, and dividing that sum by the number of vehicles of that vehicle type.

Combined Rating—Average Annual Mileage—a number from 1 to 12 is assigned representing the comparative annual mileage for each of a CT system's vehicle types to a measurement group's vehicle types. There are two measurement groups. One measurement group includes **all** vehicles of that type in the state. The second measurement group includes all vehicles of that type in the CT system's **peer group**. The percent difference between the CT system and each measurement group is calculated. Each percent difference is assigned a rating value from 1 to 12. The rating values for each vehicle type are then combined by weighting the peer group rating twice the all vehicles rating. Thus, the **peer group** rating accounts for 2/3 of the Combined

Rating—Average Annual Mileage score, while the **all vehicles** rating accounts for 1/3 of that score. Rating values are assigned as shown in the table below:

Figure 24: Rating System Applied to All Vehicles and to Peer Groups

Value	Description	Meaning
12	> 75% above All Vehicles average or Peer Group average	Highest Priority for receiving replacement vehicle(s)
10	51% to 75% above All Vehicles average or Peer Group average	Very High Priority for receiving replacement vehicle(s)
8	26% to 50% above All Vehicles average or Peer Group average	High Priority for receiving replacement vehicle(s)
6	1% to 25% above All Vehicles average or Peer Group average	Above Average Priority for receiving replacement vehicle(s)
5	At All Vehicles average or Peer Group average	Average Priority for receiving replacement vehicle(s)
4	1% to 25% below All Vehicles average or Peer Group average	Below Average Priority for receiving replacement vehicle(s)
2	26% to 50% below All Vehicles average or Peer Group average	Low Priority for receiving replacement vehicle(s)
1	> 50% below All Vehicles average or Peer Group average	Lowest Priority for receiving replacement vehicle(s)

The Combined Rating—Average Annual Mileage is calculated as follows:

Combined Rating—Avg. Ann. Mileage = (All Vehicles Rating + (Peer Group Rating x 2)) / 3

Having the Peer Group Rating count twice the All Vehicles Rating reflects the importance of excelling within one's peer group as compared to within the statewide fleet. The reason for stressing comparative use within peer groups is that CT systems in each peer group are deemed to experience similar levels of challenges to efficient and effective operations. In addition, placing a high priority on the peer group mitigates the impact from any peer group consistently performing lower than the statewide average.

Minimum Adequate Mileage—minimum annual mileage values for each type of vehicle. Values are calculated by dividing useful life mileage figures used by the NCDOT/PTD by the ten-year anticipated lifetime for a van or LTV, and then rounding the mileage to the nearest 1,000 miles. Minimum values for transit buses are calculated according to whether a bus is classified as having a 350,000 mile/10-year life or a 500,000 mile/12-year life. Minimum adequate mileage values for each type of vehicle are shown in the table below.

Figure 25: Minimum Adequate Mileage Values for Vehicle Types

Vehicle Type	Minimum Annual Adequate Mileage
Minivan	12,000
Standard / Center Aisle Van	12,000
Conversion Van	12,000
Lift Equipped Van	12,000

Vehicle Type	Minimum Annual Adequate Mileage
20’ LTV	15,000
22’ LTV	15,000
25’ LTV	15,000
28’ LTV	15,000
Transit Bus	Per FTA guidelines: 35,000 miles for vehicles with a lifetime minimum of 350,000 miles or 41,667 miles for vehicles with a lifetime minimum of 500,000 miles

Adequate Vehicle Utilization (mileage)—“Yes” if the average annual mileage for a type of vehicle exceeds the Minimum Adequate Mileage; “No” if the average annual mileage for a type of vehicle is less than the Minimum Adequate Mileage.

In the example, the average annual mileage for the system’s minivan, conversion van, lift-equipped vans, and 22-foot LTV were greater than the minimum adequate mileage target values for those types of vehicles. However, the average mileage for the system’s three standard/center aisle vans (7,618 miles) was less than the 12,000 annual miles that would result in fully utilizing those vehicles over a ten-year lifespan.

Comparative Passenger Trips per Hour Assessment

This section provides information on the comparative productivity of each type of vehicle, as measured by passenger trips per hour. The higher the number of passenger trips per hour, the greater the productivity. ***The Combined Ratings—Passenger Trips per Hour are the basis for determining the level of productivity for each type of vehicle operated by a transit system. Types of vehicles with high levels of productivity merit priority for additional vehicles and/or a larger type of vehicle.***

Figure 26: “Comparative Pass. Trips per Hour Assessment” Section of the Tool

Vehicles	Comparative Pass. Trips per Hour Assessment			
Vehicle Type	Pass. Trips per Hour (VUD)	Combined Rating--Pass. Trips per Hour	Minimum Adequate Pass/Hr	Adequate Vehicle Utilization (Pass/Hr)
Minivan	1.02	4	1.00	Yes
Standard/Ctr Aisle Van	3.52	7	1.75	Yes
Conversion Van	2.12	4	1.75	Yes
Lift Van	2.16	6	1.50	Yes
20 ft LTV				
22 ft LTV	1.96	2	2.00	No
25 ft LTV				
28 ft LTV				
Bus				

Passenger Trips per Hour (VUD)—the **median** number of annual passenger trips per hour for each type of vehicle, calculated as the value at the midpoint of all values. The reason for using the median rather than the mean for this statistic is that an analysis of the data found it was skewed by outliers that were significantly above or below the range of most values. When data are skewed, the median provides a better indication of "average" performance than the mean.

Combined Rating—Average (Median) Passenger Trips per Hour—a number from 1 to 12 representing the average annual passenger trips per hour for a CT system's vehicles compared to both the average number of passenger trips per hour for ***all*** vehicles of that type and all vehicles of that type operated by CT systems in its ***peer group*** (refer to Figure 4). The percent difference is calculated from the averages for all vehicles and for vehicles in a peer group. Each CT system vehicle type is assigned a rating value. The rating values are combined, weighting the peer group rating two times the all vehicles rating. Rating values are assigned as described above for Average Annual Mileage.

The Combined Rating—Passenger Trips per Hour is calculated as follows:

Combined Rating—Pass. Trips per Hour = (All Vehicles Rating + (Peer Group Rating x 2)) / 3

Again, the Peer Group Rating counts twice the All Vehicles Rating, reflecting the greater importance of excelling within one's peer group, as CT systems in each Peer Group are deemed to experience similar levels of challenges to efficient and effective operations.

Minimum Adequate Passenger Trips per Hour—minimum passenger trips per hour values for each type of vehicle. Larger capacity vehicles can transport more passengers than smaller capacity vehicles, and can provide a higher number of passenger trips per hour. Therefore, minivans are assigned the lowest minimum adequate passengers per hour value, vans the second-lowest values, and LTVs the highest values.

Figure 27: Values Used for Minimum Adequate Passenger Trips per Hour

Vehicle Type	Minimum Annual Adequate Passengers per Hour
Minivan	1.00
Standard / Center Aisle Van	1.75
Conversion Van	1.75
Lift Equipped Van	1.50
20' LTV	2.00
22' LTV	2.00
25' LTV	2.20
28' LTV	2.25

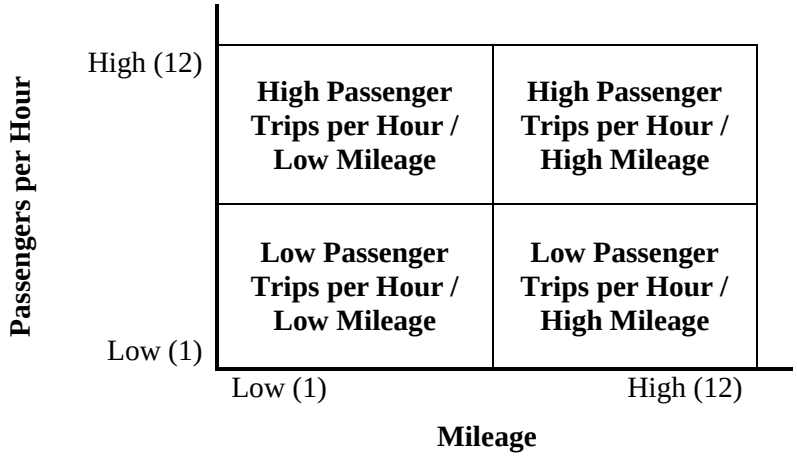
Adequate Vehicle Utilization (passenger trips per hour)—"Yes" if the average number of passengers per hour for a particular type of vehicle exceeds the Minimum Adequate Passenger Trips per Hour; "No" if the average passenger trips per hour for a particular type of vehicle is less than the Minimum Adequate Passenger Trips per Hour.

In the example, the average annual passenger trips per hour for the system's minivan, standard/center aisle vans, conversion van, and lift-equipped vans were greater than the minimum adequate passenger trips per hour target values for those types of vehicles. However, the average annual passenger trips per hour for the system's 22-foot LTV (1.96 passenger trips per hour) was less than the 2.0 average annual passenger trips per hour that would result in meeting the minimum productivity target for that type of vehicle.

Interpreting the Mileage and Passengers per Hour Ratings

There are four possible outcomes when looking at both the combined average annual mileage and passengers per hour ratings for each vehicle type at a CT system, as shown in the following figure.

Figure 28: Combinations of Average Annual Mileage and Passenger Trips per Hour



Each of these outcomes indicates different combinations of vehicle use and productivity, as described below. The specific outcomes for each CT system should serve as the basis for a discussion among the NCDOT/PTD Mobility Development Specialist, CT system management, and consultants developing or updating the system's CTSP. The discussion would involve the circumstances contributing to the mileage and passenger trips per hour outcomes, and the need to change the number and/or type of vehicles in the system's fleet to best address local mobility needs.

High Passengers per Hour; Low Mileage

This outcome indicates vehicles are productive and are not accumulating high mileage to provide a high number of passenger trips. Since vehicles are not accumulating mileage quickly, there may not be a need to replace them more quickly than planned. This situation should be investigated more closely to determine the circumstances responsible for vehicles having relatively low annual mileage. For example, a transit system may operate in a relatively small geographic area, which may result in fewer annual average miles than a system operating in a larger geographic area or that uses vehicles for out-of county trips. Also, vehicles may be operated in a more urban environment and subject to stop-and-start driving conditions, which may result in greater wear-and-tear than on vehicles that operate

for longer distances at a constant speed. These types of conditions highlight the need to determine the specific circumstances contributing to vehicle use patterns.

A high number of passenger trips per hour with relatively low mileage should trigger an investigation to determine if purchasing an expansion vehicle or a larger capacity vehicle is warranted. If a CT system is operating one or more of the larger capacity vehicles under consideration, the use and productivity for that type of vehicle should be examined to determine if existing larger capacity vehicles are as well-used and productive as the smaller type of vehicle. If the larger vehicles are well-used and at least as productive as the smaller vehicles, a larger vehicle may be warranted. If the larger vehicles are not well-used and at least as productive as the smaller vehicles, a larger vehicle is likely not warranted. Of course, before purchasing an expansion vehicle, the system's vehicle utilization should be examined to determine if it might be possible to spread demand more effectively. For example, are vehicles being utilized throughout the span of service, or just during periods of peak demand? If they are used primarily during peak demand periods, could demand be spread over a longer period, resulting in more effective use of the existing fleet? This type of analysis should be performed prior to shifting to a larger vehicle or an expansion vehicle.

High Passengers per Hour; High Mileage
Vehicles are productive and are accumulating relatively high mileage. Since vehicles are accumulating mileage quickly, a closer assessment should be made to determine if replacement vehicles need to be purchased sooner than planned. Also, purchase of an expansion vehicle or a larger capacity vehicle may be warranted. The same type of analysis, assessing the use and productivity levels of larger capacity vehicles operated by the CT system as described for the previous combination, should be utilized to determine if purchase of a larger vehicle may be warranted.

Low Passengers per Hour; Low Mileage
This outcome indicates that vehicles are comparatively under-utilized. Vehicle use in this category indicates lower productivity and less use in service than similar vehicles at other CT systems. This situation bears closer investigation by the NCDOT/PTD staff and/or a consultant to determine if the fleet is over-capitalized with this type of vehicle.

Low Passengers per Hour; High Mileage
Vehicles are comparatively unproductive and are accumulating comparatively high mileage. This represents the least efficient use of vehicle resources. This situation merits investigation by the NCDOT/PTD staff and/or a consultant to determine the reasons for low productivity and high mileage. For example, this type of vehicle may be used to operate many trips to out-of-county destinations. In that case, economies may be achievable by scheduling more passengers on those types of runs and reducing the number of such runs, resulting in more productive use of the fleet.

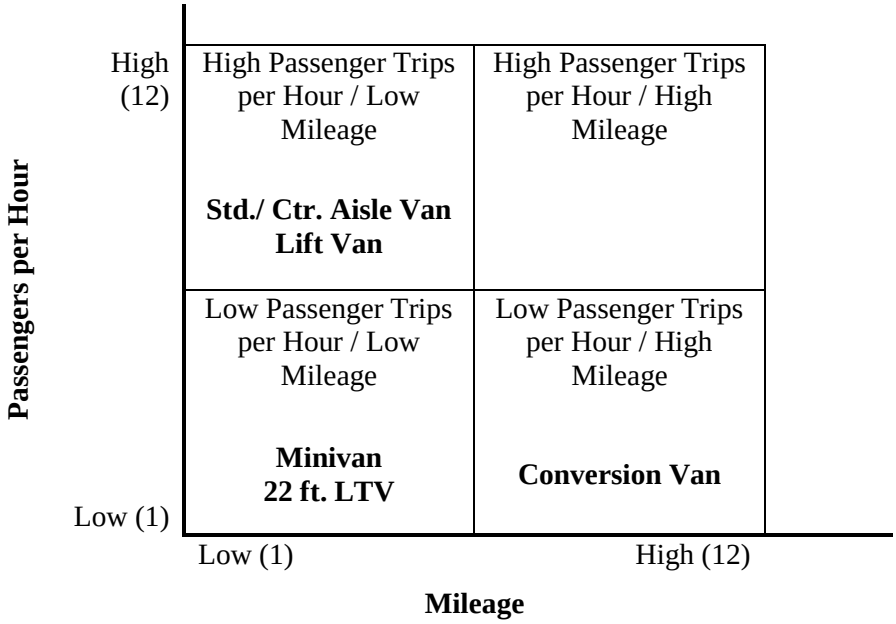
Looking at the outcomes for the various types of vehicles in the example, we find the following:

Figure 29: Combined Ratings for Avg. Annual Mileage and Pass. Trips per Hour—Example System

Vehicle Type	Number	Combined Rating—Avg. Ann. Mileage	Priority for Replacing Vehicles	Combined Rating—Pass. Trips per Hr.	Priority for Replacing Vehicles
Minivan	1	4	Below average	4	Below average
Std./Ctr. Aisle Van	3	1	Lowest priority	7	High priority
Conversion Van	1	6	Above average	4	Below average
Lift Van	4	3	Low priority	6	Above average
22 ft. LTV	1	1	Lowest priority	2	Low priority

Figure 30 illustrates how these combined ratings would fall among the four combinations of outcomes from Figure 8.

Figure 30: Results of Example System, for Vehicle Types



In this example, priorities for replacing vehicles based on both the average annual mileage and the passenger trips per hour ratings would be:

- Minivan—below average priority on both ratings means low likelihood of vehicle replacement prior to the end of vehicle's 10-year lifespan.
- Standard/Center Aisle Van—lowest priority on the basis of mileage, but high priority on the basis of passenger trips per hour. This indicates that these vehicles are productive on relatively short runs. The adjustment factors, to be discussed in the following section, should be examined to determine if the priority should be raised for replacing one or more of this type of vehicle.
- Conversion Van—above average priority on the basis of mileage, but below average priority on the basis of passenger trips per hour. This indicates that this vehicle transports relatively few passenger trips but operates long trip distances. It may be used primarily

for out-of-county trips. The adjustment factors should to be examined to determine if the priority should be raised for replacing this vehicle.

- Lift Van—low priority based on mileage, but above average priority based on passenger trips per hour. Similar to the Standard/Center Aisle Vans, these vehicles are productive on relatively short runs. The adjustment factors will need to be examined to determine if the priority should be raised for replacing one or more of this type of vehicle.
- 22 ft. LTV—lowest priority based on mileage and low priority based on passenger trips per hour. This vehicle is not being used effectively. It sees only limited use (based on the relatively low annual mileage) and is not used productively (based on low passenger trips per hour). A smaller vehicle might be a better option, since the analysis does not indicate that the capacity of this vehicle is being used effectively. Again, an examination of the adjustment factors is warranted to determine if poor vehicle condition, the end of the vehicle's useful life, or high maintenance costs are contributing to the low utilization of this vehicle.

Adjustment Factors

This section provides information that can be used by NCDOT/PTD staff and consultants to adjust the priority for replacing each type of vehicle.

Figure 31: "Adjustment Factors" Section of the Tool

Vehicles	Adjustment Factors					
Vehicle Type	No. in Poor/Fair Condition	% in Poor/Fair Condition	No. Met Useful Life (adj. PTMS)	% Met Useful Life	No. with Maintenance Cost > Twice Median	% with High Maintenance Cost
Minivan	0	0%	0	0%	0	0%
Standard/Ctr Aisle Van	3	100%	0	0%	0	0%
Conversion Van	0	0%	0	0%	0	0%
Lift Van	1	25%	0	0%	0	0%
20 ft LTV						
22 ft LTV	1	100%	0	0%	0	0%
25 ft LTV						
28 ft LTV						
Bus						
Total	5	50%	0	0%	0	0%

Number/Percentage in Poor/Fair Condition—lists the number and percentage of vehicles of each type reported by the CT system as being in Poor or Fair physical condition from the adjusted PTMS data. A high percentage of a particular type of vehicle in poor/fair condition indicates a need to raise the priority for replacing one or more vehicles of that type. Note that the percent of the CT system's fleet that is in poor/fair condition is provided below the main table.

Number/Percentage Met Useful Life—lists the number and percentage of vehicles of each type noted in the PTMS as having mileage or years of service in excess of that required for replacement, typically 115,000 miles or 10 years of service for all types of vans, and 145,000 miles or 10 years of service for LTVs. A high percentage of a particular type of vehicle having met its useful life indicates a need to raise the priority for replacing one or more vehicles of that

type. Note that the percent of the CT system's fleet that has met its useful life is provided below the main table.

Number/Percentage with Maintenance Costs Greater than Twice the Median—lists the number and percentage of vehicles of each type as having had annual maintenance costs of more than twice the median cost for that type of vehicle. This factor was calculated from PTMS data by calculating average (median) maintenance costs for each type of vehicle for the entire state. The median was used rather than the mean since the data had outliers that skewed the mean value. The value of twice the median value was chosen to indicate types of vehicles with significantly higher than average maintenance costs. A high percentage of a particular type of vehicle having experienced costly maintenance indicates a need to raise the priority for replacing one or more vehicles of that type. Note that the percent of the CT system's fleet that had maintenance costs higher than twice the median is provided below the main table.

