WSTA Bus Service Standards

Standards and Procedures to Evaluate and Improve Transit Service in Winston-Salem

July 20, 2022

Winston-Salem Transit Authority
with the City of Winston-Salem

WSTA Route Study

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Executive Summary

The City of Winston-Salem is creating service standards for WSTA to measure the performance of its bus routes and to make data-driven changes to carry more passengers to jobs, educational opportunities, health care, houses of worship, and community and social events.

The service standards in this document will help the City measure WSTA's performance in regards to:

- Service Effectiveness (how much passenger travel is obtained per unit of service)

- Cost Effectiveness (how much cost is incurred per unit of passenger travel)

- Cost Efficiency (how much cost is incurred per unit of service)

The standards identify four key indicators:

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

System averages will be generated for these variables for Weekday, Saturday, and Sunday service as data is available to do so. Using these system averages, each indicator for each route will be classified as **Low-Performing** if it is at 75% of the system average or below, **High-Performing** if it is at 125% of the system average or more, and **Average** if in between 75% and 125% of the system average. **Table 4** demonstrates the application of this method to Unlinked Passenger Trips Per Vehicle Revenue Hour.

These standards will analyze performance monthly. For routes that are consistently Low-Performing across multiple indicators, the standards recommend actions that could include changing route geography or route elimination. For High-Performing routes, the standards recommend actions to support continued service growth.

Staff will use the standards to report on performance regularly to decision-makers, to recommend data-driven changes to improve performance, and to enable WSTA to provide more access to jobs, education, healthcare, and community for residents of the City.

Introduction: What are Service Standards?

Service standards are performance goals set by a transit agency that define where transit service is Higher Performing, Low Performing, or Average. By comparing the performance of individual routes to appropriate service standards, WSTA staff can determine if a route is performing well or poorly in one or more dimensions of the service.

Purpose: What are the Benefits of Service Standards?

Having an established method of measuring performance and well-defined indicators that can be tracked over time will allow WSTA to make planning decisions based on legitimized data whether they are responding to customer or policymaker inquiries or proposing new initiatives.

By using service standards on a regular and continuous basis, WSTA will be able to monitor changes in route performance, determine which operating practices lead to higher levels of ridership and revenue, and then apply those practices to areas of the system that are underperforming.

Furthermore, having clearly defined goals enumerated in a set of service standards will help guide WSTA when the data gathered prompt staff and the Board to make difficult decisions.

Finally, sharing information about performance data and service standards with the public will allow WSTA to display greater transparency and accountability as a steward of public funds.

Below is a glossary of transit terms that may be useful to refer to while reading the document.

Glossary of Terms

Alighting: The act of a single passenger getting off a bus at one stop.

Boarding: The act of a single passenger getting onto a bus at one stop.

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

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

Frequency: Also sometimes referred to as a "headway," this is a description of how often a bus route serves a certain stop every hour. An hourly headway or frequency would be a bus that comes once every 60 minutes, whereas a 10-minute headway would be one where buses serve a stop 6 times every hour.

Headway: see Frequency.

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

Peak Load: The highest number of passengers on a particular bus route during the day. This may or may not occur during the Peak Period, described below.

Peak Period: A peak period is a time of day when the vast majority of commuters are traveling to and from work. These times of day are often when transit services experience their greatest ridership demands, and consequently, their maximum level of operation. Even at systems that operate the same frequency of service all day long, there may still be ridership peaks based on patterns of demand. Before COVID-19, transit

agencies in the United States typically experienced the A.M. Peak period as 6:00 to 9:00 A.M., and the evening peak, or P.M. Peak period from 3:30 to 6:30 P.M.

Route Pattern: A route pattern is the series of turns followed by a fixed-route bus repeatedly throughout the day. If a route serves a slightly different geography at any time of day, such as diverting to serve a school in the early afternoon on weekdays, this is a different route pattern from the primary pattern.

Route Segment: Routes are broken down into smaller pieces called segments for analysis purposes. Sometimes ridership data can be broken into segments between major timepoints. On WSTA Route 80, the agency might measure boardings and alightings from the transit center to the Hawthorne Road/Miller Street stop as one segment, and from Hawthorne Road/Miller Street to Hanes Mall as another segment. Usually, the segmentation occurs at the route endpoints, unless the route is circular.

Service Area: The specific physical locations in which an agency supplies transit service, and the land ½-mile from the centerline of the streets that make up the routes traveled by the buses.

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

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

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

Standard or Service Standard: A service standard is a goal set by WSTA staff to make judgments about where service is performing adequately and inadequately. Standards describe "what is good" by using indicators to set performance thresholds, which helps define whether service is High Performing, Low Performing, or Average. Standards can be absolute, such as "every route must average at least five passengers per revenue hour to remain in service." Alternatively, standards can be used to draw comparisons and trigger action, such as "any route performing more than 25% below the system average will be reviewed for routing changes."

