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Benefits of Transit in North Carolina

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Table of Contents

1 EXECUTIVE SUMMARY

North Carolina's transit systems serve over 77.8 million passenger trips annually, benefiting both the state's transit customers and the overall economy. In the absence of transit, customers would be required to travel using other (often more-costly) modes, or forego their intended trip altogether.

This study estimates the benefits transit provides to its customers and to the state's economy. These benefits are detailed as *transportation cost savings* (benefits realized by traveling via transit instead of by alternative modes), *affordable mobility benefits* (benefits derived from trips that would be foregone in the absence of transit), and *expenditure-related economic contribution* (benefits to the state's economy resulting from expenditures related to transit operations). A summary of benefits is provided below, whereas a more detailed accounting of transit customer and expenditure-related economic contribution are provided in the body of this white paper.

1.1 BENEFITS FROM TRANSIT USE

Benefits from transit use include transportation cost savings and affordable mobility benefits. In North Carolina, transit operations generate the following annual benefits to customers:

Exhibit 1: Benefits from Transit Use

	Urban Systems	Small Urban Systems	Rural Systems	Statewide
Transportation Cost Savings	$200,300,000	$11,300,000	$5,600,000	$217,200,000
Affordable Mobility Benefits	$458,900,000	$48,200,000	$57,000,000	$564,200,000
Total Transit Customer Benefits	$659,200,000	$59,500,000	$62,700,000	$781,400,000

Sources: SURTC, CUTR, and NC OpStats

1.2 EXPENDITURE-RELATED ECONOMIC CONTRIBUTION

Expenditure-related economic contributions include transit operations, maintenance and capital expenditures. These expenditures generate the following economic contributions in North Carolina:

Exhibit 2: Expenditure-Related Economic Contribution

Systems	Urban Systems	Small Urban Systems	Rural Systems	Statewide
Business Output	$679,000,000	$79,000,000	$216,000,000	$975,000,000
Value Added	$162,000,000	$19,000,000	$51,000,000	$232,000,000
Jobs	6,330	740	2,260	9,340
Wage Income	$248,000,000	$29,000,0000	$79,000,000	$356,000,000

Sources: SURTC, CUTR, and NC OpStats

2 Overview of North Carolina's Transit System

Transit is an important part of the daily lives of many North Carolinians. The state's rural, small urban, and urban transit systems serve 77.8 million passenger trips annually. These trips made to work, school, training opportunities, medical facilities, shopping locations, tourist areas, and other destinations provide a substantial benefit to North Carolina transit customers. In addition, transit operations benefit the state's economy as they provide a source of employment and income. Fully understanding the costs and benefits public transit provides to its customers and to the state's economy can be helpful when making decisions regarding transit investment.

The purpose of this study is to determine the costs and benefits of North Carolina's public transit systems. The study focuses on two specific types of benefits: benefits from transit use and expenditure-related economic benefits. Benefits from transit use are accrued by passengers who would either incur a higher cost of transportation or would forego the trip without the availability of public transit. These benefits also accrue to communities in which transit operates. Expenditure-related economic benefits are the effects from capital and operational expenditures of North Carolina's transit systems on the state's economy.

2.1 North Carolina's Transit System Revenues

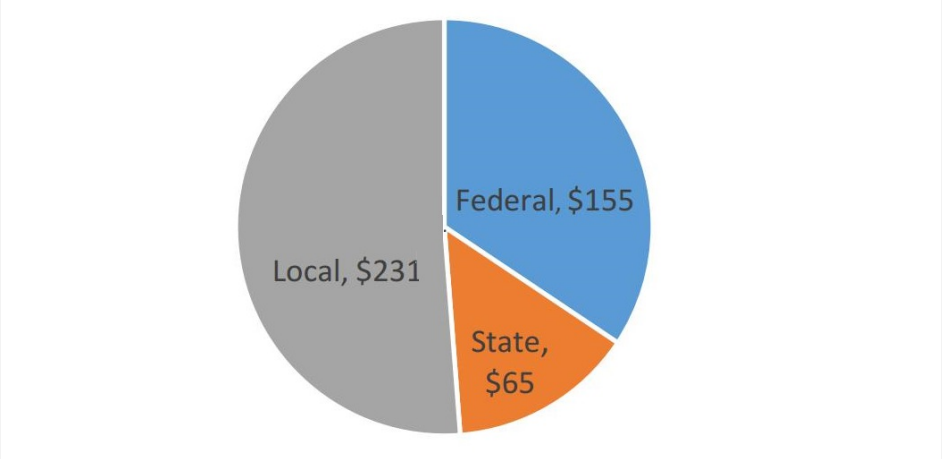
Transit operations are supported through federal, state and local funds, with the largest revenue streams coming from North Carolina's local governments. In fiscal year 2014 (FY2014), North Carolina transit received operating revenues of $346 million as shown in Exhibit 3. North Carolina capital revenues for 2014 were estimated using a five-year average to smooth out variation from large one-time grants. The five-year average for capital funds was $105 million as shown in Exhibit 3. Exhibit 4 shows combined capital and operating revenues.