Figure 32: Annual Average Maintenance Costs by Vehicle Type

Vehicle Type	Code	Minimum	Maximum	Mean	Median	Median x 2
Minivan	4	$0	$4,595	$1,057	$830	$1,660
Standard/Center Aisle Van	1	$0	$5,690	$1,457	$1,130	$2,260
Conversion Van	2	$0	$11,049	$2,265	$1,665	$3,330
Lift Van	3	$0	$9,466	$2,594	$2,047	$4,094
20 ft LTV	6	$95	$4,242	$1,107	$861	$1,722
22 ft LTV	7	$0	$11,216	$2,399	$1,848	$3,696
25 ft LTV	8	$0	$10,898	$2,492	$2,076	$4,152
28 ft LTV	11	$323	$3,130	$904	$628	$1,256
Bus	9	$1,032	$19,976	$4,572	$3,725	$7,450

Applying these adjustment factors to the vehicles in the example results in these outcomes:

- Minivan—no adjustments; replacement remains a low priority and unlikely to occur prior to the end of the vehicle's 10-year lifetime.
- Standard/Center Aisle Van—all indicated to be in Poor/Fair condition, but maintenance costs are not reported as being excessively high. Vehicles should be examined to determine the condition of critical parts, such as the transmission. If critical parts are in poor condition, that could result in raising the priority for replacing one or more of these vehicles. Otherwise, vehicles to be replaced, if warranted, at the end of their useful lives.
- Conversion Van—no adjustment indicated. Therefore, no increase in replacement priority—it remains relatively low. Vehicle to be replaced, if warranted, when it reaches the end of its useful life.
- Lift Vans—one of the four vehicles indicated in Poor/Fair condition. That vehicle should be examined to determine the condition of critical parts, such as the lift. If critical parts are in poor condition, that could result in raising the priority for replacing one of these vehicles. Otherwise, vehicles to be replaced, if warranted, at the end of their useful lives.
- 22 ft. LTV—no adjustment indicated on the basis of vehicle condition, stage in useful life, or maintenance costs. Since this vehicle appears to be under-utilized, a discussion

between NCDOT/PTD staff and CT system management is warranted to assess the reasons for the seeming under-utilization of this vehicle, and to determine if this vehicle is really needed, or if a smaller vehicle might better meet the system's needs.

Other Factors to Be Considered

The final part of the process is to account for other circumstances that may impact the decision on the number and type of vehicles to be purchased, or the relative priority for replacing some vehicles in a CT system's fleet. This part of the process will ideally involve discussion among NCDOT/PTD staff, CT system management, and/or the consultant assigned to develop or update the system's Community Transportation Service Plan (CTSP)

Examples of other types of circumstances that impact fleet size and mix decisions are described below.

Replacement Vehicles

1. **Small fleet—**a CT system may operate a small fleet in which one vehicle has reached the end of its useful life, and must be replaced to provide dependable transportation even though the average mileage for that type of vehicle may be relatively low. For example, if a transit system operates three vehicles of a particular type and one has reached the end of its useful life, it may be necessary to replace that vehicle as there are insufficient other vehicles in service or available as backups to ensure reliable operations. This will need to be determined on a case-by-case basis.

2. **Need for lift-equipped vehicle(s)—**a CT system fleet may not have a sufficient number of lift-equipped vehicles to meet the needs of persons with disabilities. In that case, one or more lift-equipped vehicles may need to be purchased to meet those needs or to achieve a desired target, such as having 50% of each fleet lift-equipped.

Expansion Vehicles or a Shift to a Larger Vehicle

1. **Vehicle considerations:**
   - Fuel type—most vans are gasoline-fueled, and gasoline is the fuel with which most CT systems have the greatest experience. Some vans, as well as many LTVs, are diesel-fueled. CT systems should consider the availability and comparative cost of gasoline vs. diesel or even alternative fuels at their primary fueling locations. Limited diesel fuel supply locations, as well as local costs of diesel vs. gasoline may preclude the purchase of diesel- or alternative-fueled vehicles.

   - Dimensions—some vehicles may be too large to fit within service facilities or roofed areas at trip origins/destinations. For example, a covered passenger loading/ unloading area may have a low height clearance that may preclude the use of tall vehicles, such as conversion vans or LTVs with high roofs. Some driveways may have curves that are too sharp to accommodate large vehicles or vehicles with a large turning radius, which may also preclude using some types of vehicles in those

locations. Some accessible minivans may have low ground clearance that limits their operation on uneven surfaces. CT systems and consultants should check manufacturers' specifications to determine vehicle dimensions, turning radii, approach angle clearance for front and rear overhangs, and other characteristics that may limit where vehicles may be operated.

2. **Operating considerations**:

- Spares—all transit systems need spare vehicles to be used as backups when a vehicle is in the shop for maintenance or repairs, and to meet peak demand. The NCDOT / PTD has typically recommended one spare vehicle per five vehicles in use during the peak period of operation (as determined from Vehicle Utilization Data). However, when various types of vehicles are operated in a fleet, it may not be feasible to have one or more spare vehicles available for each type of vehicle in a fleet.

  Consider appropriate numbers and types of spare vehicles for the example fleet used in the description of the tool. That vehicle mix of that fleet, and recommended spare vehicles are listed below.

Figure 33: Spare Vehicles—Example Fleet

Vehicle Type	Number	Number of Spares
Minivan	1	0
Standard/Center Aisle Van	3	1
Conversion Van	1	0
Lift Van	4	1
22 ft. LTV	1	0
TOTAL	**10**	**2**

  Two spare vehicles are recommended—one Standard/Center Aisle Van, and one Lift Van. Two spare vehicles will provide one spare per each five vehicles. The system operates five vehicles without a lift (1 Minivan, 3 Standard/Center Aisle Vans, and 1 Conversion Van), and five vehicles with a lift (4 Lift Vans and 1 22 ft. LTV). With the recommended spares, there will also be one spare vehicle per five vehicles without a lift, and one spare vehicle per five vehicles with a lift, maintaining the recommended ratio for both of those types of vehicles.

  Systems that out-station vehicles, or base them at various locations within their service area may need additional spare vehicles to ensure that backup vehicles are always available throughout the service area. This consideration applies particularly to regional CT systems whose service area includes multiple counties.

- Passenger demand—the number of passengers that need/desire transportation; the times of peak demand; the number and proportion of passengers with mobility devices to be transported.

  In cases where there is high peak demand but excess transportation capacity during off-peak periods, it may be more efficient to spread peak demand over a longer time

period than to purchase an expansion vehicle to meet the peak demand. Negotiating travel times with customers can help in spreading peak demand over more of the period of service resulting in increased vehicle utilization.

Alternatively, purchasing a larger vehicle may help meet high peak period demand. However, peak period travel patterns should be examined to determine if it is feasible to pick up and drop off more passengers on one or more runs without increasing the travel time excessively for other passengers.

A larger vehicle may also be warranted in situations where there is a need to transport a large proportion of passengers with mobility devices (wheelchairs or scooters) that strains the capabilities of lift-equipped vans. It may increase scheduling efficiency to use a LTV rather than a lift-equipped van when two wheelchair stations are required to avoid having to shift passengers who are not located behind each other in de-boarding order.

- Geographic locations of trip origins and destinations—the concentration or dispersion of trip origins and destinations impacts the type of vehicle that is able to operate at optimal efficiency. Trip origins and/or destinations that are concentrated primarily in a few locations can be served efficiently with higher capacity vehicles. Trips origins and/or destinations that are dispersed throughout the service area may be served more efficiently with lower capacity vehicles. Vehicle capacity should be matched to the numbers of passengers to be transported.

- Scheduling efficiency—the degree to which trips are combined on runs. As a general principal, CT systems should maximize the number of passengers on each trip (within vehicle limits) to maximize the use of vehicle, personnel, and fuel resources.

3. Maintenance and repair considerations:

There are several maintenance and repair considerations that impact vehicle selection, including:

- Maintenance capabilities—vehicles will need to be maintained locally, either by a CT system, or at a local facility. It is important to identify local capabilities to maintain vehicles to avoid purchasing a vehicle that will be difficult or impossible to maintain locally. In addition to having to make costly long-distance trips, lack of local maintenance capabilities can result in a vehicle being out of service for a lengthy period, requiring an additional spare vehicle.

- Special training—maintenance staff may need to receive specialized training to service some types of vehicles or vehicle components, such as diesel engines, a different brand of lift, etc. When staff who possess special skills leave, a CT system will need to have another staff member become trained in those skills. Maintaining sufficient staff who have received special training can be a challenge that should be considered.

- Parts inventory—additional parts inventory and space to store it are likely to be required for each type of vehicles that a CT system operates and maintains. A CT system should determine the inventory needs and associated space requirements for any new or different type of vehicle prior to purchasing such vehicles. The costs of maintaining an adequate parts inventory or of providing storage space for it should also be determined, to make a determination on the feasibility of purchasing such vehicles.

- Special tools—special tools may be required to support some types of vehicles or accessories. A CT system should determine the need for, and cost of any special tools that may need to be purchased to maintain any new type of vehicle or accessory prior to making a decision to purchase that item.

4. **Cost considerations:**
   - Life-cycle costs—maintenance and operations costs (fuel, insurance, driver wages, etc.) need to be considered in addition to vehicle purchase price to determine the full cost of owning and operating each type of vehicle. CT systems should purchase and operate only the types of vehicles that they can reasonably afford over the full expected lifetime of the vehicle. Conducting this type of cost analysis will help to avoid purchasing a type of vehicle that has a low purchase cost but high operating and/or maintenance costs. A vehicle is purchased once; operating and maintenance costs occur throughout a vehicle's lifetime.

     For example, LTVs are not only more expensive to purchase than a van, they are also more expensive to operate. LTVs are not appropriate for long trips with few passengers, a common type of trip for CT systems in remote, rural areas. Also, collision and comprehensive insurance costs increase based on increased value of vehicles.

   - Commercial Driver License (CDL) requirement—drivers of vehicles seating more than 15 passengers plus the driver, or vehicles with a gross vehicle weight rating (GVWR) of more than 26,000 pounds must have a CDL. There may not be many drivers with a CDL in a CT system's service area. Also, a CT system may have to compete with other transportation providers for drivers with a CDL, resulting in the need to pay those drivers at a higher rate than drivers with only a regular license. Before purchasing a vehicle that will require the driver to possess a CDL, a CT system should determine the availability of, and going wages for such drivers. If drivers with a CDL are in short supply, or wages are at a prohibitive level, that may preclude the purchase of vehicles with a capacity of 15 or more passengers (plus driver).

Statewide Prioritization

The previous analysis has provided an assessment of a single CT system. Another aspect of fleet size is prioritizing vehicle purchases among all CT systems. The spreadsheets used to compile

information used in the tool can also be utilized to provide guidance on prioritizing vehicle purchases among CT systems.

Vehicles would be replaced according to replacement schedules developed as part of the Community Transportation Service Plan (CTSP). If sufficient federal and state funding were available to allow purchasing additional vehicles to replace a greater number of vehicles that have reached the end of their useful life or for fleet expansion, the information compiled for the tool can provide assistance to NCDOT/PTD staff to prioritize those purchases.

As in the tool, data for both **average annual mileage** and **average passenger trips per hour** are available. Examining the average annual mileage for each vehicle type reveals which CT systems put the most mileage on each vehicle type, indicating the relative level of vehicle use. Examining the average passenger trips per hour for each vehicle type reveals which CT systems achieved the highest productivity for each vehicle type. Systems with the greatest level of use would merit consideration for replacement of additional vehicles; systems with the highest productivity would merit consideration for purchase of expansion and/or higher capacity vehicles.

As an example, Figure 34 provides information on **average annual mileage** for all CT systems that reported using Lift Equipped Vans in revenue service during FY 2010. One system received a Combined Rating of 10, and four a 9. Those systems put substantially more mileage than average on their Lift Equipped Vans during FY 2010, and should receive high priority for any replacement Lift Equipped Van purchases. Systems receiving a Combined Rating of 4 or less would not receive priority for replacing additional Lift Equipped Vans, as their use of that vehicle type does not warrant additional vehicles.

Figure 34: Combined Ratings—Average Annual Mileage, Lift Equipped Van

System	Peer Group	No. Vehicles	Avg. Ann. Mileage	All Vehicles Average	Comparison--All Vehicles	Rating--All Vehicles	Peer Group Average	Comparision--Peer Group	Rating--Peer Group	Combined Rating
Duplin County	4	4	47,336	30,772	54%	10	27,442	72%	10	10
Greene County	4	3	42,862	30,772	39%	8	27,442	56%	10	9
Ashe County	5	8	35,014	30,772	14%	6	22,915	53%	10	9
Lenoir County	3	7	47,203	30,772	53%	10	33,853	39%	8	9
Wilson County	2	7	51,037	30,772	66%	10	34,104	50%	8	9
Carteret County	3	7	43,300	30,772	41%	8	33,853	28%	8	8
Gaston County	2	7	42,804	30,772	39%	8	34,104	26%	8	8
Columbus County	4	6	35,037	30,772	14%	6	27,442	28%	8	7
Gates County	4	2	34,930	30,772	14%	6	27,442	27%	8	7
Cherokee County	5	5	30,143	30,772	-2%	4	22,915	32%	8	7
Harnett County	3	8	39,240	30,772	28%	8	33,853	16%	6	7
Kerr Area Transportation Authority	3	26	42,224	30,772	37%	8	33,853	25%	6	7
Onslow United Transit System Inc.	2	10	40,513	30,772	32%	8	34,104	19%	6	7
Choanoke Public Transportation Authority	4	5	32,965	30,772	7%	6	27,442	20%	6	6
Craven County	4	10	32,338	30,772	5%	6	27,442	18%	6	6
Pender Adult Services Inc.	4	7	34,046	30,772	11%	6	27,442	24%	6	6
Buncombe County	3	30	35,947	30,772	17%	6	33,853	6%	6	6
City of Rocky Mount	3	25	36,160	30,772	18%	6	33,853	7%	6	6
Dare County	3	4	36,448	30,772	18%	6	33,853	8%	6	6
Johnston County	3	8	36,612	30,772	19%	6	33,853	8%	6	6
Lincoln County	3	8	35,970	30,772	17%	6	33,853	6%	6	6
Richmond Interagency Transportation Inc.	3	3	38,569	30,772	25%	6	33,853	14%	6	6
Goldsboro-Wayne Transportation Authority	2	13	38,459	30,772	25%	6	34,104	13%	6	6
Iredell County	2	17	34,729	30,772	13%	6	34,104	2%	6	6
Union County	2	9	38,434	30,772	25%	6	34,104	13%	6	6
Alleghany County	5	5	23,307	30,772	-24%	4	22,915	2%	6	5
Jackson County	5	2	24,266	30,772	-21%	4	22,915	6%	6	5
Mitchell County Transportation Authority	5	3	25,944	30,772	-16%	4	22,915	13%	6	5
Polk County Transportation Authority	5	4	26,164	30,772	-15%	4	22,915	14%	6	5
Albermarle Regional Health Services	4	14	29,626	30,772	-4%	4	27,442	8%	6	5
Cape Fear Public Transportation Authority	1	22	29,053	30,772	-6%	4	26,187	11%	6	5
Anson County	4	5	27,505	30,772	-11%	4	27,442	0%	5	5
Macon County	4	4	27,419	30,772	-11%	4	27,442	0%	5	5
Moore County	3	16	33,581	30,772	9%	6	33,853	-1%	4	5
Caswell County	4	3	25,141	30,772	-18%	4	27,442	-8%	4	4
Rutherford County	4	13	25,843	30,772	-16%	4	27,442	-6%	4	4
Washington County	4	2	24,751	30,772	-20%	4	27,442	-10%	4	4
Wilkes Transportation Authority	4	12	25,974	30,772	-16%	4	27,442	-5%	4	4
Robeson County	3	6	25,886	30,772	-16%	4	33,853	-24%	4	4
Rockingham County	3	14	28,950	30,772	-6%	4	33,853	-14%	4	4
Transportation Admin. Of Cleveland Co. Inc	3	22	26,016	30,772	-15%	4	33,853	-23%	4	4
Alamance County	2	14	30,298	30,772	-2%	4	34,104	-11%	4	4
Pitt County	2	13	25,658	30,772	-17%	4	34,104	-25%	4	4
Durham County	1	12	25,589	30,772	-17%	4	26,187	-2%	4	4
Graham County	5	4	22,687	30,772	-26%	2	22,915	-1%	4	3
Madison County	5	2	21,471	30,772	-30%	2	22,915	-6%	4	3
Swain County Focal Point on Aging Inc.	5	4	20,181	30,772	-34%	2	22,915	-12%	4	3
Beaufort County Developmental Center Inc.	4	4	22,604	30,772	-27%	2	27,442	-18%	4	3
Mountain Projects Inc.	4	9	21,908	30,772	-29%	2	27,442	-20%	4	3
Sampson County	4	4	22,013	30,772	-28%	2	27,442	-20%	4	3
Randolph County Sr. Adults Association Inc	3	9	23,097	30,772	-25%	4	33,853	-32%	2	3
Western Piedmont Regional Transp. Authori	3	11	25,113	30,772	-18%	4	33,853	-26%	2	3
Lee County	2	8	24,689	30,772	-20%	4	34,104	-28%	2	3
Rowan County	2	11	23,980	30,772	-22%	4	34,104	-30%	2	3
Avery County	5	2	17,053	30,772	-45%	2	22,915	-26%	2	2
Transylvania County	5	3	16,354	30,772	-47%	2	22,915	-29%	2	2
Bladen County	4	2	18,389	30,772	-40%	2	27,442	-33%	2	2
Brunswick Transit System Inc.	4	3	17,718	30,772	-42%	2	27,442	-35%	2	2
Martin County	4	6	19,533	30,772	-37%	2	27,442	-29%	2	2
Scotland County	3	2	21,793	30,772	-29%	2	33,853	-36%	2	2
Stanly County	3	4	22,341	30,772	-27%	2	33,853	-34%	2	2
Western Carolina Community Action Inc.	3	3	17,820	30,772	-42%	2	33,853	-47%	2	2
Mecklenburg County	1	6	16,871	30,772	-45%	2	26,187	-36%	2	2
Clay County	5	4	14,634	30,772	-52%	1	22,915	-36%	2	2
Yancey County Transportation Authority	5	3	11,836	30,772	-62%	1	22,915	-48%	2	2
AppalCART	4	7	14,677	30,772	-52%	1	27,442	-47%	2	2
McDowell County Transp. Planning Board I	5	4	10,404	30,772	-66%	1	22,915	-55%	1	1
Tyrrell County	4	1	13,087	30,772	-57%	1	27,442	-52%	1	1

Figure 35 provides information on **average passenger trips per hour** for all CT systems that reported using Lift Equipped Vans in revenue service during FY 2010. Two systems received a Combined Rating of 12, one system an 11, and four a 9. Those systems achieved substantially higher productivity than average with their Lift Equipped Vans during FY 2010, and should receive high priority for any expansion Lift Equipped Van purchases. Also, those systems should be considered first for purchase of a larger vehicle, such as a lift-equipped 20-foot LTV. Systems receiving a Combined Rating of 4 or less would not receive priority for purchasing additional Lift Equipped Vans or for purchasing a larger type of vehicle, as their use of Lift Equipped Vans does not warrant additional vehicles.