Time Points: Scheduled stops that the bus operator must wait at if they arrive early to ensure the bus does not get ahead of schedule. These stops are often key destinations and are also those which should be announced for passengers with visual impairment.

Unlinked and Linked Passenger Trips: Passenger trips are often referred to as "linked" or "unlinked," in terms of explaining whether a passenger's travel involves a transfer. An "unlinked" passenger trip is counted without any regard to whether transfers occurred. A linked trip only occurs when a transfer takes place, and a passenger completes a trip using two or more buses.

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

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

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

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

Service Evaluation Standards: An Overview

While there are many ways to measure performance against service standards, virtually all traditional transit service standards seek to answer one or more of the following three questions:

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

These three questions are often addressed by transit agencies by examining one of these questions against another. For example, a transit agency may wish to know how many units of travel (i.e., trips) are occurring per every unit of service (i.e. hours) being provided.

The indicators that are produced by comparing two of the above questions can be broadly divided into three categories: **Service Effectiveness, Cost Effectiveness,** and **Cost Efficiency.** The next section explains each of these terms, how they differ from each other, and why they are important to determining system performance.

A Note on "Effectiveness" Versus "Efficiency" – while these terms seem very similar, they refer to different measurements. Specifically, any time we are measuring passenger

TRAVEL against another service attribute, we are talking about **effectiveness**. When we are not measuring passenger TRAVEL, our comparison is focused on TIME and MONEY, or DISTANCE and MONEY, where the relationship is expressed using the term **efficiency**.

Service Effectiveness

What Is It?

Service Effectiveness measures how much travel is obtained per unit of service.

Imagine there are two buses, A and B, and each is in service for two hours. Bus A carries 40 passengers in that time period, and Bus B carries 20 passengers. In this example, when we compare both routes, Bus A is carrying an average of 20 passengers per hour and has greater Service Effectiveness than Bus B, which only carries 10 passengers per hour.

Table 1 Service Effectiveness Example: Passengers Per Hour

Bus	# Hours in Service	Passengers carried	Passengers Per Hour
A	2	40	20
B	2	20	10

Why Measure Service Effectiveness?

This dimension of service evaluation is the one that is most focused on the ability to meet the customers' needs. The cost to operate one bus for an hour is relatively similar whether it carries 10 passengers or a full load of 35 to 40 passengers. Identifying which routes or portions of routes, or times of day have the greatest Service Effectiveness allows the agency to figure out what it is about those routes that make them the most attractive ones, and then to try to, where possible, add those characteristics to other routes. We can say that the WSTA route with the greatest Service Effectiveness is the route that meets the needs of the largest number of people per unit of service.

Examples of Service Effectiveness:

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

Cost Effectiveness

What Is It?

Cost Effectiveness measures how much cost is incurred per unit of travel.

Imagine there are two more buses, C and D, and each carries 50 passengers per day. The operations manager has also determined that it costs $100 per day to run either bus. On Bus C, each passenger pays a hypothetical fare of $1. On bus D, which serves a senior citizens' center, each passenger pays a reduced fare of $.50. Bus C receives $50 in revenue, but incurs $100 in costs, producing a 50 percent Farebox Recovery Ratio. Bus D receives $25 in revenue, but also incurs $100 in costs, producing a 25 percent Farebox Recovery Ratio. We can then say that Bus C, recouping one-half of its operating cost through fares, has greater Service Effectiveness than Bus D, which only recovers one-quarter of its operating cost through fares.

Table 2 Cost Effectiveness Example: Farebox Recovery Ratio

Route Name	# Passengers per day	Cost to operate per day	Fare	Revenue	Farebox Recovery ratio
C	50	$100	$1	$50	50%
D	50	$100	$0.50	$25	25%

Why Measure Cost Effectiveness?

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

Examples of Cost Effectiveness:

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

Cost Efficiency

What Is It?

Cost Efficiency measures how much cost is incurred per unit of service. Imagine there are two buses, E and F, and each operates for the same number of hours each day.

The route that Bus E follows has its first stop only one mile from the garage and it has 2 total "deadhead" miles of service at the beginning and end of each day where the bus cannot pick up passengers.

The route that Bus F follows starts on the outskirts of the city. Its first stop is 10 miles from the garage, creating 20 total deadhead miles.

While both buses serve passengers for the same number of daily hours, Bus F will burn significantly more fuel and brake pads driving a greater distance to the initial starting point of the route.

Assuming the transit agency operates 357 days a year, like WSTA, by the end of the year, Bus F will have driven 714 miles more than Bus E while covering the deadhead miles before and after its route and cost more to operate the same number of hours of service.

Table 3 Cost Efficiency Calculations

Route Name	Daily Deadhead miles before/after the route	Days of Service	Annual Deadhead miles	Cost Per Mile of Operations	Annual Cost of Deadhead miles
E	2	357	714	$0.10	$71.40
F	20	357	7,140	$0.10	$714.00

Why Measure Cost Efficiency?