Exhibit 3: North Carolina Operating and Capital Revenue Streams by Source

Federal Operating	Federal Capital	State Operating	State Capital	Local Operating	Local Capital	Total Operating	Total Capital
$70,000,000	$85,000,000	$53,000,000	$12,000,000	$223,000,000	$8,000,000	$346,000,000	$105,000,000

Source: NC OpStats

Exhibit 4: Combined North Carolina Revenue Streams by Source ($ in millions)



Source: NC OpStats

In FY2014, North Carolina transit had a total of $451 million in revenues, which carried over 72.4 million passenger trips. Exhibit 5 shows a breakout of the $451 million in revenue received by North Carolina's urban, small urban, and rural transit systems.

Exhibit 5: Transit Revenue Allocations By Level Of Government And Transit System Type

	Urban System	Small Urban System	Rural System	Statewide
Federal	$117,500,000	$13,000,000	$24,400,000	$154,900,000
State	$38,900,000	$6,700,000	$19,400,000	$65,000,000
Local	$175,600,000	$13,400,000	$41,800,000	$230,800,000

Source: NC OpStats

Exhibit 6 shows the number of trips that were supported by transit system operations in North Carolina.

Exhibit 6: Transit Trips By Transit System Type

	Urban System	Small Urban System	Rural System	Statewide
Trips	63,600,000	2,200,000	6,600,000	72,400,000

Source: NC OpStats

For this study urban transit systems are defined as those that are Federal Transit Administration (FTA) Section 5307 eligible and serve a population of greater than 200,000; small urban systems are defined as those that are FTA Section 5307 eligible and serve a population of less than 200,000; and rural systems are defined as those that are FTA Section 5311 eligible. AppalCART in Watauga County is a rural system by this definition. However, it is classified as small urban for this study due to its unique operating characteristic of providing fixed route service to Boone and Appalachian State University. See Exhibit 7 for a categorization of North Carolina's transit systems.

Transit systems that operate both rural and urban service such as Cape Fear, City of Rocky Mount, Goldsboro/Wayne, Western Carolina Community Action (Henderson), and Western Piedmont appear in multiple categories, and their data are reported and analyzed separately by category. Additionally, Charlotte light rail is included as part of the fixed-route urban service.

For this study, benefits are only calculated for the 72.4 million directly operated trips. Trips contracted to other providers such as taxis are not considered because these 5.4 million trips may have significantly different characteristics from what is considered in the reference studies.