Figure 35: Combined Ratings—Average Passenger Trips per Hour, Lift Equipped Van

System	Peer Group	No. Vehicles	Avg. Pass. Per Hour	All Vehicles Median	Comparison--All Vehicles	Rating--All Vehicles	Peer Group Median	Comparision--Peer Group	Rating--Peer Group	Combined Rating
Scotland County Area Transit System	3	3	3.84	2.01	91%	12	1.69	127%	12	12
Riverlight Transit	4	2	3.84	2.01	91%	12	2.16	78%	12	12
McDowell Transit	5	5	3.53	2.01	76%	12	2.17	63%	10	11
RCATS--Randolph County	3	10	2.85	2.01	42%	8	1.69	69%	10	9
South East Area Transit System of Robeson County	3	5	2.77	2.01	38%	8	1.69	64%	10	9
Transportation Administration of Cleveland County	3	22	2.66	2.01	32%	8	1.69	57%	10	9
AppalCART	4	8	3.24	2.01	61%	10	2.16	50%	8	9
EBCI Transit	5	3	2.99	2.01	49%	8	2.17	38%	8	8
Brunswick Transit System Inc.	4	6	2.94	2.01	46%	8	2.16	36%	8	8
Greene County Transportation	4	3	2.92	2.01	45%	8	2.16	35%	8	8
Duplin County Transportation	4	12	2.91	2.01	45%	8	2.16	35%	8	8
Transylvania County Transportation	5	3	2.91	2.01	45%	8	2.17	34%	8	8
Hoke Area Transit Services	4	7	2.88	2.01	43%	8	2.16	33%	8	8
Gates County Inter-Regional Transportation System	4	2	2.85	2.01	42%	8	2.16	32%	8	8
Mitchell County Transportation Authority	5	8	2.84	2.01	41%	8	2.17	31%	8	8
Graham County Transit	5	4	2.82	2.01	40%	8	2.17	30%	8	8
Cherokee County Transit	5	8	2.74	2.01	36%	8	2.17	26%	8	8
Mecklenburg County	1	4	2.34	2.01	16%	6	1.63	44%	8	7
Stanly County Umbrella Service Agency	3	7	2.35	2.01	17%	6	1.69	39%	8	7
Lenoir County Transit	3	10	2.32	2.01	15%	6	1.69	37%	8	7
Gaston County ACCESS	2	16	2.63	2.01	31%	8	2.14	23%	6	7
Inter-County Public Transportation Authority	4	25	2.21	2.01	10%	7	2.16	2%	6	6
Craven Area Rural Transit System	4	12	2.20	2.01	9%	7	2.16	2%	6	6
Martin County Transit	4	7	2.19	2.01	9%	7	2.16	1%	6	6
Choanoke Public Transportation Authority	4	9	2.18	2.01	8%	7	2.16	1%	6	6
Carteret County Area Transportation System	3	10	2.09	2.01	4%	6	1.69	24%	6	6
Iredell County Area Transportation System	2	23	2.51	2.01	25%	6	2.14	17%	6	6
County of Lee Transit	2	4	2.39	2.01	19%	6	2.14	12%	6	6
Polk County Transportation Authority	5	4	2.39	2.01	19%	6	2.17	10%	6	6
Wilson County Transportation Services	2	16	2.26	2.01	12%	6	2.14	6%	6	6
Cabarrus County Transportation Services	2	18	2.21	2.01	10%	6	2.14	3%	6	6
Buncombe County / Mountain Mobility	3	30	2.01	2.01	0%	5	1.69	19%	6	6
Caswell County Division of Transportation	4	3	2.16	2.01	7%	7	2.16	0%	5	6
Sampson Area Transportation	4	7	2.16	2.01	7%	7	2.16	0%	5	6
ACCESS	1	13	1.93	2.01	-4%	4	1.63	18%	6	5
Richmond Interagency Transportation, Inc.	3	4	1.94	2.01	-3%	4	1.69	15%	6	5
Ashe County Transportation Authority	5	9	2.17	2.01	8%	6	2.17	0%	5	5
Goldsboro-Wayne Transportation Authority	2	16	2.14	2.01	6%	6	2.14	0%	5	5
Chatham Transit Network	4	13	2.11	2.01	5%	7	2.16	-2%	4	5
Guilford County	1	25	1.63	2.01	-19%	4	1.63	0%	5	5
Harnett Area Rural Transit System	3	4	1.69	2.01	-16%	4	1.69	0%	5	5
Kerr Area Transportation Authority	3	62	1.69	2.01	-16%	4	1.69	0%	5	5
Onslow United Transit System Inc.	2	10	2.04	2.01	1%	6	2.14	-5%	4	5
Beaufort Area Transit System	4	4	2.00	2.01	0%	6	2.16	-7%	4	5
Union County Transportation	2	10	2.00	2.01	0%	5	2.14	-7%	4	4
Anson County Transportation System	4	5	1.96	2.01	-2%	5	2.16	-9%	4	4
Wilkes Transportation Authority	4	29	1.82	2.01	-9%	5	2.16	-16%	4	4
Macon County Transit	4	6	1.78	2.01	-11%	5	2.16	-18%	4	4
Columbus County Transportation	4	14	1.67	2.01	-17%	5	2.16	-23%	4	4
Hyde County Transit	4	2	1.66	2.01	-17%	5	2.16	-23%	4	4
Pender Adult Services	4	6	1.66	2.01	-17%	5	2.16	-23%	4	4
Western Piedmont Regional Transit Authority	3	26	1.66	2.01	-17%	4	1.69	-2%	4	4
Tar River Transit	3	27	1.65	2.01	-18%	4	1.69	-2%	4	4
Rockingham County Council on Aging	3	14	1.60	2.01	-20%	4	1.69	-5%	4	4
Cape Fear Public Transportation Authority	1	27	1.51	2.01	-25%	4	1.63	-7%	4	4
Person Area Transportation System	3	6	1.53	2.01	-24%	4	1.69	-9%	4	4
Jackson County Transit	5	5	1.79	2.01	-11%	4	2.17	-18%	4	4
Pitt Area Transit System	2	15	1.68	2.01	-16%	4	2.14	-21%	4	4
Wake County	1	37	1.47	2.01	-27%	2	1.63	-10%	4	3
Johnston County Area Transit System	3	6	1.49	2.01	-26%	2	1.69	-12%	4	3
Transportation Lincoln County	3	8	1.47	2.01	-27%	2	1.69	-13%	4	3
Apple Country Transportation	3	13	1.46	2.01	-27%	2	1.69	-14%	4	3
Moore County Transportation Service	3	18	1.42	2.01	-29%	2	1.69	-16%	4	3
Rowan Transit System	2	13	1.58	2.01	-21%	4	2.14	-26%	2	3
Alamance County Transportation Authority	2	17	1.57	2.01	-22%	4	2.14	-27%	2	3
Mountain Projects Inc. / Haywood Public Transit	4	8	1.47	2.01	-27%	3	2.16	-32%	2	2
Rutherford County Transit Department	4	16	1.47	2.01	-27%	3	2.16	-32%	2	2
Tyrrell County Senior & Disabled Transp. System	4	1	1.35	2.01	-33%	3	2.16	-38%	2	2
Alleghany in Motion	5	5	1.43	2.01	-29%	2	2.17	-34%	2	2
Yadkin Valley Economic Development District, Inc.	3	35	1.11	2.01	-45%	2	1.69	-34%	2	2
Yancey County Transportation Authority	5	3	1.20	2.01	-40%	2	2.17	-45%	2	2
Swain Public Transit	5	4	1.12	2.01	-44%	2	2.17	-48%	2	2
Avery County Transportation Authority	5	4	1.02	2.01	-49%	2	2.17	-53%	1	1
Clay County Transportation	5	6	0.99	2.01	-51%	1	2.17	-54%	1	1
Dare County Transportation System	3	5	0.71	2.01	-65%	1	1.69	-58%	1	1
Madison County	5	3	0.50	2.01	-75%	1	2.17	-77%	1	1

Another way to compare vehicle use and productivity is by peer group. Sorting the data by peer group provides a quick means to compare use and productivity for different types of vehicles reported by all CT systems in a peer group. Figure 36 provides comparative ratings of average annual mileage for all vehicle types reported by CT systems in peer group 2.

Figure 36: Combined Ratings—Average Annual Mileage, All Vehicle Types, Peer Group 2

Peer Group 2										
Code	**Vehicle Type**	**System**	**Avg. Ann. Mileage**	**All Vehicles Average**	**Comparison--All Vehicles**	**Rating--All Vehicles**	**Peer Group Average**	**Comparision--Peer Group**	**Rating--Peer Group**	**Combined Rating**
1	Std./Ctr. Aisle Van	Lee County	23,330	22,479	4%	6	10,218	128%	12	10
		Rowan County	13,681	22,479	-39%	2	10,218	34%	8	6
		Davidson County	5,539	22,479	-75%	1	10,218	-46%	2	2
		Pitt County	5,486	22,479	-76%	1	10,218	-47%	2	2
2	Conversion Van	Wilson County	41,424	25,408	63%	10	26,792	55%	10	10
		Onslow United Transit System Inc.	41,806	25,408	65%	10	26,792	56%	10	10
		Union County	33,055	25,408	30%	8	26,792	23%	6	7
		Rowan County	29,836	25,408	17%	6	26,792	11%	6	6
		Lee County	26,190	25,408	3%	6	26,792	-2%	4	5
		Pitt County	5,947	25,408	-77%	1	26,792	-78%	1	1
3	Lift Equipped Van	Wilson County	51,037	30,772	66%	10	34,104	50%	8	9
		Gaston County	42,804	30,772	39%	8	34,104	26%	8	8
		Onslow United Transit System Inc.	40,513	30,772	32%	8	34,104	19%	6	7
		Goldsboro-Wayne Transportation Authority	38,459	30,772	25%	6	34,104	13%	6	6
		Union County	38,434	30,772	25%	6	34,104	13%	6	6
		Iredell County	34,729	30,772	13%	6	34,104	2%	6	6
		Alamance County	30,298	30,772	-2%	4	34,104	-11%	4	4
		Pitt County	25,658	30,772	-17%	4	34,104	-25%	4	4
		Lee County	24,689	30,772	-20%	4	34,104	-28%	2	3
		Rowan County	23,980	30,772	-22%	4	34,104	-30%	2	3
4	Minivan	Union County	34,570	26,452	31%	8	19,641	76%	12	11
		Goldsboro-Wayne Transportation Authority	27,550	26,452	4%	6	19,641	40%	8	7
		Onslow United Transit System Inc.	23,731	26,452	-10%	4	19,641	21%	6	5
		Iredell County	14,064	26,452	-47%	2	19,641	-28%	2	2
		Davidson County	10,929	26,452	-58%	1	19,641	-44%	2	2
		Alamance County	9,170	26,452	-65%	1	19,641	-53%	1	1
		Rowan County	5,881	26,452	-78%	1	19,641	-70%	1	1
		Gaston County	5,863	26,452	-78%	1	19,641	-70%	1	1
6	20' LTV	Onslow United Transit System Inc.	46,278	31,975	45%	8	40,027	16%	6	7
		Goldsboro-Wayne Transportation Authority	36,901	31,975	15%	6	40,027	-8%	4	5
7	22' LTV	Goldsboro-Wayne Transportation Authority	41,724	28,720	45%	8	31,584	32%	8	8
		Gaston County	37,684	28,720	31%	8	31,584	19%	6	7
		Rowan County	28,919	28,720	1%	6	31,584	-8%	4	5
		Davidson County	27,271	28,720	-5%	4	31,584	-14%	4	4
		Iredell County	21,200	28,720	-26%	2	31,584	-33%	2	2
8	25' LTV	Gaston County	49,605	29,503	68%	10	36,254	37%	8	9
		Davidson County	30,168	29,503	2%	6	36,254	-17%	4	5
		Iredell County	30,473	29,503	3%	6	36,254	-16%	4	5
		Alamance County	32,265	29,503	9%	6	36,254	-11%	4	5
		Pitt County	23,690	29,503	-20%	4	36,254	-35%	2	3

Similarly, Figure 37 provides comparative ratings of average passenger trips per hour for all vehicle types reported by CT systems in peer group 2.

Figure 37: Combined Ratings—Average Passenger Trips per Hour, All Vehicle Types, Peer Group 2

Vehicle Type	System	No. Vehicles	Avg. Pass. Per Hour	All Vehicles Median	Comparison--All Vehicles	Rating--All Vehicles	Peer Group Median	Comparision--Peer Group	Rating--Peer Group	Combined Rating
Std./Ctr. Aisle Van	Rowan Transit System	3	3.22	2.26	42%	8	1.38	133%	12	11
	County of Lee Transit	13	2.78	2.26	23%	6	1.38	101%	12	10
	Wilson County Transportation System	1	1.95	2.26	-14%	4	1.38	41%	8	7
	Pitt Area Transit System	1	0.80	2.26	-65%	1	1.38	-42%	2	2
	Orange Public Transportation	1	0.72	2.26	-68%	1	1.38	-48%	2	2
	Davidson County Transportation System	1	0.36	2.26	-84%	1	1.38	-74%	1	1
Conversion Van	Rowan Transit System	6	3.43	2.50	37%	8	2.28	50%	8	8
	Iredell County Area Transportation System	1	2.87	2.50	15%	6	2.28	26%	8	7
	Cabarrus County Transportation Services	3	2.40	2.50	-4%	4	2.28	5%	6	5
	Onslow United Transit System Inc.	3	2.33	2.50	-7%	4	2.28	2%	6	5
	Union County Transportation	6	2.28	2.50	-9%	4	2.28	0%	5	5
	Gaston County ACCESS	2	2.08	2.50	-17%	4	2.28	-9%	4	4
	Pitt Area Transit System	4	1.98	2.50	-21%	4	2.28	-13%	4	4
	Wilson County Transportation System	2	1.75	2.50	-30%	2	2.28	-23%	4	3
	Orange Public Transportation	3	1.19	2.50	-52%	1	2.28	-48%	2	2
Lift Equipped Van	Gaston County ACCESS	16	2.63	2.01	31%	8	2.14	23%	6	7
	Iredell County Area Transportation System	23	2.51	2.01	25%	6	2.14	17%	6	6
	County of Lee Transit	4	2.39	2.01	19%	6	2.14	12%	6	6
	Wilson County Transportation Services	16	2.26	2.01	12%	6	2.14	6%	6	6
	Cabarrus County Transportation Services	18	2.21	2.01	10%	6	2.14	3%	6	6
	Goldsboro-Wayne Transportation Authority	16	2.14	2.01	6%	6	2.14	0%	5	5
	Onslow United Transit System Inc.	10	2.04	2.01	1%	6	2.14	-5%	4	5
	Union County Transportation	10	2.00	2.01	0%	5	2.14	-7%	4	4
	Pitt Area Transit System	15	1.68	2.01	-16%	4	2.14	-21%	4	4
	Rowan Transit System	13	1.58	2.01	-21%	4	2.14	-26%	2	3
	Alamance County Transportation Authority	17	1.57	2.01	-22%	4	2.14	-27%	2	3
Minivan	Davidson County Transportation System	1	2.50	1.03	143%	12	1.12	123%	12	12
	Iredell County Area Transportation System	2	1.96	1.03	90%	12	1.12	75%	10	11
	Union County Transportation	6	1.85	1.03	80%	12	1.12	65%	10	11
	County of Lee Transit	1	1.24	1.03	20%	6	1.12	11%	6	6
	Rowan Transit System	1	1.00	1.03	-3%	4	1.12	-11%	4	4
	Onslow United Transit System Inc.	2	0.98	1.03	-5%	4	1.12	-13%	4	4
	Alamance County Transportation Authority	2	0.90	1.03	-13%	4	1.12	-20%	4	4
	Goldsboro-Wayne Transportation Authority	1	0.58	1.03	-44%	2	1.12	-48%	2	2
20' LTV	Union County Transportation	1	2.72	2.67	2%	6	2.67	2%	6	6
	Onslow United Transit System Inc.	2	2.67	2.67	0%	5	2.67	0%	5	5
	Goldsboro-Wayne Transportation Authority	2	2.56	2.67	-4%	4	2.67	-4%	4	4
22' LTV	Iredell County Area Transportation System	2	4.50	3.01	50%	8	2.59	74%	10	9
	Orange Public Transportation	1	2.68	3.01	-11%	4	2.59	3%	6	5
	Davidson County Transportation System	4	2.64	3.01	-12%	4	2.59	2%	6	5
	Goldsboro-Wayne Transportation Authority	3	2.54	3.01	-16%	4	2.59	-2%	4	4
	Rowan Transit System	5	2.33	3.01	-23%	4	2.59	-10%	4	4
	Gaston County ACCESS	4	2.24	3.01	-26%	2	2.59	-14%	4	3
25' LTV	Iredell County Area Transportation System	3	4.81	3.10	55%	10	2.81	71%	10	10
	Orange Public Transportation	7	3.43	3.10	11%	6	2.81	22%	6	6
	Davidson County Transportation System	8	3.09	3.10	0%	5	2.81	10%	6	6
	Gaston County ACCESS	16	2.54	3.10	-18%	4	2.81	-10%	4	4
	Alamance County Transportation Authority	9	2.22	3.10	-28%	2	2.81	-21%	4	3
	Pitt Area Transit System	2	1.39	3.10	-55%	1	2.81	-51%	1	1

These data can also be used to compare relative use and productivity across different types of vehicles. For example, the highest Combined Rating was a 12 for a minivan for Davidson County Transportation System. Other CT systems and vehicle types with high Combined Ratings include Rowan Transit System, and COLTS for Standard/Center Aisle Vans, ICATS and Union County Transportation for Minivans, and ICATS for 25-foot LTVs. NCDOT/PTD staff

can utilize the statewide data and the peer group data to better inform their prioritization of replacement and expansion vehicles.

Procedures to Compile Data for the Tool

This section describes the process to compile data used in the tool to evaluate Community Transportation (CT) system fleet size and mix. Data are from two sources—(1) the Public Transportation Management System (PTMS), and (2) Vehicle Utilization Data (VUD). PTMS data are compiled annually. VUD data are also compiled annually, but only during one week in April and one week in August.

The data are used in the spreadsheet tool as part of a three-phase process that (1) uses annual vehicle mileage from the PTMS to determine and assess vehicle use, (2) uses annual passengers per hour from the two VUD periods to determine and assess vehicle productivity, and (3) considers other factors (vehicle condition, numbers of vehicles past useful life, and high maintenance expenses) to develop recommendations for replacement and/or expansion vehicles.

Vehicles are assessed by type (center-aisle van, conversion van, lift-equipped van, minivan, etc.), and can be compared both on the basis of all CT systems operating each type of vehicle, and within peer groups that were developed for, and used in benchmarking performance on annual operating statistics. An outline of the process follows.