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

Examples of Cost Efficiency:

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

Additional Service Characteristics

Some key questions for any transit agency that must be answered before providing service are:

- Where is the transit agency allowed to deploy services?

- Within that area in which the agency is allowed to put services, on which streets will those services run?
- What is the agency's sphere of influence?

Service Jurisdiction

The **service jurisdiction** is usually the area of a region in which transit services can be provided by the transit agency's charter documents. In WSTA's case, the Winston-Salem city limits are the service jurisdiction, whereas unincorporated areas of Forsyth County and any parts of the surrounding counties are not part of the service jurisdiction.

Service Area

The portions of the City of Winston-Salem that are within ½ mile of WSTA routes are part of the **service area**. Defining the service area as such helps focus marketing and research efforts on the areas of the region most likely to use existing services.

Service Span

Transit agencies must also determine when services should operate- from time A in the morning until time B at night. Some transit agencies specify a minimum service span as one of their service standards for all or some of their routes.

Equity in Service Provision

System characteristics that address equity are also of great importance to transit agencies. Civil rights guidelines stipulate that transit services be provided equitably among communities with varying socioeconomic backgrounds and racial composition.

Increasingly, transit agencies are becoming more specific about which populations within the community that have the greatest need for transit and measuring the presence of those populations throughout the community with an index.

For example, the Port Authority of Allegheny County in Pittsburgh has established an Equity Index with eight socio-economic populations shown in Figure 1.

When WSTA is evaluating a service change, staff will use GIS analysis to document the proportion of each of the four Title VI protected populations documented in the top half of the Pittsburgh Regional Transit graphic in the area where service is being proposed for changes or elimination, as well as zero-car households. Those variables are:

- Low-income households

- Minorities

- Non-English speakers

- People with disabilities

The analysis will compare those numbers to the average for the City of Winston-Salem and the overall WSTA service area to identify whether any proposed change disproportionately impacts one of these populations.

Figure 1 Pittsburgh Regional Transit Equity Index Component Populations
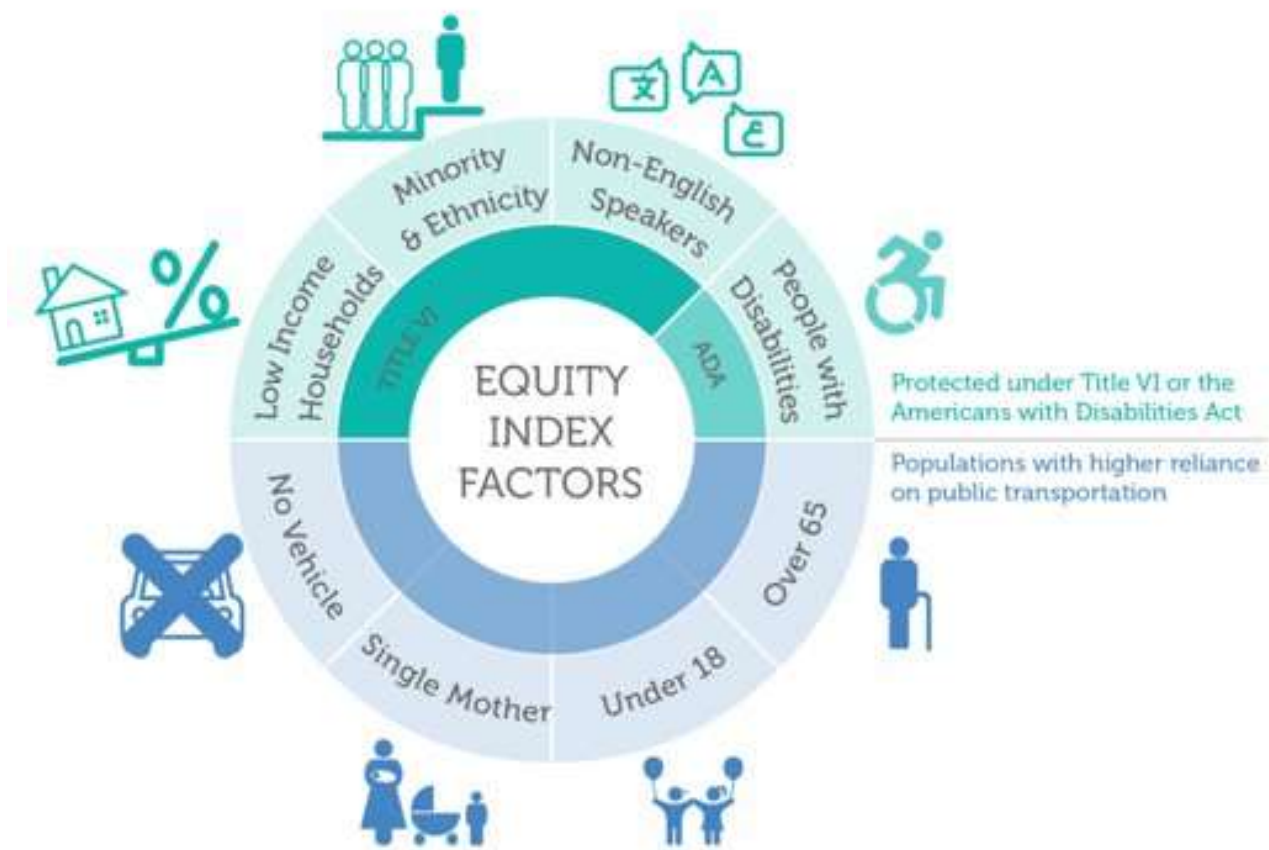
Rational and Fair Service Adjustments