Exhibit 7: Rural, Small Urban and Urban Transit Systems in North Carolina

RURAL TRANSIT SYSTEMS

- ALAMANCE COUNTY TRANSPORTATION AUTHORITY
- ALBEMARLE REGIONAL HEALTH SERVICES
- ALLEGHANY COUNTY
- ANSON COUNTY
- ASHE COUNTY TRANSPORTATION AUTHORITY, INC.
- BEAUFORT COUNTY DEVELOPMENTAL CENTER INC.
- BLADEN COUNTY
- BRUNSWICK TRANSIT SYSTEM, INC.
- CABARRUS COUNTY
- CAPE FEAR PUBLIC TRANSPORTATION AUTHORITY - WAVE TRANSIT
- CARTERET COUNTY
- CASWELL COUNTY
- CHATHAM TRANSIT NETWORK
- CHEROKEE COUNTY
- CHOANOKE PUBLIC TRANSPORTATION AUTHORITY
- CLAY COUNTY
- COLUMBUS COUNTY
- CUMBERLAND COUNTY
- DARE COUNTY
- DUPLIN COUNTY
- DURHAM COUNTY
- EASTERN BAND OF CHEROKEE INDIANS
- GATES COUNTY
- GOLDSBORO-WAYNE TRANSPORTATION AUTHORITY
- GRAHAM COUNTY
- GREENE COUNTY
- GUILFORD COUNTY
- HARNETT COUNTY
- HOKE COUNTY
- HYDE COUNTY NON-PROFIT PRIVATE TRANSPORTATION CORP INC.
- JACKSON COUNTY
- JOHNSTON COUNTY COUNCIL ON AGING, INC.
- KERR AREA TRANSPORTATION AUTHORITY
- LEE COUNTY
- LENOIR COUNTY
- LINCOLN COUNTY
- MACON COUNTY
- MADISON COUNTY TRANSPORTATION AUTHORITY
- MARTIN COUNTY
- MCDOWELL COUNTY TRANSPORTATION PLANNING BD INC.
- MECKLENBURG COUNTY
- MITCHELL COUNTY TRANSPORTATION AUTHORITY
- MOORE COUNTY
- MOUNTAIN PROJECTS INC.
- ONSLOW UNITED TRANSIT SYSTEM, INC.
- PENDER ADULT SERVICES INC.
- PERSON COUNTY
- PITT COUNTY/PITT AREA TRANSIT SYSTEM
- POLK COUNTY TRANSPORTATION AUTHORITY
- RANDOLPH COUNTY SENIOR ADULTS ASSOC. INC.
- RICHMOND INTERAGENCY TRANSPORTATION, INC.
- ROBESON COUNTY
- ROCKINGHAM COUNTY COUNCIL ON AGING INC.
- ROWAN COUNTY
- RUTHERFORD COUNTY
- SAMPSON COUNTY
- SCOTLAND COUNTY
- STANLY COUNTY
- SWAIN COUNTY FOCAL POINT ON AGING INC.
- TRANSPORTATION ADMINISTRATION OF CLEVELAND COUNTY INC.
- TRANSYLVANIA COUNTY
- TYRRELL COUNTY
- UNION COUNTY
- WAKE COUNTY
- WASHINGTON COUNTY
- WILKES TRANSPORTATION AUTHORITY
- WILSON COUNTY
- YADKIN VALLEY ECONOMIC DEVELOPMENT DISTRICT INC.
- YANCEY COUNTY TRANSPORTATION AUTHORITY

SMALL URBAN TRANSIT SYSTEMS

- APPALCART
- BUNCOMBE COUNTY
- CITY OF ROCKY MOUNT
- CRAVEN COUNTY
- DAVIDSON COUNTY
- GASTON COUNTY
- GOLDSBORO
- GREENVILLE
- HIGH POINT
- IREDELL COUNTY
- JACKSONVILLE
- ORANGE COUNTY
- ROCKY MOUNT
- WESTERN CAROLINA COMMUNITY ACTION INC.
- WESTERN PIEDMONT REGIONAL TRANSPORTATION AUTHORITY CT
- WESTERN PIEDMONT REGIONAL TRANSPORTATION AUTHORITY URBAN
- WILSON CITY