Average Annual Mileage from PTMS Data

The purpose of these calculations is to provide the basis for an assessment of vehicle use, i.e., average annual mileage is an indicator of vehicle use. The greater the average annual mileage for a vehicle type, the greater the use.

1. Download PTMS vehicle information including:
    - Grantee ID
    - Grantee Legal Name
    - Model Year
    - Model
    - VIN Number
    - Vehicle Type
    - Vehicle Code
    - Seating Capacity
    - Wheelchair Stations
    - Vehicle Use
    - Physical Condition
    - Mechanical Condition
    - FY 20__ Expense – Preventive Vehicle Maint. & Repairs
    - 10/1/20__ Odometer Reading (end of year reading)
    - 10/1/20__ Odometer Reading (start of year reading)
    - Annual Miles

- Projected Year Vehicle will meet Useful Life
- Projected Year of Replacement Request
- Comments

2. Add a column and enter the peer group for each system (if not present).

3. Save the spreadsheet as a master, and copy the information to a working spreadsheet.

4. Identify and delete or hide records for vehicles with low mileage that are used primarily/only in non-revenue service. These are identified by one or more of the following means:
   - "Vehicle Use" coded: "A"—Administrative Vehicle; "S"—Service Vehicle; or "H"—Head Start only. This will leave only vehicles coded "R"—Revenue Service, or "B"—Backup Vehicle. This eliminated 37 vehicles from the FY 2010 data.
   - Vehicles with an odometer reading of "0" (or no reading) at the start date (in this case, 10/1/2009). This eliminated 224 additional vehicles that were not in use for the full year. Only vehicles that were in service for the full year are included in the calculations to provide a more uniform basis for comparing vehicle mileage.
   - Noted as a "Service Vehicle" under Vehicle Type. This eliminated 1 additional vehicle.
   - "Primary Source of Funding" = "Local". This eliminated 29 additional vehicles.
   - Three additional vehicles were eliminated as a result of information that was provided in the "Comments" field.

   A total of 296 vehicles were identified and eliminated from further calculations using the FY 2010 PTMS as a result of this step.

5. Copy the adjusted data (to be referred to as "Adjusted PTMS" data into a new spreadsheet and sort the data in the new spreadsheet by Vehicle Code.

6. From the sorted PTMS data, first calculate values to be used to identify vehicle types from **all systems** with high and low average annual mileage, as follows:
   - Copy the information for all vehicles of each Vehicle Code into separate spreadsheets. There are 12 Vehicle Codes, which will result in 12 spreadsheets, each with the data for one vehicle type.
   - Calculate the Mean and Median and identify the Minimum and Maximum values the "Annual Miles" column for each vehicle type. MS Excel functions can be used to make those calculations.
   - Review the data to determine if outliers are present. Outliers are values that are much larger or smaller than the Mean or Median values. If there are wide ranges in the data from the Mean or Median values, i.e., the minimum and maximum values are far from the Mean or Median, use the **Median** for further calculations. If the maximum and minimum data are clustered near the Mean or Median values, use the **Mean** for further calculations.
   - After determining whether the Mean or the Median values will be used for further calculations, copy the appropriate Mean or Median values into a summary table in a new worksheet.

7. Next, in a new spreadsheet, calculate the Mean, Median, Minimum, and Maximum values for "Annual Miles" for each **Vehicle Code by Peer Group**.
   - Sort the records by Peer Group (there are five Peer Groups).
   - Copy the records for each Peer Group into a separate worksheet.
   - For each Peer Group, sort the records first by Vehicle Code and then by Annual Miles.
   - Insert four rows between records of different vehicle types, unless there are less than four records for any particular vehicle type. In that case, insert only one row.
   - Calculate the Mean, Median, Minimum, and Maximum values for each type of vehicle using the blank rows that you inserted. Do not perform calculations for vehicle types for which there are less than four records. If there are less than four records, there are too few records available to calculate meaningful values for the Mean or Median, and Minimum and Maximum values.
   - If it was determined in the previous step that most values were clustered near the Mean and that the Mean provides an acceptable average value, use the **Mean** for further calculations of each Vehicle Code by Peer Group. If the previous step determined that the Median provided a better measure of the average value, use the **Median** for further calculations of each Vehicle Code by Peer Group.
   - Copy the appropriate Mean or Median values into a summary table in a new worksheet.

8. Calculate average mileage for each vehicle type, for each transit system. This results in average annual mileage values for each type of vehicle (e.g., Center Aisle Van, Conversion Van, Lift Equipped Van, Minivan, etc.) used by each system.

9. Calculate the percentage difference for each vehicle type from the Mean or Median values for all systems and for peer groups, i.e., calculate the percentage differences between the averages determined in Step 8 from the values calculated in Step 6 (all vehicles) and Step 7 (peer groups).

10. Assign values to ranges of percentage difference between the overall average annual mileage for all vehicles of each vehicle type and a CT system's average annual mileage for vehicle type. The table below shows the values that were assigned when developing the tool.

Figure 38: Rating System Applied to All Vehicles and to Peer Groups

Value	Description	Meaning
12	> 75% above All Vehicles average or Peer Group average	Highest Priority for receiving replacement vehicle(s)
10	51% to 75% above All Vehicles average or Peer Group average	Very High Priority for receiving replacement vehicle(s)
8	26% to 50% above All Vehicles average or Peer Group average	High Priority for receiving replacement vehicle(s)
6	1% to 25% above All Vehicles average or Peer Group average	Above Average Priority for receiving replacement vehicle(s)
5	At All Vehicles average or Peer Group average	Average Priority for receiving replacement vehicle(s)
4	1% to 25% below All Vehicles average or Peer Group average	Below Average Priority for receiving replacement vehicle(s)

Value	Description	Meaning
2	26% to 50% below All Vehicles average or Peer Group average	Low Priority for receiving replacement vehicle(s)
1	> 50% below All Vehicles average or Peer Group average	Lowest Priority for receiving replacement vehicle(s)

11. Calculate the Combined Rating—Average Annual Mileage as follows:

    Combined Rating—Avg. Ann. Mileage = (All Vehicles Rating + (Peer Group Rating x 2)) / 3

    Having the Peer Group Rating count twice the All Vehicles Rating reflects the importance of excelling within one's peer group as compared to within the statewide fleet. The reason for stressing comparative use within peer groups is that CT systems in each peer group are deemed to experience similar levels of challenges to efficient and effective operations. In addition, placing a high priority on the peer group mitigates the impact from any peer group consistently performing lower than the statewide average.

    Enter the Combined Rating—Average Annual Mileage values in the spreadsheets for All Vehicles and for Peer Groups. This completes the use of the PTMS data to calculate comparative ratings for Average Annual Mileage.

Average Annual Passenger Trips per Hour from VUD

Perform similar calculations using VUD statistics for annual passenger trips per hour. The purpose of these calculations is to provide the basis for an assessment of vehicle productivity to prioritize requests for expansion vehicles or requests to shift to a larger capacity vehicle. The systems with the highest ratings of annual passenger trips per hour will be those systems utilizing their vehicles most productively to provide transportation.

1. Download VUD information including:
   - County
   - System Name
   - # Vehicles
   - Class (Type)
   - Code
   - Service Hours
   - Service Miles
   - Total Passengers
   - Capacity

2. Compile the data from the two VUD analysis weeks.
   - Code vehicles according to vehicle type.
   - Combine both the April and August VUD data collection periods into one dataset.
   - Calculate the total number of vehicles of each vehicle type by transit system:
     a. Vehicles should be listed on the Vehicle Information spreadsheet of the VUD even if the vehicle was not utilized during the collection periods.

- Calculate the total service hours, and total passengers for each vehicle type for each transit system by summing the values for individual vehicles.

3. Add a column and enter the peer group for each system (if not present).

4. Calculate Passengers per Hour (Total Passengers / Service Hours) in a separate column.

5. Save the spreadsheet as a master, and copy the information to a working spreadsheet.

6. Sort the data by Vehicle Code.

7. From the resulting VUD data, first calculate values to be used to identify vehicles from **all systems** with high and low passengers per hour, as follows:
   - Copy the information for all vehicles of each Vehicle Code into a separate spreadsheet. There are 12 Vehicle Codes, which will result in 12 spreadsheets, each with the information for one vehicle type.
   - Calculate the Mean and Median and identify the Minimum and Maximum values for each vehicle type.
   - Review the data to determine if outliers are present. Outliers are values that are far from the Mean or Median values. If there are wide ranges in the data from the Mean or Median values, i.e., the minimum and maximum values are far from the Mean or Median use the **Median** for further calculations. If the maximum and minimum data are clustered near the Mean or Median values, use the **Mean** for further calculations.
   - After determining whether the Mean or the Median values will be used for further calculations, copy the appropriate Mean or Median values into a summary table in a new worksheet.

8. Next, in a new spreadsheet, calculate the Mean, Median, Minimum, and Maximum values for each **Vehicle Code by Peer Group**.
   - Sort the records by Peer Group (there are five Peer Groups).
   - Copy the records for each Peer Group into a separate worksheet.
   - For each Peer Group, sort the records first by Vehicle Code and then by Annual Miles.
   - Insert four rows between records of different vehicle types, unless there are less than five records for any particular vehicle type. In that case, insert only one row.
   - Calculate the Mean, Median, Minimum, and Maximum values for each type of vehicle in the blank rows. Do not perform calculations for vehicle types for which there are less than five records.
   - If it was determined in the previous step that the Mean provided an acceptable average value, use the Mean for further calculations of each Vehicle Code by Peer Group. If the previous step determined that the Median provided a better measure of the average value, use the Median for further calculations of each Vehicle Code by Peer Group.
   - Copy the appropriate Mean or Median values into a summary table in a new worksheet.

9. Calculate average passenger trips per hour for each vehicle type, for each transit system. This results in average annual passenger trips per hour values for each type of vehicle (e.g., Center Aisle Van, Conversion Van, Lift Equipped Van, Minivan, etc.) used by each system.

10. Calculate the percentage difference for each vehicle type from the Mean or Median values for all systems and for peer groups, i.e., calculate the percentage differences between the averages determined in Step 9 from the values calculated in Step 7 (all vehicles) and Step 8 (peer groups).

11. Assign values to ranges of percentage difference between the overall average annual passenger trips per hour for all vehicles of each vehicle type and a CT system's average annual mileage for vehicle type. The table below shows the values that were assigned when developing the tool.

Figure 39: Rating System Applied to All Vehicles and to Peer Groups

Value	Description	Meaning
12	> 75% above All Vehicles average or Peer Group average	Highest Priority for receiving replacement vehicle(s)
10	51% to 75% above All Vehicles average or Peer Group average	Very High Priority for receiving replacement vehicle(s)
8	26% to 50% above All Vehicles average or Peer Group average	High Priority for receiving replacement vehicle(s)
6	1% to 25% above All Vehicles average or Peer Group average	Above Average Priority for receiving replacement vehicle(s)
5	At All Vehicles average or Peer Group average	Average Priority for receiving replacement vehicle(s)
4	1% to 25% below All Vehicles average or Peer Group average	Below Average Priority for receiving replacement vehicle(s)
2	26% to 50% below All Vehicles average or Peer Group average	Low Priority for receiving replacement vehicle(s)
1	> 50% below All Vehicles average or Peer Group average	Lowest Priority for receiving replacement vehicle(s)

12. Calculate the Combined Rating—Passenger Trips per Hour is calculated as follows:

Combined Rating—Pass. Trips per Hour = (All Vehicles Rating + (Peer Group Rating x 2)) / 3

Having the Peer Group Rating count twice the All Vehicles Rating reflects the importance of excelling within one's peer group as compared to within the statewide fleet. The reason for stressing comparative use within peer groups is that CT systems in each peer group are deemed to experience similar levels of challenges to efficient and effective operations. In addition, placing a high priority on the peer group mitigates the impact from any peer group consistently performing lower than the statewide average.

13. Enter the Combined Rating—Passenger Trips per Hour values in the spreadsheets for All Vehicles and for Peer Groups. This completes the use of the VUD data to calculate comparative ratings for Average Annual Passenger Trips per Hour.

PTMS Annual Maintenance Cost Data

Average annual maintenance costs for each vehicle type are calculated from PTMS data. The results of the calculations are used to determine, for CT systems, vehicle types that have significantly higher than average maintenance costs. After identifying the vehicles, NCDOT/PTD staff can work with local CT system managers to determine the cost effectiveness of replacing vehicles with high maintenance costs prior to their planned replacement date. The calculations are as follows:

1. Using the spreadsheets from Step 7 conducted for the **Average Annual Mileage from PTMS Data** process calculate the Mean, Median, Minimum, and Maximum values for each vehicle type.

2. Review the data to determine if outliers are present. Outliers are values that are much larger or smaller than the Mean or Median values. If there are wide ranges in the data from the Mean or Median values, i.e., the minimum and maximum values are far from the Mean or Median use the **Median** for further calculations. If the maximum and minimum data are clustered near the Mean or Median values, use the **Mean** for further calculations.
3. After determining whether the Mean or the Median values will be used for further calculations, copy the appropriate Mean or Median values into a summary table in a new worksheet.

4. Calculate twice the value of the Mean or Median for each type of vehicle. Those values will form the basis for determining if one or more vehicle types operated by a CT system has maintenance costs that are significantly higher than the average for all vehicles of that type.

Refer to Figure 40 for the calculations that were developed from FY 2010 adjusted PTMS data.

Figure 40: Annual Maintenance Costs by Vehicle Type, from FY 2010 Adjusted PTMS

Vehicle Type	Code	Minimum	Maximum	Mean	Median	Median x 2
Minivan	4	$0	$4,595	$1,057	$830	$1,660
Standard/Center Aisle Van	1	$0	$5,690	$1,457	$1,130	$2,260
Conversion Van	2	$0	$11,049	$2,265	$1,665	$3,330
Lift Van	3	$0	$9,466	$2,594	$2,047	$4,094
20 ft LTV	6	$95	$4,242	$1,107	$861	$1,722
22 ft LTV	7	$0	$11,216	$2,399	$1,848	$3,696
25 ft LTV	8	$0	$10,898	$2,492	$2,076	$4,152
28 ft LTV	11	$323	$3,130	$904	$628	$1,256
Bus	9	$1,032	$19,976	$4,572	$3,725	$7,450

Conclusions

The determination of an appropriate fleet size and mix for Community Transportation systems is part art, part science. This tool does not provide an exact output of the numbers of each type of vehicle that would be optimal for any CT system to operate, as a more detailed assessment of local circumstances is required to develop appropriate solutions. At a minimum, it requires open discussion among NCDOT/PTD staff, CT system managers, and consultants who develop and update Community Transportation System Plans.

The tool described in this document is intended to provide data-driven guidance to those involved in making fleet decisions. Two primary indicators—average annual mileage and passenger trips per hour—compiled and evaluated by vehicle type, provide the basis for making decisions on prioritizing replacement vehicles and adding an expansion vehicle or purchasing a larger type of vehicle. Use of the comparative values for the two indicators at both the statewide and the peer group levels will allow NCDOT/PTD staff to develop statewide vehicle replacement strategies, as well as CT system managers and consultants to develop system-specific strategies.

Average annual mileage is used as an indicator of the level of use of each type of vehicle in a system's fleet. Average passenger trips per hour is used as an indicator of the level of productivity of each vehicle type in a system's fleet. Assessing both the level of vehicle use and vehicle productivity reduces the likelihood of expanding vehicle fleets based only on use. Vehicles that experience high annual mileage may or may not be utilized productively. If they are not being used productively, then an assessment of operating practices may yield an increase in productivity for a lower cost than the purchase of an additional vehicle (which would result in even lower average productivity).

Incorporating other factors—vehicle condition, percent having met useful life requirements, and percent with high maintenance costs—helps to better prioritize vehicle replacement both for vehicles within a CT system's fleet, and when making comparative assessments of all CT systems' replacement needs.

Appendices

Appendix A: Community Transportation (CT) System Survey Questions

Survey on Factors Transit Systems Consider When Selecting Vehicles

1. Please rank each of the following factors on its importance in making decisions to purchase new vehicles. (**1 = Most** important and **5 = Least** important):

Factor	1	2	3	4	5	N/A
Seating capacity						
Type of service in which the vehicle will be operated						
Passengers' convenience in accessing seats						
Purchase price						
Reliability						
Durability						
Quality of wheelchair lift						
Operating cost						
Ease of maintenance						
Cost of maintenance						
Same type of vehicle as in existing fleet						
Other #1 (describe):						
Other #2 (describe):						

2. You might consider several factors if you were to decide between purchasing a minivan or a conversion van/center-aisle van. Please indicate the importance of each of the following factors in influencing that decision. (**1 = Most** important and **5 = Least** important):

Factor	1	2	3	4	5	N/A
Seating capacity						
Type of service in which the vehicle will be operated						
Purchase price						
Reliability						
Durability						
Operating cost						
Ease of maintenance						
Cost of maintenance						
Same type of vehicle as in existing fleet						
Other (describe):						

3. You might consider several factors if you were to decide between purchasing a conversion van or a center-aisle van. Please indicate the importance of each of the following factors in influencing that decision. (**1 = Most** important and **5 = Least** important):

Factor	1	2	3	4	5	N/A
Seating capacity						
Passengers' convenience in accessing seats						
Type of service in which the vehicle will be operated						
Purchase price						
Reliability						
Durability						
Ease of maintenance						
Cost of maintenance						
Same type of vehicle as in existing fleet						
Other (describe):						

4. You might consider several factors if you were to decide between purchasing a conversion van/center-aisle van or an LTV. Please indicate the importance of each of the following factors in influencing that decision. (**1 = Most** important and **5 = Least** important):

Factor	1	2	3	4	5	N/A
Seating capacity						
Passengers' convenience in accessing seats						
Type of service in which the vehicle will be operated						
Purchase price						
Reliability						
Durability						
Ease of maintenance						
Cost of maintenance						
Same type of vehicle as in existing fleet						
Other (describe):						

5. What types of vehicles have you found to be most useful in meeting your service needs? Rank each of the following: **1 = Most** useful and **5 = Least** useful):

Type of Vehicle	1	2	3	4	5	N/A
Minivan						
Conversion Van (12 passenger)						
Conversion Van with Interior Rear Lift						
Conversion Van with Interior Side Lift, 2 wheelchair stations						
Conversion Van with Interior Side Lift, 3 wheelchair stations						
Center-Aisle Van (13 passenger)						
20' LTV						
20' LTV with Lift						

Type of Vehicle	1	2	3	4	5	N/A
22’ LTV						
22’ LTV with Lift						
25’ LTV						
25’ LTV with Lift, rear wheelchair stations						
25’ LTV with Lift, forward wheelchair stations						
25’ LTV with Lift, 4 wheelchair stations						
28’ LTV						
28’ LTV with Lift, 2 rear wheelchair stations						
28’ LTV with Lift, 6 wheelchair stations						

6. What types of vehicles have you found to have the fewest number of problems? Rank each of the following: **1 = Most** problems and **5 = Fewest** problems):

Type of Vehicle	1	2	3	4	5	N/A
Minivan						
Conversion Van (12 passenger)						
Conversion Van with Interior Rear Lift						
Conversion Van with Interior Side Lift, 2 wheelchair stations						
Conversion Van with Interior Side Lift, 3 wheelchair stations						
Center-Aisle Van (13 passenger)						
20’ LTV						
20’ LTV with Lift						
22’ LTV						
22’ LTV with Lift						
25’ LTV						
25’ LTV with Lift, rear wheelchair stations						
25’ LTV with Lift, forward wheelchair stations						
25’ LTV with Lift, 4 wheelchair stations						
28’ LTV						
28’ LTV with Lift, 2 rear wheelchair stations						
28’ LTV with Lift, 6 wheelchair stations						

7. What type(s) of vehicles that are not currently available for purchase on the State contract would be useful to add to the contract?