While performance standards help guide service evaluation by identifying High-Performing and Low-Performing routes as targets for changes, it is equally important to have policies that describe the process by which routes can be introduced, altered, or

eliminated. This ensures that decisions are made on a rational and equitable basis. These types of standards are particularly useful for ensuring public participation in the process of planning and adjusting transit services.

WSTA Service Performance Indicators

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

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

The next section provides an overview of how these indicators are useful, and why one indicator is the best indicator of route health: Unlinked Passenger Trips Per Vehicle Revenue Hour.

Unlinked Passenger Trips Per Vehicle Revenue Hour

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

The Maryland Mass Transit District (MTD), which encompasses bus service, light rail in Baltimore, and the Baltimore/Washington Corridor MARC Commuter Rail, states in their evaluation policy:

> *"Staff shall use as the critical performance measure for service evaluation: Unlinked Passenger Trips Per Vehicle Revenue Hour. This measure is a direct indicator of Service Effectiveness and a strong indicator of Service Effectiveness (e.g., hours are the primary determinant of Service Effectiveness, and passengers are the primary determinant of fare revenue)."*

Using the rationale supplied above by Maryland MTD, it is recommended that the primary indicator of WSTA route performance be Unlinked Passenger Trips per Vehicle Revenue Hour.

The rationales for the other three indicators are as follows:

Farebox Recovery Ratio

To the extent that any agency wishes to have a user fee contribute to the cost to operate the transit system, tracking this figure is imperative to measure progress. It is also a primary way to measure whether fare policy is working in the intended manner.

Operating Cost Per Unlinked Passenger Trip

Like Farebox Recovery Ratio, this helps measure "bang for the buck." This measure also allows comparison to peer agencies to see how WSTA performs on cost management.

Unlinked Passenger Trips Per Vehicle Revenue Mile

This indicator can give service planning staff a sense of whether routes that have stops with greater distance between them are more or less effective than typical urban routes with ¼-mile stop spacing. Additionally, this metric is very helpful in determining the numbers of Vehicle Miles Traveled (VMT) by WSTA passengers and calculating the potential air quality benefits that accrue to the metropolitan area by those passengers not driving.

Future Indicator: On-Time Performance

At the time of the writing of this document in the summer of 2022, WSTA is currently unable to track On-Time Performance due to a change in AT&T's cellular data from 3G to 5G service. New On-Time Performance tracking equipment is in the process of being procured and deployed. When that equipment is installed, tracking of On-Time Performance will resume.

This indicator shows how well the performance of the bus system's travel times meets the published schedule and the expectations of the public. This metric is crucial because it is one of the most strongly associated with customer satisfaction. In a system with relatively long headways, poor on-time performance can cause passengers to be late for work, and potentially put their employment at risk. On-time performance problems can be due to high ridership, traffic, or construction. Staff should monitor on-time performance carefully to respond with small route adjustments if needed.

Calculating Averages for Indicators to Apply Standards

After the indicators above have been measured for all routes individually, the following averages will be determined for each indicator:

- Systemwide Average
- Weekday Peak Period (6:00-9:00 A.M.; 3:30-6:30 P.M) Average
- Weekday Daytime (9:00 A.M – 3:30 P.M.) Average
- Weekday Evening (6:30 P.M. – 10:30 P.M.) Average
- Saturday Average
- Sunday Average

Each route will then be classified as Low-Performing, Average, or High-Performing for each indicator.

Low-Performing Indicator value is less than 75 percent of the system or category average

Average Indicator value is equal to or greater than 75 percent of the system or category average but less than or equal to 125 percent

High-Performing Indicator value is greater than 125 percent of the system or category average

To demonstrate how this works in practice, Table 4 on the next page shows the primary indicator of route performance, Unlinked Passenger Trips per Vehicle Revenue Hour, for each route. It also shows the Unlinked Passenger Trips and Vehicle Revenue Hours for each route to illustrate how the calculation is made.

In Table 2, the system average is 13.0 trips per hour. The low-performance threshold of 75% of the system average is 9.7 trips per hour. The high-performance threshold of 125% of the system average is 16.2 trips per hour.