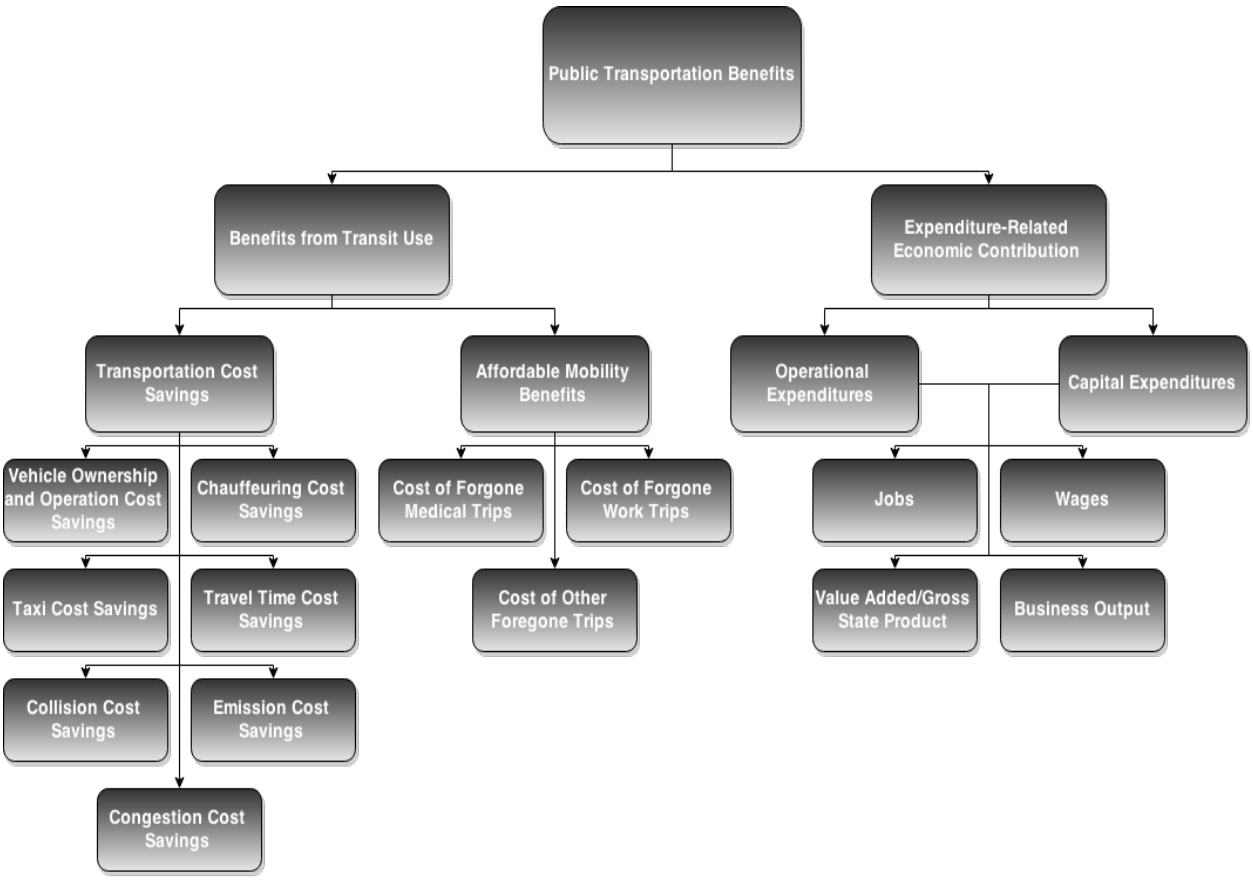
URBAN TRANSIT SYSTEMS

- ASHEVILLE
- CARY
- CHAPEL HILL
- CHARLOTTE
- CONCORD/KANNAPOLIS
- DURHAM
- FAYETTEVILLE
- GASTONIA
- GREENSBORO
- HENDERSON COUNTY
- PIEDMONT AUTHORITY
- RALEIGH - CAT
- RALEIGH - NCSU
- SALISBURY
- TRIANGLE TRANSIT
- WILMINGTON
- WINSTON-SALEM

3 METHODOLOGY

The potential benefits of North Carolina transit operations are two-fold: they offer individual benefits to transit customers and overall benefits to North Carolina's economy. The methodology used to determine these benefits can be conceptualized through the use of a transit benefits assessment tree as shown in Exhibit 8.

Exhibit 8: Assessment Tree of Transit Customer Benefits and Expenditure-Related Economic Contribution



3.1 BENEFITS FROM TRANSIT USE

If transit were not provided in a North Carolina community, then transit customers would have to either use a different mode to travel or forego the trip. Thus, benefits of using transit are determined by deriving the savings that result when individuals are able to use transit in place of another mode (transportation cost savings), and when trips are made that would otherwise be foregone (affordable mobility benefits).