Type of Vehicle #1: _____
Type of Vehicle #2: _____
Type of Vehicle #3: _____

Appendix B: Detailed CT System Survey Response Information

Q1: Importance of factors in making decisions to purchase new vehicles.

Factor	Importance					Does Not Apply	No. Resp. (n)	Average Score	Rank
	Most (1)	2	3	4	Least (5)				
Seating Capacity	62%	26%	3%	6%	0%	3%	34	1.5	2 (tie)
Type of Service	50%	29%	9%	6%	3%	3%	34	1.8	5 (tie)
Convenient Seat Access	41%	32%	15%	9%	0%	3%	34	1.9	7 (tie)
Purchase Price	29%	47%	6%	9%	6%	3%	34	2.1	10
Reliability	74%	9%	15%	0%	0%	3%	34	1.4	1
Durability	65%	18%	15%	0%	0%	3%	34	1.5	2 (tie)
Quality of Lift	62%	27%	6%	3%	0%	3%	34	1.5	2 (tie)
Operating Cost	47%	24%	18%	9%	0%	3%	34	1.9	7 (tie)
Ease of Maintenance	38%	32%	18%	9%	0%	3%	34	2.0	9
Cost of Maintenance	53%	21%	18%	6%	0%	3%	34	1.8	5 (tie)
Match Exist. Fleet	15%	32%	27%	15%	6%	6%	34	2.6	11
Other #1	40%	20%	0%	0%	0%	40%	10	N.A.	N.A.
Other #2	43%	0%	0%	0%	0%	57%	7	N.A.	N.A.

Q2: Describe other factor #1.

Seven responses:

- "Whether or not a CDL license is required to operate the vehicle."
- "Whatever is available on NCDOT PTD contract"
- "Does it require a CDL for the driver."
- "#1—number of miles on vehicle"
- "NCDOT Capital Expenditure Reimbursement Ratio"
- "Wheelchair layout."
- "Purchases are primarily dictated by state contract and approved DOT funding authorizations; everything else is secondary and choices are limited to contract items and funding."

Q3: Describe other factor #2.

Three responses:

- "Have no control over color, size, model, wheelchair"

- "Local match funding availability"
- "Security system availability"

Q4: Importance of factors in deciding between purchasing a minivan or a conversion van.

Factor	Importance					Does Not Apply	No. Resp. (n)	Average Score	Rank
	Most (1)	2	3	4	Least (5)				
Seating Capacity	64%	15%	15%	0%	0%	6%	33	1.5	1 (tie)
Type of Service	55%	33%	6%	0%	0%	6%	33	1.5	1 (tie)
Purchase Price	33%	27%	30%	3%	0%	6%	33	2.0	8
Reliability	64%	15%	15%	0%	0%	6%	33	1.5	1 (tie)
Durability	55%	24%	15%	0%	0%	6%	33	1.6	4
Operating Cost	42%	27%	24%	0%	0%	6%	33	1.8	5 (tie)
Ease of Maintenance	30%	42%	18%	3%	0%	6%	33	1.9	7
Cost of Maintenance	46%	27%	18%	3%	0%	6%	33	1.8	5 (tie)
Match Exist. Fleet	15%	27%	30%	6%	12%	9%	33	2.7	9
Other #1	67%	0%	0%	0%	0%	33%	9	N.A.	N.A.
Other #2	33%	0%	0%	0%	0%	67%	6	N.A.	N.A.

Q5: Describe other factor #1.

Six responses:

- "Population and system not large enough to consider minivan"
- "Safety"
- "We are not allowed to replace a minivan with anything other than a minivan."
- "Whether or not the minivan is wheelchair accessible"
- "Wheelchair capability"
- "Same as previous comments; state contract and funding authorizations"

Q6: Describe other factor #2.

- "Door access"

Q7: Importance of factors in deciding between purchasing a conversion van or LTV.

Factor	Importance					Does Not Apply	No. Resp. (n)	Average Score	Rank
	Most (1)	2	3	4	Least (5)				
Seating Capacity	73%	15%	3%	0%	0%	9%	33	1.2	1
Convenient Seat Access	42%	36%	9%	3%	0%	9%	33	1.7	4 (tie)
Type of Service	53%	22%	9%	6%	0%	9%	32	1.9	7 (tie)
Purchase Price	30%	33%	27%	0%	0%	9%	33	2.0	9
Reliability	58%	15%	18%	0%	0%	9%	33	1.6	2 (tie)
Durability	53%	19%	19%	0%	0%	9%	32	1.6	2 (tie)
Operating Cost	52%	15%	24%	0%	0%	9%	33	1.7	4 (tie)
Ease of Maintenance	33%	36%	15%	6%	0%	9%	33	1.9	7 (tie)
Cost of Maintenance	49%	21%	18%	3%	0%	9%	33	1.7	4 (tie)
Match Exist. Fleet	18%	27%	18%	9%	15%	12%	33	2.7	10
Other #1	43%	0%	0%	0%	0%	57%	7	N.A.	N.A.
Other #2	20%	0%	0%	0%	0%	80%	5	N.A.	N.A.

Q8: Describe other factor #1.

Four responses:

- "CDL requirement"
- "All state contract vehicles are specified by NCDOT and we have little or no input as a whole group"
- "Floor layout for wheelchairs"
- "State contract and funding authorizations; additionally we prefer to purchase vehicles that have wheelchair access for the majority of the fleet"

Q9: Describe other factor #2.

One response:

- "Door access"

Q10: Types of vehicles found most useful in meeting service needs.

Vehicle	Useful					Does Not Apply	No. Resp. (n)	Average Score	Rank
	Most (1)	2	3	4	Least (5)				
Minivan	13%	20%	27%	7%	20%	13%		3.0	8
Conversion Van-no lift	29%	32%	7%	13%	10%	10%		2.4	4 (tie)
Conv. Van Rear Lift	50%	22%	22%	3%	0%	3%		1.8	2
Conv. Van Side Lift	7%	10%	24%	10%	24%	24%		3.5	12
20' LTV—w/o Lift	4%	7%	7%	4%	26%	52%		3.9	14
20' LTV w/Lift	31%	14%	10%	7%	7%	31%		2.2	3
22' LTV—w/o Lift	4%	4%	12%	0%	28%	52%		3.1	9 (tie)
22' LTV w/Lift	40%	17%	3%	3%	3%	33%		1.7	1
25' LTV—w/o Lift	8%	0%	12%	0%	19%	62%		3.6	13
25' LTV w/Lift, rear WC station	11%	11%	15%	0%	11%	52%		2.8	6 (tie)
25' LT—Lift, Front WC station	4%	4%	18%	0%	7%	68%		3.1	9 (tie)
25' LTV—Lift, 4 WC stations	8%	8%	12%	4%	0%	69%		2.4	4 (tie)
28' LTV—w/o Lift	0%	0%	4%	0%	19%	77%		4.7	15
28' LTV—Lift, 2 rear WC station	11%	7%	4%	0%	11%	67%		2.8	6 (tie)
28' LTV—Lift, 6 WC stations	7%	0%	4%	4%	11%	75%		3.4	11
Other #1	18%	9%	0%	0%	0%	73%			
Other #2	11%	0%	0%	0	0	89			

Q11: Describe other #1.

Four responses:

- "No one type vehicle can meet all needs. Therefore there is no one "most useful" type of vehicle."
- "25' LTV Low Floor 2 forward wheelchair stations"
- "If we must show preferred service to Medicaid and not fill the van, mix the riders in the future the type vans to meet the need will change"
- "25' with side wheelchair stations"

Q12: Describe other #2.

One response:

- "Door access"

Q13: Types of vehicles with the fewest/least severe problems.

Vehicle	Problems					Does Not Apply	No. Resp. (n)	Average Score	Rank
	Least (1)	2	3	4	Most (5)				
Minivan	52%	23%	0%	3%	0%	23%	31	1.4	1
Conversion Van-no lift	18%	36%	25%	0%	4%	18%	28	2.2	4
Conv. Van Rear Lift	13%	29%	32%	10%	10%	7%	31	2.7	8
Conv. Van Side Lift	3%	17%	24%	10%	3%	41%	29	2.9	11 (tie)
20' LTV—w/o Lift	4%	15%	7%	0%	0%	74%	27	2.1	3
20' LTV w/Lift	4%	18%	14%	7%	7%	50%	28	2.9	11 (tie)
22' LTV—w/o Lift	4%	19%	4%	0%	0%	74%	27	2.0	2
22' LTV w/Lift	10%	17%	20%	3%	3%	47%	30	2.5	5 (tie)
25' LTV—w/o Lift	4%	11%	4%	0%	7%	74%	27	2.9	11 (tie)
25' LTV w/Lift, rear WC station	0%	8%	23%	4%	0%	65%	26	3.7	15
25' LT—Lift, Front WC station	0%	0%	15%	4%	0%	82%	27	3.2	14
25' LTV—Lift, 4 WC stations	4%	4%	19%	0%	0%	74%	27	2.6	7
28' LTV—w/o Lift	0%	7%	7%	0%	0%	85%	27	2.5	5 (tie)
28' LTV—Lift, 2 rear WC station	0%	4%	19%	0%	0%	78%	27	2.8	9 (tie)
28' LTV—Lift, 6 WC stations	0%	4%	12%	0%	0%	85%	26	2.8	9 (tie)

Q14: For types of vehicles with the most problems (those with a check for a "4" or "5 Most Problems"), describe the problem(s) you have experienced, noting each type of vehicle and its problem(s):

Seven responses:

- "We have one (out of two) 20 ft. LTV with side lift that has had multiple issues: with wiring harness, and multiple air conditioning problems. Still covered under warranty so far – less than 15,000 miles."
- "25' LTV with Lift: Overall basic mechanical problems, lift problems and availability of parts at a reasonable cost."
- "Ford have given MANY more problems than Dodges or LTV's"
- "22' LTB w/Lift: Electrical problems, A/C problems, brake problems."
- "Conversion van with rear lift: lots of problems with A/C and lifts not working. 25' LTV with rear lift: A/C, battery, charging system."
- "Most issues with lift equipment – electrical switches, components, leaking hatches. For Conversion van, extra weight of lift equipment puts greater strain on drivetrain components, tire wear. With the lift-equipped LTV's lesser strain on drivetrain, but greater tire wear, less mileage for tires, greater fuel consumption. Greater operating safety (better stability, etc.) of LTV's outweighs the higher operating costs."
- "Floor layout for 20' vehicles with rear wheelchair positions side by side is completely impractical with size of today's clients and wheelchairs."

Q15: Frequency at which non-ambulatory and ambulatory passengers share rides on a vehicle.

Frequency	Response Percent	Number of Responses (n)
75% -- 100% of the time	48%	15
50% -- 75% of the time	32%	10
25% -- 50% of the time	19%	6
0% -- 25% of the time	0%	0
Never	0%	0

Note: 31 total responses.

Q16: Frequency at which all wheelchair stations on a vehicle are filled at the same time.

Frequency	Response Percent	Number of Responses (n)
75% -- 100% of the time	13%	4
50% -- 75% of the time	10%	3
25% -- 50% of the time	35%	11
0% -- 25% of the time	35%	11
Never	7%	2

Note: 31 total responses.

Q17: Types of vehicles not currently available for purchase on the state contract that would be useful to consider adding to the contract.

Fourteen CT systems provided a single response, four provided a second response, and one system provided a third response. Responses included:

- Minivan with lift (3)
- Minivan with ramp (2)
- Minivan
- Center Aisle Van
- 14 passenger Conversion Vans
- "Lift equipped conversion van (not LTV) with seating for more than eight people."
- "A 20' vehicle with higher floor and better W/C layout"
- "LTV without lift"
- "LTV with more than 2 wheelchair stations"
- "22' LTV Low Floor"
- "25' LTV Low Floor"
- "28' Low Floor"
- "Vehicles w/o half step at angle to the floor—safety issue"
- "4WD or AWD"
- "Head Start useable with Public Capacity"
- "We have not been allowed to replace conversion vans with 22' LTV's. That would be a good option for us!"

Note: LTVs (20', 22', 25' and 28') have been available without a lift. The 25' LTV with four wheelchair stations and the 28' LTV with six wheelchair stations have been available.

Appendix C: Calculations of Individual Analysis Factors

Table C-1: Passenger Trips per Vehicle—5311 Systems

Peer Group	Sub-Recipient Name	Active Fleet		No. Pass. Trips (FY2011)		Pass. Trips per Vehicle
5	Clay County	14		17,814		1,272
5	Alleghany County	12		19,168		1,597
4	Pender Adult Services, Inc.	11		21,352		1,941
2	Pitt County	25		51,658		2,066
4	Columbus County	18		38,341		2,130
3	Moore County	25		54,080		2,163
4	Washington County	9		19,497		2,166
4	Martin County	18		40,441		2,247
3	Yadkin Valley Economic Dev. District, Inc.	90		209,282		2,325
4	Wilkes Transportation Authority	30		70,194		2,340
3	City of Rocky Mount	43		101,861		2,369
3	Transp. Admin. of Cleveland County. Inc.	28		69,644		2,487
3	Dare County	8		20,046		2,506
5	Graham County	9		22,928		2,548
4	Caswell County	10		25,946		2,595
4	Rutherford County	23		60,487		2,630
5	Madison County Transportation Authority	11		29,707		2,701
3	Person County	15		40,695		2,713
2	Alamance County Transportation Authority	28		76,056		2,716
2	Cabarrus County Transportation Services	30		81,844		2,728
4	Sampson County	13		35,674		2,744
3	Western Carolina Community Action Inc.	19		52,148		2,745
5	Yancey County Transportation Authority	12		33,022		2,752
4	Anson County	15		41,657		2,777
4	Gates County	9		25,035		2,782
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		16,886		2,814
4	Chatham Transit Network	19		54,343		2,860
3	Harnett County	29		83,758		2,888
3	Kerr Area Transportation Authority	53		156,465		2,952
3	Lincoln County	16		47,339		2,959
4	Macon County	12		35,665		2,972
5	Cherokee County	14		41,728		2,981
3	Rockingham County Council on Aging	20		59,875		2,994
4	Bladen County	9		28,191		3,132
5	Jackson County	13		40,833		3,141
1	Durham County	17		53,475		3,146
5	Ashe County Transportation Authority Inc.	16		50,601		3,163
3	Randolph County Senior Adult Assoc. Inc.	27		85,852		3,180
3	Stanly County	20		63,610		3,181
4	Mountain Projects, Inc.	18		58,233		3,235

Peer Group	Sub-Recipient Name	Active Fleet		No. Pass. Trips (FY2011)		Pass. Trips per Vehicle
4	Greene County	8		26,020		3,253
2	Rowan County	29		97,893		3,376
4	Brunswick Transit System Inc.	14		47,310		3,379
2	Onslow United Transit System	19		66,219		3,485
5	Avery County Transportation Authority	13		46,505		3,577
4	Craven County	29		106,038		3,656
4	Duplin County	14		52,249		3,732
2	Lee County	17		63,579		3,740
4	Albemarle Regional Health Services	27		101,274		3,751
3	Johnston Co. Council on Aging Inc.	24		93,247		3,885
3	Carteret County	16		62,407		3,900
2	Union County	22		86,067		3,912
4	Beaufort Co. Developmental Center, Inc.	10		39,560		3,956
3	Scotland County	9		35,619		3,958
5	Polk County Transportation Authority	14		56,081		4,006
2	Goldsboro/Wayne Transportation Authority	24		97,184		4,049
2	Iredell County	28		117,858		4,209
3	Buncombe County- Mountain Mobility	42		178,873		4,259
2	Wilson County	14		61,272		4,377
2	Gaston County	32		141,377		4,418
4	Choanoke Public Transportation Authority	43		190,288		4,425
4	Hoke County	17		76,580		4,505
3	Robeson County	15		68,361		4,557
5	Transylvania County	7		33,677		4,811
3	Richmond Interagency Transportation Inc.	11		54,911		4,992
5	Mitchell County Transportation Authority	10		58,364		5,836
5	Swain County Focal Point on Aging Inc.	9		53,059		5,895
2	Davidson County	17		103,890		6,111
2	Orange County	16		113,600		7,100
3	Lenoir County	15		107,019		7,135
1	Wake County DSS	42		321,196		7,648
1	Mecklenburg County DSS	28		316,449		11,302
1	Guilford County	11		190,438		17,313
	TOTAL / Calculated Value for All Systems	**1,460**		**5,399,895**		**3,699**
	Minimum Value	6		16,886		1,272
	Maximum Value	90		321,196		17,313
	Average Value	20		73,971		3,755
	Standard Deviation	13		59,270		2,226
	Mean Minus One Standard Deviation					
	Mean Plus One Standard Deviation					

Note: Passenger trips per vehicle for Mecklenburg County DSS and Guilford County are much higher than for any other system, resulting in a large Standard Deviation (STD). Table A-2 provides passenger trips per vehicle data excluding those two systems, to narrow the STD.