For this indicator, Table 2 ranks performance from the lowest performing route to the highest performing route. Based on the order in the first column in the table:

- Routes 100 through 104 in Table 4 would be classified as Low-Performing

- Routes 90 through 107 in Table 4 would be classified as average

- Routes 86 through 83 in Table 4 would be classified as High-Performing

Table 4 Service Standards Application: Unlinked Passenger Trips Per Vehicle Revenue Hour - Weekday Service

	Oct 21 Weekday Revenue Hours	Oct 21 Weekday Unlinked Passenger Trips	Oct 21 Trips/RevHR
Route 100	11.25	11	1.0
Route 99	12.25	28	2.3
Route 110	7.00	24	3.4
Route 108	13.45	68	5.1
Route 98	13.00	66	5.1
Route 88	13.00	69	5.3
Route 102	5.00	28	5.6
Route 82	6.50	38	5.9
Route 97	13.70	87	6.3
Route 109	18.33	122	6.6
Route 95	12.62	94	7.4
Route 104	14.00	129	9.2
Low-Performance Threshold	**(Low Performers Above)**		**9.7**
Route 90	14.42	146	10.1
Route 101	13.50	137	10.1
Route 80	17.62	214	12.2
Route 85	15.42	191	12.4
Route 94	18.58	237	12.7
System Average			**13.0**
Route 84	13.42	179	13.3
Route 106	13.58	191	14.0
Route 91	18.08	266	14.7
Route 107	17.75	262	14.7
High-Performance Threshold	**(High Performers Below)**		**16.2**
Route 86	18.16	271	14.9
Route 105	14.00	247	17.6
Route 89	18.00	320	17.8
Route 93	13.58	248	18.3
Route 103	18.00	332	18.4
Route 96	18.58	343	18.5
Route 92	17.91	341	19.1
Route 81	6.50	127	19.6
Route 87	31.93	667	20.9
Route 83	18.00	437	24.3

This type of evaluation quickly identifies the routes within the WSTA system that are doing well, which routes are ripe for updates and adjustments, and allows staff to respond with appropriate actions.

Making Comparisons within Categories

Routes should be compared against services that have similar goals. For example, cross-town routes that connect the ends of services far outside of downtown are never going to be as productive as those that make transfers at the Clark Transportation Center, and the WSTA standards should account for this.

To the extent that WSTA has multiple types of services now or in the future, there could be analysis to determine average performance within these categories in addition to the time of day, day of the week, and systemwide averages:

- Standard all-day fixed-route
- Peak period only fixed-route
- Express service
- Crosstown
- Shuttle

Actions to Address Low-Performing Routes

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

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

Routes that are Low-Performing according to three or four indicators

These routes are a significant drain on WSTA's resources and should be studied to find potential major adjustments, re-routings, or time changes that may improve performance. If the route has been Low-Performing across three or more indicators for 6 months or more, WSTA should strongly consider recycling the service hours or eliminating the route.

Actions to Support High-Performing Routes

Routes that are High-Performing according to 2 or more indicators
These routes demonstrate WSTA's value to the community, and consistently attract riders. Therefore, WSTA should place high ridership stops on these routes at the top of the list for passenger amenity improvements such as new shelters, passenger information systems, benches, trashcans, etc.

Marketing programs tied to these routes should concentrate on leveraging the loyal riders of these routes to attract new riders. Programs such as referral incentives should be considered, "Why Transit Works for Me" stories on WSTA's website, social media page, etc.

Any changes to these routes should be small and focus on delivering the same product that passengers like in a more reliable, comfortable, or attractive manner.

Benchmarking with In-State Peers

While the service standards for WSTA are meant primarily to promote improvement and performance through analysis and comparison of routes within the WSTA system, comparing overall system performance to other peer systems can help identify when a trend of any type may be local or national. Potential in-state peers for analysis include Greensboro, High Point, Raleigh, Durham, Chapel Hill, and Asheville.

Meeting Federal Title VI Requirements

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

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

In addition to the maps specified above, any of the following indicators may be used to further assess WSTA's compliance with Title VI. The primary method for most of these indicators involves looking for disparities to see if there are areas in which WSTA is not equitably distributing resources and services. The additional indicators are:

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

When recommending any service changes that would change over 25% of a bus route's geographic extent or affect over 25% of the current riders of a service, Title VI analysis should be performed on the proposal.

WSTA Service Change Standards and Public Engagement

If over 25 percent of an existing route's pattern, measured in route miles, are to be changed in this process— WSTA should hold at least one public meeting to gather input and comment on how this change would affect riders and the community. Changes in which less than 25 percent of a route pattern is changed at one time can be made by WSTA staff without a public meeting. Notifying residents and businesses within ¾ of a mile of the route ahead of the public meeting is a standard best practice.

WSTA Service Evaluation Process

Frequency of Service Evaluation

City and WSTA staff will evaluate fixed-route performance in a standard report format monthly and share the data collected with elected officials as necessary.

Additionally, twice each year, staff will also prepare a Semi-Annual Report- a more extensive look at WSTA services as part of the Route Planning and service change recommendations process, which will measure route performance at the route segment level (i.e., inbound/outbound, between major timepoints) where possible.