The approach used by the Small Urban and Rural Transit Center (SURTC)[1] was used to determine transportation cost savings and affordable mobility benefits. This approach was peer reviewed and presented at the 2015 Transportation Research Board Annual Meeting and other national venues. This approach enables small urban and rural transit benefits to be monetized. Urban transit benefits were derived with methods from the Center for Urban Transportation Research (CUTR) at the University of South Florida.[2] The CUTR study was utilized because it is a recently conducted urban transit benefit analysis for a state DOT in the same geographic region as North Carolina. The assumptions from this study are more appropriate for urban areas. Together SURTC and CUTR methods were used to determine North Carolina transit customer benefits as transportation cost savings and affordable mobility benefits.

3.1.1 Transportation Cost Savings

A potential benefit of transit services is a change in transportation costs to those who use transit in place of another mode of travel. Some who do not own a car may have to purchase one, incurring the costs of automobile ownership. If the passenger were to get a ride from someone else, the cost would include the operating costs plus the time and inconvenience required for someone to provide the ride. A trip by taxi, if available, would cost the taxi fare. The comparative costs of walking and bicycling (generally an increase in travel time) are also considered.

In addition to out-of-pocket costs, there are other costs associated with travel, including the cost of travel time, safety costs resulting from crashes, and environmental costs resulting from emissions. Switching from transit to other modes would affect each of these costs. For this study, transportation cost savings include the following components:

- Vehicle ownership and operation cost savings
- Chauffeuring cost savings (getting a ride from someone else)
- Taxi fare cost savings
- Bicycling and walking cost savings
- Travel time cost savings
- Collision cost savings
- Environmental cost savings
- Congestion cost savings (urban transit systems only)

Each of these components sum to the total transportation cost savings afforded to customers who use transit in lieu of another mode. It is important to note that some of the components of cost savings may have negative values if customers experience greater costs instead of savings by taking transit in lieu of other modes. For this study, a number of different data sources and methodologies were used to derive these benefits. These methods and sources are detailed in the following subsections.

[1] The approach originates from the following study: *Ranjit Godavarthy, Jeremy Mattson, and Elvis Ndembe, "Cost-Benefit Analysis of Rural and Small Transit," National Center for Transit Research: North Dakota State University Upper Great Plains Transportation Institute – Small Urban and Rural Transit Center, October 2014.* http://www.nctr.usf.edu/wp-content/uploads/2015/01/77060-NCTR-NDSU03-508.pdf

[2] *Diane Quigley, Sisinnio Concas, Xuehao Chu, and Steve Polzin, "Economic and Community Benefits of Urban Fixed-Route Transit in Florida," June 2011,* http://www.dot.state.fl.us/transit/Pages/EconomicsandCommunityBenefits.pdf

3.1.1.1 Vehicle Ownership and Operation Cost Savings

If public transportation were not available, some transit customers would make the trip in their personal automobiles and some who do not own an automobile would have to purchase one. Therefore, transit customers using personal automobiles for their trips would incur vehicle ownership and operating expenses, which can be considered savings if the customer instead used transit to make the trip. The savings can be calculated based on the savings per vehicle mile of the personal vehicle traveled using the following method:

Vehicle Ownership and Operation Cost Savings = (Total transit trips) x (% of trips shifted to car) x (vehicle miles traveled) x (vehicle operating cost)

Determining vehicle ownership and operation cost savings requires data for:

- Transit trips (from NC OpStats FY14)
- The proportion of those trips shifted to driving (from SURTC study, CUTR study)
- Vehicle miles traveled (from NC OpStats FY2014, SURTC study, CUTR study)
- Vehicle ownership and operation costs (from SURTC study)

3.1.1.2 Chauffeuring Cost Savings

While some will drive themselves in the absence of transit, many cannot drive or do not have access to an automobile and will require a ride from someone else, such as a family member or friend. Chauffeuring trips are additional automobile trips made specifically for a passenger, and their costs can be calculated using the following method:

Chauffeuring Cost Savings = (Total transit trips) x (% of trips shifted to chauffeur) x (vehicle miles traveled) x (chauffeuring cost)

Determining chauffeuring cost savings requires data for:

- Transit trips (from NC OpStats FY14)
- The proportion of those trips shifted to chauffeur (from SURTC study, CUTR study)
- Vehicle miles traveled (from NC OpStats FY2014, SURTC study, CUTR study)
- Chauffeur costs (from SURTC study)

3.1.1.3 Taxi Cost Savings

Those who are unable to secure a ride from someone else may opt to take a taxi (if taxi service is available). Taxi costs can be calculated using the following method:

Taxi Cost Savings = (Total transit trips) x (% of trips shifted to taxi) x (vehicle miles traveled) x (taxi cost)

Determining taxi cost savings requires data for:

- Transit trips (from NC OpStats FY14)
- The proportion of those trips shifted to taxi (from SURTC study, CUTR study)
- Vehicle miles traveled (from NC OpStats FY2014, SURTC study, CUTR study)
- Taxi costs (from SURTC study)

3.1.1.4 Bicycling and Walking Savings

Bicycling ownership and maintenance costs as well as walking costs are marginal. For this study, no ownership or operation costs were considered. However, the travel time costs of bicycling and walking were considered and those costs are addressed in the following section.

3.1.1.5 Travel Time Cost Savings

In addition to out-of-pocket costs, there are additional costs associated with travel, such as the amount of time devoted to travel. Because travel times differ between transit and other modes, these differences need to be taken into consideration when valuing the benefits of transit. In many instances, travel time costs are greater for transit customers than those who drive, are chauffeured, or are taxied. However, the travel time costs of transit should be analyzed in conjunction with other transit system costs and benefits to understand transit's net value.

Travel time cost savings can be calculated using the following method:

Travel Time Cost Savings = Car_{TTC} + $Chauffeur_{TTC}$ + $Taxi_{TTC}$ + $Bike_{TTC}$ + $Walk_{TTC}$ - $Transit_{TTC}$

> *Car Travel Time Costs Savings = (Total transit trips) x (% of trips shifted to car) x (vehicle miles traveled) x (average speed of travel) x (travel time cost per hour)*
>
> *Chauffeur Travel Time Cost Savings = (Total transit trips) x (% of trips shifted to chauffeur) x (vehicle miles traveled) x (average speed of travel) x (travel time cost per hour)*
>
> *Taxi Travel Time Cost Savings = (Total transit trips) x (% of trips shifted to taxi) x (vehicle miles traveled) x (average speed of travel) x (travel time cost per hour)*
>
> *Bike Travel Time Cost Savings = (Total transit trips) x (% of trips shifted to bike) x (vehicle miles traveled) x (average speed of travel) x (travel time cost per hour)*
>
> *Walk Travel Time Cost Savings = (Total transit trips) x (% of trips shifted to walk) x (vehicle miles traveled) x (average speed of travel) x (travel time cost per hour)*
>
> *Transit Travel Time Cost Savings = (Total transit trips) x (vehicle miles traveled) x (average speed of travel) x (travel time cost per hour)*

Determining travel time cost savings requires data for:

- Transit trips (from NC OpStats FY14)
- The proportion of those trips shifted to another mode (from SURTC study, CUTR study)
- Vehicle miles traveled (from NC OpStats FY2014, SURTC study, CUTR study)
- Average speed of travel (from SURTC study)
- Travel time costs per hour (from SURTC study)

3.1.1.6 Collision Cost Savings

Transit is a relatively safe mode of travel which often provides collision cost savings for its customers. Collision cost savings are derived by comparing the collision costs of transit to the collision costs of other modes that would be utilized in the absence of transit. The following method can be used to calculate collision cost savings.

Collision Cost Saving = Car_{CCS} + $Chauffeur_{CCS}$ + $Taxi_{CCS}$ + $Bike_{CCS}$ + $Walk_{CCS}$ – $Transit_{CCS}$

Car Collision Cost Savings = (Total transit trips) x (% of trips shifted to car) x (vehicle miles traveled) x (collision cost per mile)

Chauffeur Collision Cost Savings = (Total transit trips) x (% of trips shifted to chauffeur) x (vehicle miles traveled) x (collision cost per mile)

Taxi Collision Cost Savings = (Total transit trips) x (% of trips shifted to taxi) x (vehicle miles traveled) x (collision cost per mile)

Bike Collision Cost Savings: (Total transit trips) x (% of trips shifted to bike) x (vehicle miles traveled) x (collision cost per mile)

Walk Collision Cost Savings = (Total transit trips) x (% of trips shifted to walk) x (vehicle miles traveled) x (collision cost per mile)

Transit Collision Cost Savings = (Total transit trips) x (vehicle miles traveled) x (collision cost per mile)