Table C-2: Passenger Trips per Vehicle—5311 Systems Excluding Guilford, and Mecklenburg Counties

Peer Group	Sub-Recipient Name	Active Fleet		No. Pass. Trips (FY2011)		Pass. Trips per Vehicle
5	Clay County	14		17,814		1,272
5	Alleghany County	12		19,168		1,597
4	Pender Adult Services, Inc.	11		21,352		1,941
2	Pitt County	25		51,658		2,066
4	Columbus County	18		38,341		2,130
3	Moore County	25		54,080		2,163
4	Washington County	9		19,497		2,166
4	Martin County	18		40,441		2,247
3	Yadkin Valley Economic Dev. District, Inc.	90		209,282		2,325
4	Wilkes Transportation Authority	30		70,194		2,340
3	City of Rocky Mount	43		101,861		2,369
3	Transp. Admin. of Cleveland County. Inc.	28		69,644		2,487
3	Dare County	8		20,046		2,506
5	Graham County	9		22,928		2,548
4	Caswell County	10		25,946		2,595
4	Rutherford County	23		60,487		2,630
5	Madison County Transportation Authority	11		29,707		2,701
3	Person County	15		40,695		2,713
2	Alamance County Transportation Authority	28		76,056		2,716
2	Cabarrus County Transportation Services	30		81,844		2,728
4	Sampson County	13		35,674		2,744
3	Western Carolina Community Action Inc.	19		52,148		2,745
5	Yancey County Transportation Authority	12		33,022		2,752
4	Anson County	15		41,657		2,777
4	Gates County	9		25,035		2,782
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		16,886		2,814
4	Chatham Transit Network	19		54,343		2,860
3	Harnett County	29		83,758		2,888
3	Kerr Area Transportation Authority	53		156,465		2,952
3	Lincoln County	16		47,339		2,959
4	Macon County	12		35,665		2,972
5	Cherokee County	14		41,728		2,981
3	Rockingham County Council on Aging	20		59,875		2,994
4	Bladen County	9		28,191		3,132
5	Jackson County	13		40,833		3,141
1	Durham County	17		53,475		3,146
5	Ashe County Transportation Authority Inc.	16		50,601		3,163
3	Randolph County Senior Adult Assoc. Inc.	27		85,852		3,180
3	Stanly County	20		63,610		3,181
4	Mountain Projects, Inc.	18		58,233		3,235
4	Greene County	8		26,020		3,253
2	Rowan County	29		97,893		3,376

Peer Group	Sub-Recipient Name	Active Fleet		No. Pass. Trips (FY2011)		Pass. Trips per Vehicle
4	Brunswick Transit System Inc.	14		47,310		3,379
2	Onslow United Transit System	19		66,219		3,485
5	Avery County Transportation Authority	13		46,505		3,577
4	Craven County	29		106,038		3,656
4	Duplin County	14		52,249		3,732
2	Lee County	17		63,579		3,740
4	Albemarle Regional Health Services	27		101,274		3,751
3	Johnston Co. Council on Aging Inc.	24		93,247		3,885
3	Carteret County	16		62,407		3,900
2	Union County	22		86,067		3,912
4	Beaufort Co. Developmental Center, Inc.	10		39,560		3,956
3	Scotland County	9		35,619		3,958
5	Polk County Transportation Authority	14		56,081		4,006
2	Goldsboro/Wayne Transportation Authority	24		97,184		4,049
2	Iredell County	28		117,858		4,209
3	Buncombe County- Mountain Mobility	42		178,873		4,259
2	Wilson County	14		61,272		4,377
2	Gaston County	32		141,377		4,418
4	Choanoke Public Transportation Authority	43		190,288		4,425
4	Hoke County	17		76,580		4,505
3	Robeson County	15		68,361		4,557
5	Transylvania County	7		33,677		4,811
3	Richmond Interagency Transportation Inc.	11		54,911		4,992
5	Mitchell County Transportation Authority	10		58,364		5,836
5	Swain County Focal Point on Aging Inc.	9		53,059		5,895
2	Davidson County	17		103,890		6,111
2	Orange County	16		113,600		7,100
3	Lenoir County	15		107,019		7,135
1	Wake County DSS	42		321,196		7,648
	TOTAL / Calculated Value for All Systems	**1,421**		**4,893,008**		**3,443**
	Minimum Value			16,886		1,272
	Maximum Value			321,196		7,648
	Average Value			68,916		3,458
	Standard Deviation			50,534		1,253
	Mean Minus One Standard Deviation					
	Mean Plus One Standard Deviation					

Note: Excluding Mecklenburg and Guilford Counties results in a more meaningful STD for passenger trips per vehicle. These data will be used in the analysis for this indicator.

Table C-3: Average Miles per Vehicle—5311 Systems

Peer Group	Sub-Recipient Name	Active Fleet		No. Svc. Miles (FY 2011)		Average Miles per Vehicle
3	Western Carolina Community Action Inc.	19		218,530		11,502
5	Yancey County Transportation Authority	12		157,115		13,093
4	Bladen County	9		132,652		14,739
1	Durham County	17		254,108		14,948
2	Cabarrus County Transportation Services	30		474,596		15,820
5	Transylvania County	7		112,806		16,115
3	Stanly County	20		333,525		16,676
5	Jackson County	13		220,089		16,930
1	Mecklenburg County DSS	28		492,809		17,600
4	Martin County	18		325,500		18,083
5	Madison County Transportation Authority	11		199,304		18,119
5	Avery County Transportation Authority	13		238,513		18,347
3	Person County	15		279,071		18,605
4	Washington County	9		169,072		18,786
5	Swain County Focal Point on Aging Inc.	9		171,387		19,043
2	Davidson County	17		325,165		19,127
4	Sampson County	13		255,381		19,645
3	Yadkin Valley Economic Dev. District, Inc.	90		1,806,857		20,076
2	Pitt County	25		502,272		20,091
3	Transp. Admin. of Cleveland County. Inc.	28		601,667		21,488
4	Wilkes Transportation Authority	30		646,018		21,534
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		132,973		22,162
5	Clay County	14		319,601		22,829
2	Rowan County	29		696,924		24,032
3	Randolph County Senior Adult Assoc. Inc.	27		649,961		24,073
2	Lee County	17		425,963		25,057
3	Scotland County	9		226,604		25,178
4	Macon County	12		302,160		25,180
3	Robeson County	15		386,602		25,773
5	Graham County	9		237,178		26,353
4	Beaufort Co. Developmental Center, Inc.	10		265,226		26,523
2	Alamance County Transportation Authority	28		781,694		27,918
4	Choanoke Public Transportation Authority	43		1,200,468		27,918
4	Hoke County	17		482,121		28,360
3	Rockingham County Council on Aging	20		569,375		28,469
4	Craven County	29		831,262		28,664
4	Rutherford County	23		659,385		28,669
4	Mountain Projects, Inc.	18		518,598		28,811
3	City of Rocky Mount	43		1,250,610		29,084
2	Orange County	16		465,377		29,086
5	Polk County Transportation Authority	14		410,157		29,297
5	Cherokee County	14		410,722		29,337
5	Mitchell County Transportation Authority	10		296,657		29,666

Peer Group	Sub-Recipient Name	Active Fleet		No. Svc. Miles (FY 2011)		Average Miles per Vehicle
2	Iredell County	28		839,555		29,984
4	Greene County	8		240,879		30,110
4	Caswell County	10		301,310		30,131
4	Pender Adult Services, Inc.	11		331,752		30,159
3	Harnett County	29		878,736		30,301
3	Dare County	8		249,158		31,145
4	Chatham Transit Network	19		598,304		31,490
3	Kerr Area Transportation Authority	53		1,669,738		31,504
4	Columbus County	18		569,008		31,612
2	Onslow United Transit System	19		615,353		32,387
4	Brunswick Transit System Inc.	14		458,507		32,751
2	Union County	22		731,047		33,229
2	Gaston County	32		1,068,561		33,393
4	Albemarle Regional Health Services	27		902,681		33,433
3	Buncombe County- Mountain Mobility	42		1,412,465		33,630
3	Richmond Interagency Transportation Inc.	11		373,083		33,917
3	Moore County	25		859,570		34,383
3	Lincoln County	16		558,008		34,876
4	Gates County	9		317,428		35,270
3	Johnston Co. Council on Aging Inc.	24		854,306		35,596
2	Goldsboro/Wayne Transportation Authority	24		893,160		37,215
3	Carteret County	16		622,254		38,891
4	Anson County	15		598,922		39,928
2	Wilson County	14		575,861		41,133
5	Ashe County Transportation Authority Inc.	16		662,691		41,418
4	Duplin County	14		629,416		44,958
5	Alleghany County	12		565,876		47,156
3	Lenoir County	15		812,372		54,158
1	Wake County DSS	42		3,584,798		85,352
1	Guilford County	11		2,103,725		191,248
	TOTAL / Calculated Value for All Systems	**1,460**		**44,314,579**		**30,352**
	Minimum Value	6		112,806		11,502
	Maximum Value	90		3,584,798		191,248
	Average Value	20		607,049		30,597
	Standard Deviation	13		525,289		21,882
	Mean Minus One Standard Deviation					
	Mean Plus One Standard Deviation					

Note: Average miles per vehicle for Guilford County are much higher than for any other system, resulting in a large Standard Deviation (STD). Table A-4 provides miles per vehicle data excluding that system, to narrow the STD to a more meaningful statistic.

Table C-4: Average Miles per Vehicle—5311 Systems Excluding Guilford County

Peer Group	Sub-Recipient Name	Active Fleet		No. Svc. Miles (FY 2011)		Average Miles per Vehicle
3	Western Carolina Community Action Inc.	19		218,530		11,502
5	Yancey County Transportation Authority	12		157,115		13,093
4	Bladen County	9		132,652		14,739
1	Durham County	17		254,108		14,948
2	Cabarrus County Transportation Services	30		474,596		15,820
5	Transylvania County	7		112,806		16,115
3	Stanly County	20		333,525		16,676
5	Jackson County	13		220,089		16,930
1	Mecklenburg County DSS	28		492,809		17,600
4	Martin County	18		325,500		18,083
5	Madison County Transportation Authority	11		199,304		18,119
5	Avery County Transportation Authority	13		238,513		18,347
3	Person County	15		279,071		18,605
4	Washington County	9		169,072		18,786
5	Swain County Focal Point on Aging Inc.	9		171,387		19,043
2	Davidson County	17		325,165		19,127
4	Sampson County	13		255,381		19,645
3	Yadkin Valley Economic Dev. District, Inc.	90		1,806,857		20,076
2	Pitt County	25		502,272		20,091
3	Transp. Admin. of Cleveland County. Inc.	28		601,667		21,488
4	Wilkes Transportation Authority	30		646,018		21,534
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		132,973		22,162
5	Clay County	14		319,601		22,829
2	Rowan County	29		696,924		24,032
3	Randolph County Senior Adult Assoc. Inc.	27		649,961		24,073
2	Lee County	17		425,963		25,057
3	Scotland County	9		226,604		25,178
4	Macon County	12		302,160		25,180
3	Robeson County	15		386,602		25,773
5	Graham County	9		237,178		26,353
4	Beaufort Co. Developmental Center, Inc.	10		265,226		26,523
2	Alamance County Transportation Authority	28		781,694		27,918
4	Choanoke Public Transportation Authority	43		1,200,468		27,918
4	Hoke County	17		482,121		28,360
3	Rockingham County Council on Aging	20		569,375		28,469
4	Craven County	29		831,262		28,664
4	Rutherford County	23		659,385		28,669
4	Mountain Projects, Inc.	18		518,598		28,811
3	City of Rocky Mount	43		1,250,610		29,084
2	Orange County	16		465,377		29,086
5	Polk County Transportation Authority	14		410,157		29,297
5	Cherokee County	14		410,722		29,337
5	Mitchell County Transportation Authority	10		296,657		29,666

Peer Group	Sub-Recipient Name	Active Fleet		No. Svc. Miles (FY 2011)		Average Miles per Vehicle
2	Iredell County	28		839,555		29,984
4	Greene County	8		240,879		30,110
4	Caswell County	10		301,310		30,131
4	Pender Adult Services, Inc.	11		331,752		30,159
3	Harnett County	29		878,736		30,301
3	Dare County	8		249,158		31,145
4	Chatham Transit Network	19		598,304		31,490
3	Kerr Area Transportation Authority	53		1,669,738		31,504
4	Columbus County	18		569,008		31,612
2	Onslow United Transit System	19		615,353		32,387
4	Brunswick Transit System Inc.	14		458,507		32,751
2	Union County	22		731,047		33,229
2	Gaston County	32		1,068,561		33,393
4	Albemarle Regional Health Services	27		902,681		33,433
3	Buncombe County- Mountain Mobility	42		1,412,465		33,630
3	Richmond Interagency Transportation Inc.	11		373,083		33,917
3	Moore County	25		859,570		34,383
3	Lincoln County	16		558,008		34,876
4	Gates County	9		317,428		35,270
3	Johnston Co. Council on Aging Inc.	24		854,306		35,596
2	Goldsboro/Wayne Transportation Authority	24		893,160		37,215
3	Carteret County	16		622,254		38,891
4	Anson County	15		598,922		39,928
2	Wilson County	14		575,861		41,133
5	Ashe County Transportation Authority Inc.	16		662,691		41,418
4	Duplin County	14		629,416		44,958
5	Alleghany County	12		565,876		47,156
3	Lenoir County	15		812,372		54,158
1	Wake County DSS	42		3,584,798		85,352
	TOTAL / Calculated Value for All Systems	**1,449**		**42,210,854**		**29,131**
	Minimum Value			112,806		11,502
	Maximum Value			3,584,798		85,352
	Average Value			586,262		28,365
	Standard Deviation			497,822		10,817
	Mean Minus One Standard Deviation					
	Mean Plus One Standard Deviation					

Note: Excluding Guilford County results in a more meaningful STD for miles per vehicle. These data will be used in the analysis for this indicator.

Table C-5: Average Hours per Vehicle—5311 Systems

Peer Group	Sub-Recipient Name	Active Fleet		No. Svc. Hours (FY 2011)		Average Hours per Vehicle
4	Bladen County	9		5,008		556
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		4,886		814
5	Transylvania County	7		5,799		828
5	Jackson County	13		11,780		906
5	Graham County	9		8,361		929
3	Stanly County	20		18,786		939
4	Sampson County	13		12,212		939
4	Wilkes Transportation Authority	30		28,619		954
5	Yancey County Transportation Authority	12		11,584		965
4	Martin County	18		17,493		972
2	Cabarrus County Transportation Services	30		29,286		976
3	Person County	15		15,027		1,002
4	Caswell County	10		10,020		1,002
5	Madison County Transportation Authority	11		11,050		1,005
3	Western Carolina Community Action Inc.	19		19,662		1,035
4	Washington County	9		9,337		1,037
4	Brunswick Transit System Inc.	14		14,650		1,046
3	Yadkin Valley Economic Dev. District, Inc.	90		97,018		1,078
3	Transp. Admin. of Cleveland County. Inc.	28		30,344		1,084
4	Greene County	8		8,791		1,099
5	Clay County	14		16,028		1,145
3	Robeson County	15		17,421		1,161
4	Columbus County	18		20,906		1,161
5	Cherokee County	14		16,672		1,191
4	Choanoke Public Transportation Authority	43		52,802		1,228
3	Randolph County Senior Adult Assoc. Inc.	27		33,230		1,231
4	Chatham Transit Network	19		23,634		1,244
4	Pender Adult Services, Inc.	11		13,835		1,258
2	Lee County	17		22,348		1,315
5	Polk County Transportation Authority	14		18,422		1,316
1	Mecklenburg County DSS	28		37,080		1,324
4	Gates County	9		11,947		1,327
3	City of Rocky Mount	43		58,163		1,353
4	Craven County	29		39,862		1,375
4	Beaufort County Developmental Center, Inc.	10		13,750		1,375
4	Macon County	12		16,697		1,391
2	Gaston County	32		44,999		1,406
3	Scotland County	9		12,664		1,407
3	Harnett County	29		40,846		1,408
4	Anson County	15		21,670		1,445
5	Avery County Transportation Authority	13		19,085		1,468
4	Hoke County	17		25,124		1,478
5	Mitchell County Transportation Authority	10		15,136		1,514

Peer Group	Sub-Recipient Name	Active Fleet		No. Svc. Hours (FY 2011)		Average Hours per Vehicle
2	Rowan County	29		44,406		1,531
4	Mountain Projects, Inc.	18		27,915		1,551
4	Rutherford County	23		36,200		1,574
5	Swain County Focal Point on Aging Inc.	9		14,505		1,612
4	Duplin County	14		22,740		1,624
2	Alamance County Transportation Authority	28		45,557		1,627
3	Dare County	8		13,127		1,641
3	Kerr Area Transportation Authority	53		87,898		1,658
2	Iredell County	28		46,954		1,677
2	Pitt County	25		42,364		1,695
3	Moore County	25		42,771		1,711
4	Albemarle Regional Health Services	27		46,221		1,712
3	Rockingham County Council on Aging	20		34,754		1,738
2	Onslow United Transit System	19		33,019		1,738
5	Alleghany County	12		20,990		1,749
3	Johnston Co. Council on Aging Inc.	24		43,376		1,807
5	Ashe County Transportation Authority Inc.	16		29,892		1,868
3	Buncombe County- Mountain Mobility	42		79,978		1,904
3	Richmond Interagency Transportation Inc.	11		21,185		1,926
3	Lincoln County	16		31,347		1,959
2	Union County	22		45,649		2,075
3	Carteret County	16		34,336		2,146
2	Davidson County	17		36,660		2,156
2	Goldsboro/Wayne Transportation Authority	24		53,391		2,225
2	Orange County	16		36,290		2,268
1	Durham County	17		42,012		2,471
2	Wilson County	14		34,622		2,473
1	Wake County DSS	42		107,987		2,571
3	Lenoir County	15		48,991		3,266
1	Guilford County	11		134,004		12,182
	TOTAL / Calculated Value for All Systems	**1,460**		**2,301,175**		**1,576**
	Minimum Value	6		4,886		556
	Maximum Value	90		134,004		12,182
	Average Value	20		31,523		1,614
	Standard Deviation	13		23,865		1,343
	Mean Minus One Standard Deviation					
	Mean Plus One Standard Deviation					

Note: Average hours per vehicle for Guilford County are much higher than for any other system, resulting in a large Standard Deviation (STD). Table A-4 provides hours per vehicle data excluding that system, to narrow the STD to a more meaningful statistic.