Timing of Service Changes

In a city with five colleges, a best practice is to make major service changes ahead of the fall semester beginning, when new students move to the city and form new travel patterns, and smaller changes at the beginning of a new year, as the spring semester begins. The following Service Year is recommended for WSTA.

2022-2023 Potential Service Year
- July 2022: Service Standards Analysis Begins
- September 2022: Initial Performance Report to City Council and Winston-Salem Urbanized Area Metropolitan Planning Organization (MPO)
- November 2022: Recommendations for Minor Route Changes for February 2023
- January 2023: Semi-Annual Report on Individual Route Performance
- January to March 2023: Route Planning Committee conducts a detailed segment-level analysis of all routes
- March 2023: Major Fall service recommendations

- April 2023 Solicit/Receive Public Comment on Fall recommendations
- May 2023 WSTA Board and City Council Adopt Service Changes
- August 2023 New Service Implemented

WSTA Service Introduction and Elimination Standards

Service Introduction Standards

In addition to studying the performance of existing services, WSTA should have standards that dictate whether a new service should be initiated. Best practices recommend researching to determine whether the conditions in a specific portion of the City warrant fixed-route bus service. Some of these analytical techniques include:
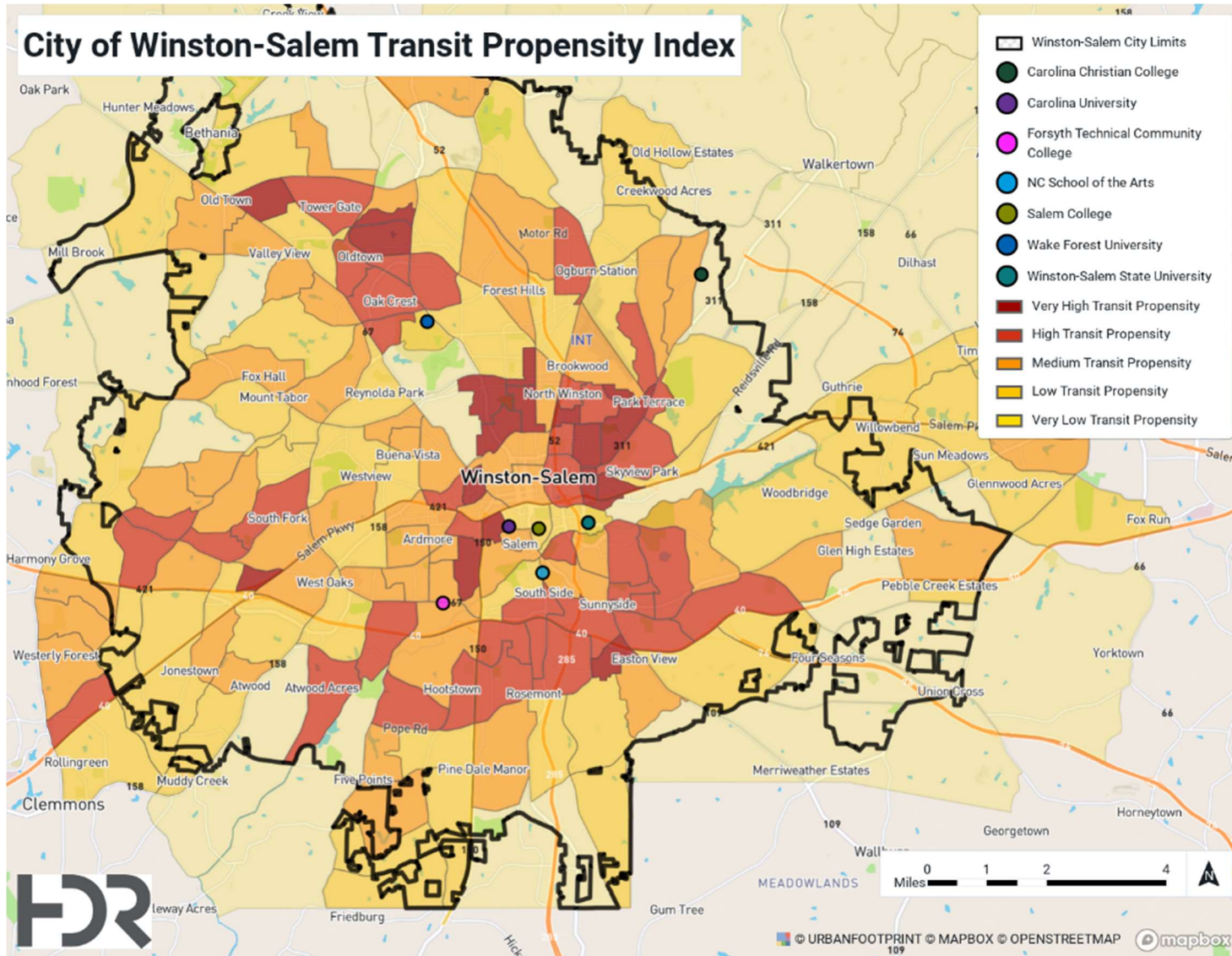
Transit Propensity Analysis

Using a series of common socio-economic indicators of the need for transit such as populations of lower incomes, age of populations below 18 or over 65, minority or ethnicity status, and zero-car households, a propensity index for transit need can be developed for the entire city to indicate where service is most needed, and most likely to be used.