Table C-6: Average Hours per Vehicle—5311 Systems Excluding Guilford County

Peer Group	Sub-Recipient Name	Active Fleet		No. Service Hours (FY 2011)		Average Hours per Vehicle
4	Bladen County	9		5,008		556
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		4,886		814
5	Transylvania County	7		5,799		828
5	Jackson County	13		11,780		906
5	Graham County	9		8,361		929
3	Stanly County	20		18,786		939
4	Sampson County	13		12,212		939
4	Wilkes Transportation Authority	30		28,619		954
5	Yancey County Transportation Authority	12		11,584		965
4	Martin County	18		17,493		972
2	Cabarrus County Transportation Services	30		29,286		976
3	Person County	15		15,027		1,002
4	Caswell County	10		10,020		1,002
5	Madison County Transportation Authority	11		11,050		1,005
3	Western Carolina Community Action Inc.	19		19,662		1,035
4	Washington County	9		9,337		1,037
4	Brunswick Transit System Inc.	14		14,650		1,046
3	Yadkin Valley Economic Dev. District, Inc.	90		97,018		1,078
3	Transp. Admin. of Cleveland County. Inc.	28		30,344		1,084
4	Greene County	8		8,791		1,099
5	Clay County	14		16,028		1,145
3	Robeson County	15		17,421		1,161
4	Columbus County	18		20,906		1,161
5	Cherokee County	14		16,672		1,191
4	Choanoke Public Transportation Authority	43		52,802		1,228
3	Randolph County Senior Adult Assoc. Inc.	27		33,230		1,231
4	Chatham Transit Network	19		23,634		1,244
4	Pender Adult Services, Inc.	11		13,835		1,258
2	Lee County	17		22,348		1,315
5	Polk County Transportation Authority	14		18,422		1,316
1	Mecklenburg County DSS	28		37,080		1,324
4	Gates County	9		11,947		1,327
3	City of Rocky Mount	43		58,163		1,353
4	Craven County	29		39,862		1,375
4	Beaufort County Developmental Center, Inc.	10		13,750		1,375
4	Macon County	12		16,697		1,391
2	Gaston County	32		44,999		1,406
3	Scotland County	9		12,664		1,407
3	Harnett County	29		40,846		1,408
4	Anson County	15		21,670		1,445
5	Avery County Transportation Authority	13		19,085		1,468
4	Hoke County	17		25,124		1,478
5	Mitchell County Transportation Authority	10		15,136		1,514

Peer Group	Sub-Recipient Name	Active Fleet		No. Service Hours (FY 2011)		Average Hours per Vehicle
2	Rowan County	29		44,406		1,531
4	Mountain Projects, Inc.	18		27,915		1,551
4	Rutherford County	23		36,200		1,574
5	Swain County Focal Point on Aging Inc.	9		14,505		1,612
4	Duplin County	14		22,740		1,624
2	Alamance County Transportation Authority	28		45,557		1,627
3	Dare County	8		13,127		1,641
3	Kerr Area Transportation Authority	53		87,898		1,658
2	Iredell County	28		46,954		1,677
2	Pitt County	25		42,364		1,695
3	Moore County	25		42,771		1,711
4	Albemarle Regional Health Services	27		46,221		1,712
3	Rockingham County Council on Aging	20		34,754		1,738
2	Onslow United Transit System	19		33,019		1,738
5	Alleghany County	12		20,990		1,749
3	Johnston Co. Council on Aging Inc.	24		43,376		1,807
5	Ashe County Transportation Authority Inc.	16		29,892		1,868
3	Buncombe County- Mountain Mobility	42		79,978		1,904
3	Richmond Interagency Transportation Inc.	11		21,185		1,926
3	Lincoln County	16		31,347		1,959
2	Union County	22		45,649		2,075
3	Carteret County	16		34,336		2,146
2	Davidson County	17		36,660		2,156
2	Goldsboro/Wayne Transportation Authority	24		53,391		2,225
2	Orange County	16		36,290		2,268
1	Durham County	17		42,012		2,471
2	Wilson County	14		34,622		2,473
1	Wake County DSS	42		107,987		2,571
3	Lenoir County	15		48,991		3,266
	TOTAL / Calculated Value for All Systems	**1,449**		**2,167,171**		**1,496**
	Minimum Value			4,886		556
	Maximum Value			107,987		3,266
	Average Value			30,100		1,467
	Standard Deviation			20,678		485
	Mean Minus One Standard Deviation					
	Mean Plus One Standard Deviation					

Note: Excluding Guilford County results in a more meaningful STD for hours per vehicle. These data will be used in the analysis for this indicator.

Table C-7: Vehicles per 10,000 Population—5311 Systems

Peer Group	Sub-Recipient Name	Active Fleet		Service Area 2010 Population		Vehicles per 10,000 Population
1	Guilford County	11		490,371		0.2
1	Mecklenburg County DSS	28		923,944		0.3
1	Wake County DSS	42		907,314		0.5
1	Durham County	17		268,925		0.6
2	Onslow United Transit System	19		185,304		1.0
2	Davidson County	17		163,488		1.0
2	Union County	22		202,592		1.1
3	Robeson County	15		134,502		1.1
2	Orange County	16		134,325		1.2
4	Brunswick Transit System Inc.	14		108,176		1.3
3	Johnston Co. Council on Aging Inc.	24		170,151		1.4
2	Pitt County	25		169,378		1.5
2	Gaston County	32		206,384		1.6
3	Randolph County Senior Adult Assoc. Inc.	27		170,119		1.6
2	Cabarrus County Transportation Services	30		179,025		1.7
2	Wilson County	14		81,643		1.7
2	Iredell County	28		160,107		1.7
3	Buncombe County- Mountain Mobility	42		239,179		1.8
3	Western Carolina Community Action Inc.	19		107,177		1.8
2	Alamance County Transportation Authority	28		151,745		1.8
2	Goldsboro/Wayne Transportation Authority	24		122,893		2.0
3	Lincoln County	16		78,684		2.0
4	Sampson County	13		63,481		2.0
4	Beaufort County Developmental Center, Inc.	10		47,929		2.1
2	Rowan County	29		138,651		2.1
4	Pender Adult Services, Inc.	11		52,504		2.1
5	Transylvania County	7		33,189		2.1
3	Rockingham County Council on Aging	20		93,764		2.1
4	Craven County	29		127,442		2.3
3	Richmond Interagency Transportation Inc.	11		46,600		2.4
3	Dare County	8		33,886		2.4
4	Duplin County	14		58,729		2.4
3	Carteret County	16		66,712		2.4
3	Scotland County	9		36,098		2.5
3	Harnett County	29		115,579		2.5
3	Lenoir County	15		59,493		2.5
4	Bladen County	9		35,243		2.6
4	Albemarle Regional Health Services	27		102,412		2.6
3	City of Rocky Mount	43		152,896		2.8
3	Kerr Area Transportation Authority	53		188,033		2.8
3	Moore County	25		88,594		2.8
3	Transp. Admin. of Cleveland County. Inc.	28		98,249		2.8
2	Lee County	17		58,059		2.9
4	Chatham Transit Network	19		63,870		3.0

Peer Group	Sub-Recipient Name	Active Fleet		Service Area 2010 Population		Vehicles per 10,000 Population
4	Mountain Projects, Inc.	18		59,148		3.0
4	Columbus County	18		58,204		3.1
5	Jackson County	13		40,480		3.2
3	Stanly County	20		60,714		3.3
4	Rutherford County	23		68,006		3.4
4	Choanoke Public Transportation Authority	43		122,827		3.5
4	Macon County	12		33,946		3.5
4	Hoke County	17		47,376		3.6
4	Greene County	8		21,277		3.8
3	Person County	15		39,585		3.8
4	Caswell County	10		23,676		4.2
4	Wilkes Transportation Authority	30		69,419		4.3
3	Yadkin Valley Economic Dev. District, Inc.	90		201,098		4.5
5	Cherokee County	14		27,527		5.1
5	Madison County Transportation Authority	11		20,795		5.3
4	Anson County	15		26,973		5.6
5	Ashe County Transportation Authority Inc.	16		27,378		5.8
5	Mitchell County Transportation Authority	10		15,588		6.4
5	Swain County Focal Point on Aging Inc.	9		14,020		6.4
5	Yancey County Transportation Authority	12		17,802		6.7
5	Polk County Transportation Authority	14		20,588		6.8
4	Washington County	9		13,224		6.8
5	Avery County Transportation Authority	13		17,812		7.3
4	Martin County	18		24,498		7.3
4	Gates County	9		12,214		7.4
5	Graham County	9		8,888		10.1
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		5,783		10.4
5	Alleghany County	12		11,171		10.7
5	Clay County	14		10,622		13.2
	TOTAL / Calculated Value for All Systems	**1,460**		**8,237,478**		**1.8**
	Minimum Value	6		5,783		0
	Maximum Value	90		923,944		13
	Average Value	20		112,842		3
	Standard Deviation	13		157,432		3
	Mean Minus One Standard Deviation					
	Mean Plus One Standard Deviation					

Table C-8: Vehicles per 100 Square Miles of Service Area

Peer Group	Sub-Recipient Name	Active Fleet		Service Area Land Area		Vehicles per 100 Sq. Miles of Service Area
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		612.7		0.98
4	Bladen County	9		874.328		1.03
4	Beaufort County Developmental Center, Inc.	10		827.192		1.21
4	Pender Adult Services, Inc.	11		869.795		1.26
4	Sampson County	13		944.74		1.38
3	Robeson County	15		949.221		1.58
4	Brunswick Transit System Inc.	14		846.973		1.65
1	Guilford County	11		645.704		1.70
5	Swain County Focal Point on Aging Inc.	9		527.996		1.70
4	Duplin County	14		816.219		1.72
5	Transylvania County	7		378.528		1.85
4	Choanoke Public Transportation Authority	43		2313.005		1.86
4	Craven County	29		1516.203		1.91
4	Columbus County	18		937.293		1.92
3	Dare County	8		383.42		2.09
3	Randolph County Senior Adult Association Inc.	27		1274.277		2.12
3	Richmond Interagency Transportation Inc.	11		473.821		2.32
4	Macon County	12		515.558		2.33
4	Albemarle Regional Health Services	27		1148.85		2.35
4	Caswell County	10		424.922		2.35
5	Madison County Transportation Authority	11		449.57		2.45
2	Onslow United Transit System	19		762.744		2.49
4	Washington County	9		348.135		2.59
4	Gates County	9		340.445		2.64
5	Jackson County	13		490.755		2.65
4	Chatham Transit Network	19		682.185		2.79
4	Anson County	15		531.452		2.82
3	Scotland County	9		318.845		2.82
4	Greene County	8		265.928		3.01
3	Johnston Co. Council on Aging Inc.	24		791.299		3.03
5	Cherokee County	14		455.426		3.07
2	Davidson County	17		552.675		3.08
5	Graham County	9		292.079		3.08
3	Kerr Area Transportation Authority	53		1705.224		3.11
3	Carteret County	16		506.251		3.16
4	Mountain Projects, Inc.	18		553.692		3.25
2	Union County	22		631.52		3.48
3	Rockingham County Council on Aging	20		565.551		3.54
3	Moore County	25		697.483		3.58
3	Lenoir County	15		400.591		3.74
5	Ashe County Transportation Authority Inc.	16		426.135		3.75
2	Wilson County	14		368.174		3.80

Peer Group	Sub-Recipient Name	Active Fleet		Service Area Land Area		Vehicles per 100 Sq. Miles of Service Area
3	Person County	15		392.322		3.82
2	Pitt County	25		651.975		3.83
5	Yancey County Transportation Authority	12		312.597		3.84
4	Martin County	18		461.217		3.90
4	Wilkes Transportation Authority	30		754.278		3.98
2	Orange County	16		397.958		4.02
4	Rutherford County	23		564.151		4.08
3	City of Rocky Mount	43		1045.743		4.11
2	Goldsboro/Wayne Transportation Authority	24		553.087		4.34
4	Hoke County	17		390.744		4.35
5	Mitchell County Transportation Authority	10		221.425		4.52
3	Harnett County	29		594.987		4.87
2	Iredell County	28		573.583		4.88
1	Wake County DSS	42		835.219		5.03
3	Stanly County	20		395.086		5.06
3	Western Carolina Community Action Inc.	19		373.068		5.09
5	Alleghany County	12		235.059		5.11
5	Avery County Transportation Authority	13		247.087		5.26
1	Mecklenburg County DSS	28		523.842		5.35
3	Lincoln County	16		297.938		5.37
2	Rowan County	29		511.374		5.67
3	Yadkin Valley Economic Dev. District, Inc.	90		1579.957		5.70
5	Polk County Transportation Authority	14		237.789		5.89
1	Durham County	17		285.975		5.94
3	Transp. Admin. of Cleveland County. Inc.	28		464.252		6.03
3	Buncombe County- Mountain Mobility	42		656.672		6.40
5	Clay County	14		214.751		6.52
2	Alamance County Transportation Authority	28		423.943		6.60
2	Lee County	17		254.959		6.67
2	Cabarrus County Transportation Services	30		361.749		8.29
2	Gaston County	32		356.027		8.99
	TOTAL / Calculated Value for All Systems	**1,460**		**44,586**		**3.27**
	Minimum Value	6		215		0.98
	Maximum Value	90		2,313		8.99
	Average Value	20		611		3.65
	Standard Deviation	13		373		1.73
	Mean Minus One Standard Deviation					
	Mean Plus One Standard Deviation					

Table C-9: Vehicles per 10,000 Passenger Trips—5311 Systems

Peer Group	Sub-Recipient Name	Active Fleet		No. Pass. Trips (FY2011)		Vehicles per 10,000 Pass. Trips
1	Guilford County	11		190,438		0.58
1	Mecklenburg County DSS	28		316,449		0.88
1	Wake County DSS	42		321,196		1.31
3	Lenoir County	15		107,019		1.40
2	Orange County	16		113,600		1.41
2	Davidson County	17		103,890		1.64
5	Swain County Focal Point on Aging Inc.	9		53,059		1.70
5	Mitchell County Transportation Authority	10		58,364		1.71
3	Richmond Interagency Transportation Inc.	11		54,911		2.00
5	Transylvania County	7		33,677		2.08
3	Robeson County	15		68,361		2.19
4	Hoke County	17		76,580		2.22
4	Choanoke Public Transportation Authority	43		190,288		2.26
2	Gaston County	32		141,377		2.26
2	Wilson County	14		61,272		2.28
3	Buncombe County- Mountain Mobility	42		178,873		2.35
2	Iredell County	28		117,858		2.38
2	Goldsboro/Wayne Transportation Authority	24		97,184		2.47
5	Polk County Transportation Authority	14		56,081		2.50
3	Scotland County	9		35,619		2.53
4	Beaufort County Developmental Center, Inc.	10		39,560		2.53
2	Union County	22		86,067		2.56
3	Carteret County	16		62,407		2.56
3	Johnston Co. Council on Aging Inc.	24		93,247		2.57
4	Albemarle Regional Health Services	27		101,274		2.67
2	Lee County	17		63,579		2.67
4	Duplin County	14		52,249		2.68
4	Craven County	29		106,038		2.73
5	Avery County Transportation Authority	13		46,505		2.80
2	Onslow United Transit System	19		66,219		2.87
4	Brunswick Transit System Inc.	14		47,310		2.96
2	Rowan County	29		97,893		2.96
4	Greene County	8		26,020		3.07
4	Mountain Projects, Inc.	18		58,233		3.09
3	Stanly County	20		63,610		3.14
3	Randolph County Senior Adult Assoc. Inc.	27		85,852		3.14
5	Ashe County Transportation Authority Inc.	16		50,601		3.16
1	Durham County	17		53,475		3.18
5	Jackson County	13		40,833		3.18
4	Bladen County	9		28,191		3.19
3	Rockingham County Council on Aging	20		59,875		3.34
5	Cherokee County	14		41,728		3.36
4	Macon County	12		35,665		3.36
3	Lincoln County	16		47,339		3.38

Peer Group	Sub-Recipient Name	Active Fleet		No. Pass. Trips (FY2011)		Vehicles per 10,000 Pass. Trips
3	Kerr Area Transportation Authority	53		156,465		3.39
3	Harnett County	29		83,758		3.46
4	Chatham Transit Network	19		54,343		3.50
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		16,886		3.55
4	Gates County	9		25,035		3.59
4	Anson County	15		41,657		3.60
5	Yancey County Transportation Authority	12		33,022		3.63
3	Western Carolina Community Action Inc.	19		52,148		3.64
4	Sampson County	13		35,674		3.64
2	Cabarrus County Transportation Services	30		81,844		3.67
2	Alamance County Transportation Authority	28		76,056		3.68
3	Person County	15		40,695		3.69
5	Madison County Transportation Authority	11		29,707		3.70
4	Rutherford County	23		60,487		3.80
4	Caswell County	10		25,946		3.85
5	Graham County	9		22,928		3.93
3	Dare County	8		20,046		3.99
3	Transp. Admin. of Cleveland County. Inc.	28		69,644		4.02
3	City of Rocky Mount	43		101,861		4.22
4	Wilkes Transportation Authority	30		70,194		4.27
3	Yadkin Valley Economic Dev. District, Inc.	90		209,282		4.30
4	Martin County	18		40,441		4.45
4	Washington County	9		19,497		4.62
3	Moore County	25		54,080		4.62
4	Columbus County	18		38,341		4.69
2	Pitt County	25		51,658		4.84
4	Pender Adult Services, Inc.	11		21,352		5.15
5	Alleghany County	12		19,168		6.26
5	Clay County	14		17,814		7.86
	TOTAL / Calculated Value for All Systems	**1,460**		**5,399,895**		**2.70**
	Minimum Value	6		16,886		0.58
	Maximum Value	90		321,196		7.86
	Average Value	20		73,971		3.16
	Standard Deviation	13		59,270		1.15
	Mean Minus One Standard Deviation					
	Mean Plus One Standard Deviation					

Table C-10: Vehicles per Trip Density—5311 Systems

Peer Group	Sub-Recipient Name	Active Fleet		Trip Density		Vehicles per Trip Density
1	Guilford County	11		294.9		0.04
5	Mitchell County Transportation Authority	10		263.6		0.04
1	Mecklenburg County DSS	28		604.1		0.05
2	Orange County	16		285.5		0.06
3	Lenoir County	15		267.2		0.06
5	Polk County Transportation Authority	14		235.8		0.06
2	Lee County	17		249.4		0.07
5	Avery County Transportation Authority	13		188.2		0.07
5	Transylvania County	7		89.0		0.08
3	Scotland County	9		111.7		0.08
2	Gaston County	32		397.1		0.08
4	Greene County	8		97.8		0.08
2	Wilson County	14		166.4		0.08
4	Hoke County	17		196.0		0.09
5	Swain County Focal Point on Aging Inc.	9		100.5		0.09
2	Davidson County	17		188.0		0.09
1	Durham County	17		187.0		0.09
3	Richmond Interagency Transportation Inc.	11		115.9		0.09
3	Lincoln County	16		158.9		0.10
1	Wake County DSS	42		384.6		0.11
5	Yancey County Transportation Authority	12		105.6		0.11
5	Graham County	9		78.5		0.11
4	Gates County	9		73.5		0.12
3	Stanly County	20		161.0		0.12
3	Carteret County	16		123.3		0.13
2	Cabarrus County Transportation Services	30		226.2		0.13
5	Ashe County Transportation Authority Inc.	16		118.7		0.13
3	Western Carolina Community Action Inc.	19		139.8		0.14
2	Iredell County	28		205.5		0.14
2	Goldsboro/Wayne Transportation Authority	24		175.7		0.14
3	Person County	15		103.7		0.14
5	Alleghany County	12		81.5		0.15
2	Rowan County	29		191.4		0.15
5	Cherokee County	14		91.6		0.15
3	Dare County	8		52.3		0.15
3	Buncombe County- Mountain Mobility	42		272.4		0.15
2	Alamance County Transportation Authority	28		179.4		0.16
5	Jackson County	13		83.2		0.16
4	Washington County	9		56.0		0.16
2	Union County	22		136.3		0.16
4	Caswell County	10		61.1		0.16
5	Madison County Transportation Authority	11		66.1		0.17
5	Clay County	14		83.0		0.17
4	Mountain Projects, Inc.	18		105.2		0.17

Peer Group	Sub-Recipient Name	Active Fleet		Trip Density		Vehicles per Trip Density
4	Macon County	12		69.2		0.17
3	Transp. Admin. of Cleveland County. Inc.	28		150.0		0.19
3	Rockingham County Council on Aging	20		105.9		0.19
4	Anson County	15		78.4		0.19
3	Johnston Co. Council on Aging Inc.	24		117.8		0.20
4	Martin County	18		87.7		0.21
3	Harnett County	29		140.8		0.21
3	Robeson County	15		72.0		0.21
4	Beaufort County Developmental Center, Inc.	10		47.8		0.21
4	Rutherford County	23		107.2		0.21
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		27.6		0.22
4	Duplin County	14		64.0		0.22
2	Onslow United Transit System	19		86.8		0.22
4	Chatham Transit Network	19		79.7		0.24
4	Brunswick Transit System Inc.	14		55.9		0.25
4	Bladen County	9		32.2		0.28
4	Albemarle Regional Health Services	27		88.2		0.31
2	Pitt County	25		79.2		0.32
4	Wilkes Transportation Authority	30		93.1		0.32
3	Moore County	25		77.5		0.32
4	Sampson County	13		37.8		0.34
3	Randolph County Senior Adult Assoc. Inc.	27		67.4		0.40
4	Craven County	29		69.9		0.41
4	Columbus County	18		40.9		0.44
3	City of Rocky Mount	43		97.4		0.44
4	Pender Adult Services, Inc.	11		24.5		0.45
4	Choanoke Public Transportation Authority	43		82.3		0.52
3	Kerr Area Transportation Authority	53		91.8		0.58
3	Yadkin Valley Economic Dev. District, Inc.	90		132.5		0.68
	TOTAL / Calculated Value for All Systems	**1,460**		**121.1**		**12.05**
	Minimum Value	6		25		0.04
	Maximum Value	90		604		0.68
	Average Value	20		135		0.19
	Standard Deviation	13		97		0.13
	Mean Minus One Standard Deviation					
	Mean Plus One Standard Deviation					

Appendix D: Summary Statistics

Table D-1: Summary Data for Vehicle Factors—5311 Systems

Peer Group	Sub-Recipient Name	Active Fleet		Service Area Pop. (2010)	Service Area Land Area	Service Area Pop. Density	Pass. Trips (FY2011)	Service Miles (FY2011)	Service Hours (FY2011)	Trip Density
4	Anson County	15		26,973	531.452	50.8	41,657	598,922	21,670	78.4
5	Avery County Transportation Authority	13		17,812	247.087	72.1	46,505	238,513	19,085	188.2
4	Beaufort County Developmental Center, Inc.	10		47,929	827.192	57.9	39,560	265,226	13,750	47.8
4	Caswell County	10		23,676	424.922	55.7	25,946	301,310	10,020	61.1
4	Chatham Transit Network	19		63,870	682.185	93.6	54,343	598,304	23,634	79.7
5	Cherokee County	14		27,527	455.426	60.4	41,728	410,722	16,672	91.6
3	Dare County	8		33,886	383.42	88.4	20,046	249,158	13,127	52.3
4	Bladen County	9		35,243	874.328	40.3	28,191	132,652	5,008	32.2
4	Brunswick Transit System Inc.	14		108,176	846.973	127.7	47,310	458,507	14,650	55.9
3	Carteret County	16		66,712	506.251	131.8	62,407	622,254	34,336	123.3
4	Columbus County	18		58,204	937.293	62.1	38,341	569,008	20,906	40.9
4	Duplin County	14		58,729	816.219	72.0	52,249	629,416	22,740	64.0
5	Graham County	9		8,888	292.079	30.4	22,928	237,178	8,361	78.5
4	Craven County	29		127,442	1516.203	84.1	106,038	831,262	39,862	69.9
3	Transp. Admin. of Cleveland County. Inc.	28		98,249	464.252	211.6	69,644	601,667	30,344	150.0
4	Greene County	8		21,277	265.928	80.0	26,020	240,879	8,791	97.8
3	Harnett County	29		115,579	594.987	194.3	83,758	878,736	40,846	140.8
4	Hoke County	17		47,376	390.744	121.2	76,580	482,121	25,124	196.0
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		5,783	612.7	9.4	16,886	132,973	4,886	27.6
5	Jackson County	13		40,480	490.755	82.5	40,833	220,089	11,780	83.2
3	Johnston Co. Council on Aging Inc.	24		170,151	791.299	215.0	93,247	854,306	43,376	117.8
3	Kerr Area Transportation Authority	53		188,033	1705.224	110.3	156,465	1,669,738	87,898	91.8
2	Lee County	17		58,059	254.959	227.7	63,579	425,963	22,348	249.4
3	Lenoir County	15		59,493	400.591	148.5	107,019	812,372	48,991	267.2
5	Madison County Transportation Authority	11		20,795	449.57	46.3	29,707	199,304	11,050	66.1
4	Martin County	18		24,498	461.217	53.1	40,441	325,500	17,493	87.7
4	Macon County	12		33,946	515.558	65.8	35,665	302,160	16,697	69.2

Peer Group	Sub-Recipient Name	Active Fleet		Service Area Pop. (2010)	Service Area Land Area	Service Area Pop. Density	Pass. Trips (FY2011)	Service Miles (FY2011)	Service Hours (FY2011)	Trip Density
5	Mitchell County Transportation Authority	10		15,588	221.425	70.4	58,364	296,657	15,136	263.6
3	Moore County	25		88,594	697.483	127.0	54,080	859,570	42,771	77.5
5	Polk County Transportation Authority	14		20,588	237.789	86.6	56,081	410,157	18,422	235.8
3	Randolph County Senior Adult Association Inc.	27		170,119	1274.277	133.5	85,852	649,961	33,230	67.4
3	Richmond Interagency Transportation Inc.	11		46,600	473.821	98.3	54,911	373,083	21,185	115.9
3	Robeson County	15		134,502	949.221	141.7	68,361	386,602	17,421	72.0
4	Rutherford County	23		68,006	564.151	120.5	60,487	659,385	36,200	107.2
4	Sampson County	13		63,481	944.74	67.2	35,674	255,381	12,212	37.8
3	Scotland County	9		36,098	318.845	113.2	35,619	226,604	12,664	111.7
3	Stanly County	20		60,714	395.086	153.7	63,610	333,525	18,786	161.0
5	Swain County Focal Point on Aging Inc.	9		14,020	527.996	26.6	53,059	171,387	14,505	100.5
5	Transylvania County	7		33,189	378.528	87.7	33,677	112,806	5,799	89.0
2	Union County	22		202,592	631.52	320.8	86,067	731,047	45,649	136.3
5	Yancey County Transportation Authority	12		17,802	312.597	56.9	33,022	157,115	11,584	105.6
4	Wilkes Transportation Authority	30		69,419	754.278	92.0	70,194	646,018	28,619	93.1
3	Rockingham County Council on Aging	20		93,764	565.551	165.8	59,875	569,375	34,754	105.9
2	Davidson County	17		163,488	552.675	295.8	103,890	325,165	36,660	188.0
5	Alleghany County	12		11,171	235.059	47.5	19,168	565,876	20,990	81.5
2	Iredell County	28		160,107	573.583	279.1	117,858	839,555	46,954	205.5
2	Rowan County	29		138,651	511.374	271.1	97,893	696,924	44,406	191.4
5	Ashe County Transportation Authority Inc.	16		27,378	426.135	64.2	50,601	662,691	29,892	118.7
5	Clay County	14		10,622	214.751	49.5	17,814	319,601	16,028	83.0
4	Choanoke Public Transportation Authority	43		122,827	2313.005	53.1	190,288	1,200,468	52,802	82.3
4	Gates County	9		12,214	340.445	35.9	25,035	317,428	11,947	73.5
4	Albemarle Regional Health Services	27		102,412	1148.85	89.1	101,274	902,681	46,221	88.2
3	Person County	15		39,585	392.322	100.9	40,695	279,071	15,027	103.7
4	Washington County	9		13,224	348.135	38.0	19,497	169,072	9,337	56.0
2	Wilson County	14		81,643	368.174	221.8	61,272	575,861	34,622	166.4
4	Mountain Projects, Inc.	18		59,148	553.692	106.8	58,233	518,598	27,915	105.2
3	Yadkin Valley Economic Dev. District, Inc.	90		201,098	1579.957	127.3	209,282	1,806,857	97,018	132.5
2	Alamance County Transportation Authority	28		151,745	423.943	357.9	76,056	781,694	45,557	179.4
3	Lincoln County	16		78,684	297.938	264.1	47,339	558,008	31,347	158.9
4	Pender Adult Services, Inc.	11		52,504	869.795	60.4	21,352	331,752	13,835	24.5

Peer Group	Sub-Recipient Name	Active Fleet		Service Area Pop. (2010)	Service Area Land Area	Service Area Pop. Density	Pass. Trips (FY2011)	Service Miles (FY2011)	Service Hours (FY2011)	Trip Density
2	Goldsboro/Wayne Transportation Authority	24		122,893	553.087	222.2	97,184	893,160	53,391	175.7
3	City of Rocky Mount	43		152,896	1045.743	146.2	101,861	1,250,610	58,163	97.4
3	Western Carolina Community Action Inc.	19		107,177	373.068	287.3	52,148	218,530	19,662	139.8
2	Cabarrus County Transportation Services	30		179,025	361.749	494.9	81,844	474,596	29,286	226.2
3	Buncombe County- Mountain Mobility	42		239,179	656.672	364.2	178,873	1,412,465	79,978	272.4
1	Guilford County	11		490,371	645.704	759.4	190,438	2,103,725	134,004	294.9
1	Mecklenburg County DSS	28		923,944	523.842	1,763.8	316,449	492,809	37,080	604.1
2	Onslow United Transit System	19		185,304	762.744	242.9	66,219	615,353	33,019	86.8
1	Wake County DSS	42		907,314	835.219	1,086.3	321,196	3,584,798	107,987	384.6
2	Gaston County	32		206,384	356.027	579.7	141,377	1,068,561	44,999	397.1
2	Pitt County	25		169,378	651.975	259.8	51,658	502,272	42,364	79.2
1	Durham County	17		268,925	285.975	940.4	53,475	254,108	42,012	187.0
2	Orange County	16		134,325	397.958	337.5	113,600	465,377	36,290	285.5
	TOTALS	**1,460**		**8,237,478**	**44,586**	**184.8**	**5,399,895**	**44,314,579**	**2,301,175**	**121.1**
	Minimum Value	6		5,783	215	9	16,886	112,806	4,886	25
	Maximum Value	90		923,944	2,313	1,764	321,196	3,584,798	134,004	604
	Mean Value	20		112,842	611	197	73,971	607,049	31,523	135
	Standard Deviation	13		157,432	373	268	59,270	525,289	23,865	97
	Mean Minus One Standard Deviation									
	Mean Plus One Standard Deviation									

Table D-2: Calculated Vehicle Factor Values—5311 Systems

Peer Group	Sub-Recipient Name	Active Fleet		Pass. Trips per Vehicle	Average Miles per Vehicle	Average Hours per Vehicle	Vehicles per 10,000 Population	Vehicles per 100 Square Miles of Service Area	Vehicles per 10,000 Pass. Trips	Vehicles per Trip Density
4	Anson County	15		2,777	39,928	1,445	5.6	2.82	3.60	0.19
5	Avery County Transportation Authority	13		3,577	18,347	1,468	7.3	5.26	2.80	0.07
4	Beaufort County Dev. Center, Inc.	10		3,956	26,523	1,375	2.1	1.21	2.53	0.21
4	Caswell County	10		2,595	30,131	1,002	4.2	2.35	3.85	0.16
4	Chatham Transit Network	19		2,860	31,490	1,244	3.0	2.79	3.50	0.24
5	Cherokee County	14		2,981	29,337	1,191	5.1	3.07	3.36	0.15
3	Dare County	8		2,506	31,145	1,641	2.4	2.09	3.99	0.15
4	Bladen County	9		3,132	14,739	556	2.6	1.03	3.19	0.28
4	Brunswick Transit System Inc.	14		3,379	32,751	1,046	1.3	1.65	2.96	0.25
3	Carteret County	16		3,900	38,891	2,146	2.4	3.16	2.56	0.13
4	Columbus County	18		2,130	31,612	1,161	3.1	1.92	4.69	0.44
4	Duplin County	14		3,732	44,958	1,624	2.4	1.72	2.68	0.22
5	Graham County	9		2,548	26,353	929	10.1	3.08	3.93	0.11
4	Craven County	29		3,656	28,664	1,375	2.3	1.91	2.73	0.41
3	Transp. Admin. of Cleveland County. Inc.	28		2,487	21,488	1,084	2.8	6.03	4.02	0.19
4	Greene County	8		3,253	30,110	1,099	3.8	3.01	3.07	0.08
3	Harnett County	29		2,888	30,301	1,408	2.5	4.87	3.46	0.21
4	Hoke County	17		4,505	28,360	1,478	3.6	4.35	2.22	0.09
4	Hyde County Private Non-Profit Transp. Corp. Inc.	6		2,814	22,162	814	10.4	0.98	3.55	0.22
5	Jackson County	13		3,141	16,930	906	3.2	2.65	3.18	0.16
3	Johnston Co. Council on Aging Inc.	24		3,885	35,596	1,807	1.4	3.03	2.57	0.20
3	Kerr Area Transportation Authority	53		2,952	31,504	1,658	2.8	3.11	3.39	0.58
2	Lee County	17		3,740	25,057	1,315	2.9	6.67	2.67	0.07
3	Lenoir County	15		7,135	54,158	3,266	2.5	3.74	1.40	0.06
5	Madison County Transportation Authority	11		2,701	18,119	1,005	5.3	2.45	3.70	0.17
4	Martin County	18		2,247	18,083	972	7.3	3.90	4.45	0.21
4	Macon County	12		2,972	25,180	1,391	3.5	2.33	3.36	0.17
5	Mitchell County Transportation Authority	10		5,836	29,666	1,514	6.4	4.52	1.71	0.04
3	Moore County	25		2,163	34,383	1,711	2.8	3.58	4.62	0.32

Peer Group	Sub-Recipient Name	Active Fleet		Pass. Trips per Vehicle	Average Miles per Vehicle	Average Hours per Vehicle	Vehicles per 10,000 Population	Vehicles per 100 Square Miles of Service Area	Vehicles per 10,000 Pass. Trips	Vehicles per Trip Density
5	Polk County Transportation Authority	14		4,006	29,297	1,316	6.8	5.89	2.50	0.06
3	Randolph County Senior Adult Assoc. Inc.	27		3,180	24,073	1,231	1.6	2.12	3.14	0.40
3	Richmond Interagency Transportation Inc.	11		4,992	33,917	1,926	2.4	2.32	2.00	0.09
3	Robeson County	15		4,557	25,773	1,161	1.1	1.58	2.19	0.21
4	Rutherford County	23		2,630	28,669	1,574	3.4	4.08	3.80	0.21
4	Sampson County	13		2,744	19,645	939	2.0	1.38	3.64	0.34
3	Scotland County	9		3,958	25,178	1,407	2.5	2.82	2.53	0.08
3	Stanly County	20		3,181	16,676	939	3.3	5.06	3.14	0.12
5	Swain County Focal Point on Aging Inc.	9		5,895	19,043	1,612	6.4	1.70	1.70	0.09
5	Transylvania County	7		4,811	16,115	828	2.1	1.85	2.08	0.08
2	Union County	22		3,912	33,229	2,075	1.1	3.48	2.56	0.16
5	Yancey County Transportation Authority	12		2,752	13,093	965	6.7	3.84	3.63	0.11
4	Wilkes Transportation Authority	30		2,340	21,534	954	4.3	3.98	4.27	0.32
3	Rockingham County Council on Aging	20		2,994	28,469	1,738	2.1	3.54	3.34	0.19
2	Davidson County	17		6,111	19,127	2,156	1.0	3.08	1.64	0.09
5	Alleghany County	12		1,597	47,156	1,749	10.7	5.11	6.26	0.15
2	Iredell County	28		4,209	29,984	1,677	1.7	4.88	2.38	0.14
2	Rowan County	29		3,376	24,032	1,531	2.1	5.67	2.96	0.15
5	Ashe County Transportation Authority Inc.	16		3,163	41,418	1,868	5.8	3.75	3.16	0.13
5	Clay County	14		1,272	22,829	1,145	13.2	6.52	7.86	0.17
4	Choanoke Public Transportation Authority	43		4,425	27,918	1,228	3.5	1.86	2.26	0.52
4	Gates County	9		2,782	35,270	1,327	7.4	2.64	3.59	0.12
4	Albemarle Regional Health Services	27		3,751	33,433	1,712	2.6	2.35	2.67	0.31
3	Person County	15		2,713	18,605	1,002	3.8	3.82	3.69	0.14
4	Washington County	9		2,166	18,786	1,037	6.8	2.59	4.62	0.16
2	Wilson County	14		4,377	41,133	2,473	1.7	3.80	2.28	0.08
4	Mountain Projects, Inc.	18		3,235	28,811	1,551	3.0	3.25	3.09	0.17
3	Yadkin Valley Economic Dev. District, Inc.	90		2,325	20,076	1,078	4.5	5.70	4.30	0.68
2	Alamance County Transportation Authority	28		2,716	27,918	1,627	1.8	6.60	3.68	0.16
3	Lincoln County	16		2,959	34,876	1,959	2.0	5.37	3.38	0.10
4	Pender Adult Services, Inc.	11		1,941	30,159	1,258	2.1	1.26	5.15	0.45
2	Goldsboro/Wayne Transportation Authority	24		4,049	37,215	2,225	2.0	4.34	2.47	0.14
3	City of Rocky Mount	43		2,369	29,084	1,353	2.8	4.11	4.22	0.44

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3	Western Carolina Community Action Inc.	19		2,745	11,502	1,035	1.8	5.09	3.64	0.14
2	Cabarrus County Transportation Services	30		2,728	15,820	976	1.7	8.29	3.67	0.13
3	Buncombe County- Mountain Mobility	42		4,259	33,630	1,904	1.8	6.40	2.35	0.15
1	Guilford County	11		17,313	191,248	12,182	0.2	1.70	0.58	0.04
1	Mecklenburg County DSS	28		11,302	17,600	1,324	0.3	5.35	0.88	0.05
2	Onslow United Transit System	19		3,485	32,387	1,738	1.0	2.49	2.87	0.22
1	Wake County DSS	42		7,648	85,352	2,571	0.5	5.03	1.31	0.11
2	Gaston County	32		4,418	33,393	1,406	1.6	8.99	2.26	0.08
2	Pitt County	25		2,066	20,091	1,695	1.5	3.83	4.84	0.32
1	Durham County	17		3,146	14,948	2,471	0.6	5.94	3.18	0.09
2	Orange County	16		7,100	29,086	2,268	1.2	4.02	1.41	0.06
	TOTALS / Calculated Values	**1,460**		**3,699**	**30,352**	**1,576**	**1.8**	**3.27**	**2.70**	**12.05**
	Minimum Value	6		1,272	11,502	556	0.2	0.98	0.58	0.04
	Maximum Value	90		17,313	191,248	12,182	13.2	8.99	7.86	0.68
	Mean Value	20		3,755	30,597	1,614	3.4	3.65	3.16	0.19
	Standard Deviation	13		2,226	21,882	1,343	2.6	1.73	1.15	0.13
	Mean Minus One Standard Deviation	7		1,529	8,715	271	0.9	1.93	2.01	0.06
	Mean Plus One Standard Deviation	33		5,982	52,478	2,957	6.0	5.38	4.32	0.32