Figure 2 on the next page shows a Transit Propensity Map created for Winston-Salem using Census Data to calculate the density of the following populations:

- Low-income households

- Minority households

- Age 16 and below

- Age 65 and above

- Households living in poverty

- Households with at least one person with a disability

- Zero-car households

**Figure 2 Transit Propensity Index**

Density Analysis

Transit is usually supported by a concentration of employment or population, as shown below in Figure 3. The urban criteria for the 2020 Census from the U.S. Census Bureau defined the minimum number of people per square mile to classify a land area as urban as 500 people per square mile. However, transit services perform best in the higher ranges of urban density, and planning to serve areas that have at least double or triple this minimum threshold is more likely to produce strong ridership. The overall population density for the City of Winston-Salem is over 1,800 people per square mile, so much of the City should be eligible using either approach below. A new fixed-route service should not be initiated unless one of these standards is met:

- Density Standard A: The ½-mile service area for the route has an average population density of at least 1,500 people per square mile.
- Density Standard B: The 1/2-mile service area for the route have a population density of over 1,000 people per square mile AND one portion of the route accesses one of WSTA's current top trip attractors such as Downtown Winston-Salem, Atrium Health Wake Forest Baptist Medical Center, or Hanes Mall.

The map in Figure 3 shows the distribution of job locations in Winston-Salem for workers who earn less than $15,000 per year and are highly likely to use transit. The data is from the Census Bureau Longitudinal Employment-Housing Dynamics database. Major clusters for these jobs can be found near Hanes Mall, Atrium Health Wake Forest Baptist Medical Center, the Hanes Mill Rd commercial cluster near exit 115 on US 52, and downtown Winston-Salem.

Figure 3 Work Locations of Employees Earning Under $15,000 Per Year
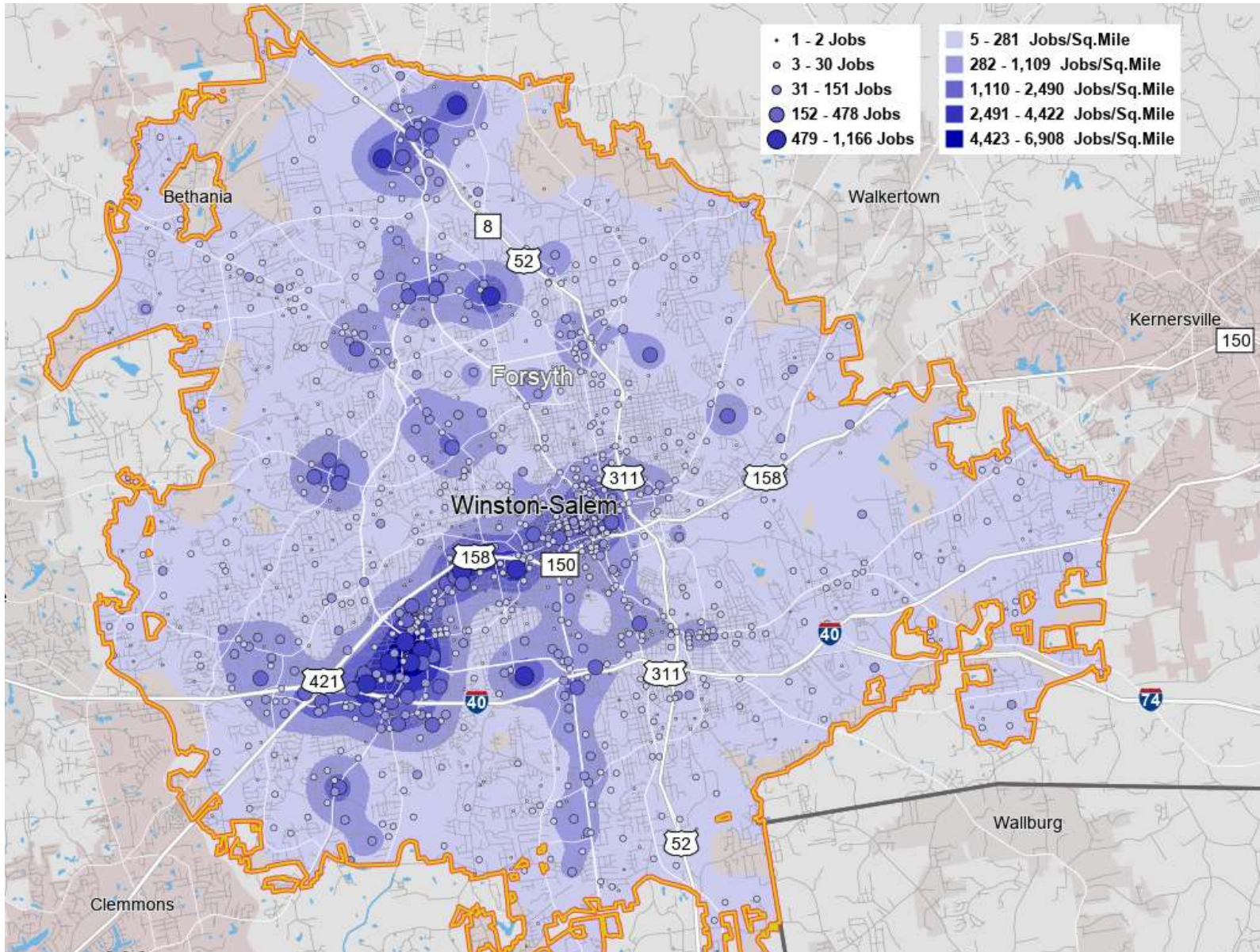
Passenger Request Analysis

In addition to traversing areas of high transit propensity and notable density, potential new routes should exhibit:

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

New Service Requests

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

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

Provision for Key Destinations

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

New Route Performance Standards

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

of the regular performance standards. After the introductory six-month period, the new route will be judged by the regular standards.

WSTA Special Events/Demonstration Services

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

WSTA Service Elimination Standards

Continued poor performance by routes drags down the financial health of WSTA and should be addressed. Wherever possible, Low-Performing routes should be considered for changes before being eliminated.

However, there are times when the only sensible course of action is to discontinue service, provided the following conditions are met:

- Any route active for more than six months that is Low-Performing against the system average for three of the five indicators can be considered for elimination.
- Any route that is not a demonstration service requires at least one public meeting in the area where the service will be eliminated before service termination. Staff should conduct the public meeting after making notice that the route is under consideration of elimination, with an appropriate public comment period of at least 30 days before a final recommendation is made to the WSTA Board. After the public meeting, staff will examine the feasibility of other alternatives that may improve ridership, including the potential of new routings, different stop locations, or other strategies.
- The costs, benefits, and ridership impacts of these alternatives will be included with any service elimination recommendation.

If WSTA proposes to eliminate more than 25 percent of the service hours on a route, or eliminates several trips on a route that affect more than 25 percent of the route's ridership, WSTA will hold a public hearing for public comment on the proposed change.

Appendix: Service Standards Applied

Table 5 Standards Indicators Sorted by Unlinked Passenger Trips Per Vehicle Revenue Hour for October 2021

Green = High-Performing for that indicator; Yellow = Average; Red = Low-Performing

October-21	Unlinked Passenger Trips Per Vehicle Revenue Hour	Farebox Recovery Ratio	Operating Cost per Unlinked Passenger Trip	Unlinked Passenger Trips Per Vehicle Revenue Mile
Route 83	24.3	12.9%	$ 3.57	2.1
Route 87	20.9	11.4%	$ 4.05	3.8
Route 81	19.6	10.0%	$ 4.60	1.3
Route 92	19.1	10.2%	$ 4.51	1.4
Route 96	18.5	9.9%	$ 4.64	1.4
Route 103	18.4	9.7%	$ 4.72	1.6
Route 93	18.3	9.5%	$ 4.83	2.6
Route 89	17.8	9.4%	$ 4.91	1.2
Route 105	17.6	9.1%	$ 5.04	1.2
High-Performance Threshold	16.2	8.5%	$ 8.41	1.3
Route 86	14.9	8.0%	$ 5.75	1.3
Route 107	14.7	7.8%	$ 5.91	1.3
Route 91	14.7	7.9%	$ 5.83	1.1
Route 106	14.0	7.6%	$ 6.08	1.9
Route 84	13.3	7.2%	$ 6.39	1.0
System Average	13.0	6.8%	$ 6.73	1.0
Route 94	12.7	6.9%	$ 6.68	1.0
Route 85	12.4	6.6%	$ 6.99	1.1
Route 80	12.2	6.6%	$ 7.01	1.1
Route 101	10.1	5.3%	$ 8.61	0.6
Route 90	10.1	5.4%	$ 8.54	1.0
Low-Performance Threshold	9.7	5.1%	$ 5.04	0.8
Route 104	9.2	4.8%	$ 9.54	0.7
Route 95	7.4	3.7%	$ 12.35	0.5
Route 109	6.6	3.5%	$ 12.99	0.4
Route 97	6.3	3.3%	$ 14.02	0.6
Route 82	5.9	3.1%	$ 14.73	0.4
Route 102	5.6	2.7%	$ 17.22	0.3
Route 88	5.3	2.8%	$ 16.66	0.4
Route 98	5.1	2.7%	$ 17.21	0.4
Route 108	5.1	2.6%	$ 17.45	0.3
Route 110	3.4	1.8%	$ 25.65	0.4
Route 99	2.3	1.2%	$ 38.40	0.1
Route 100	1.0	0.5%	$ 97.62	0.1