Determining collision cost savings requires data for:

- Transit trips (from NC OpStats FY14)
- The proportion of those trips shifted to another mode (from SURTC study, CUTR study)
- Vehicle miles traveled (from NC OpStats FY2014, SURTC study, CUTR study)
- Collision costs per mile (from SURTC study)

3.1.1.7 Emission Cost Savings

Public transit can help reduce environmental emissions particularly in urban areas. However, for small urban and rural areas, the number of people riding transit and the local highway congestion levels can be relatively low and, therefore, the environmental emissions cost savings may be minimal. However, with increased transit demand and effective management of transit, these savings can be evident. This is because, as vehicle occupancy increases, emissions per passenger decreases.

Emissions cost savings are also dependent upon fuels and vehicle types. The SURTC study emissions per mile values, which are based on national averages, are used in this study. Some North Carolina transit systems have alternative fuel fleets and/or are in are in areas with higher levels of congestion. The estimated emissions cost savings will be lower than actual for these situations. Therefore, these estimates are conservative and represent a minimum cost savings.

Car, chauffeur, and taxi trips that arise in the absence of transit all have emission costs. To determine transit emission costs savings, transit emission costs are compared to the emission costs that arise from trips taken in the absence of transit. (For this study it is assumed that walking and biking in the absence of transit result in zero emission costs.) The following method was used to calculate transit emission cost savings:

Emission Cost Savings= Car_{ECS} + $Chauffeur_{ECS}$ + $Taxi_{ECS}$ – $Transit_{ECS}$

Car Emission Cost Savings = (Total transit trips) x (% of trips shifted to car) x (vehicle miles traveled) x (car emission cost per mile)

Chauffeur Emission Cost Savings = (Total transit trips) x (% of trips shifted to chauffeur) x (vehicle miles traveled) x (chauffeur emission cost per mile)

Taxi Emission Cost Savings = (Total transit trips) x (% of trips shifted to car) x (vehicle miles traveled) x (taxi emission cost per mile)

Transit Emission Cost Savings = (Total transit trips) x (vehicle miles traveled) x (transit emission cost per mile)

Determining emission cost savings requires data for:

- Transit trips (from NC OpStats FY14)
- The proportion of those trips shifted to another mode (from SURTC study, CUTR study)
- Vehicle miles traveled (from NC OpStats FY2014, SURTC study, CUTR study)
- Emission costs per mile (from SURTC study)

3.1.1.8 Congestion Cost Savings

Transit customers utilizing public transit instead of driving, being chauffeured, or using taxies reduce the amount of vehicles on the road and help to alleviate congestion. Congestion cost savings realized by North Carolina's urban transit systems are evaluated in this study. (Rural and small urban transit systems are not included in this evaluation because congestion reductions from transit use in those areas are negligible.) Texas Transportation Institute produces an industry-standard annual Urban Mobility Report that estimates congestion in the largest urban areas and the increased cost of congestion in these areas if transit were not available[3]. In North Carolina, the large urban areas include the Charlotte, Triad, and Triangle. The results of the most recent report were used to determine congestion cost savings.

3.1.2 Affordable Mobility Benefits

Affordable mobility benefits result when trips are made that would otherwise be foregone in the absence of public transit. For many, there may be no feasible alternative mode, or the costs of using an alternate mode are prohibitively expensive, so they will forego trips. The costs of those foregone trips can be substantial. A missed work trip, for example, means lost income. A missed health care trip means a person's health might not be properly managed and could result in a need for in-home care or a future emergency care trip via an ambulance – a much more expensive mode of travel. Lost educational trips could reduce a person's future earnings potential, and lost shopping trips mean less money is spent in the community. Providing trips that would otherwise not be made results in other intangible benefits, such as providing enjoyment and fulfillment and preventing social and physical isolation. For this study, affordable mobility benefits are derived from the costs of foregone:

- Medical trips
- Work trips
- Other trips

[3] *Tim Lomax, "Urban Mobility Report and Appendices," Texas Transportation Institute, December 2012. http://mobility.tamu.edu/ums/report/.*

3.1.2.1 Value of Foregone Medical, Work, and Other Trips

The following methods were used to calculate the cost of foregone medical, work, and other trips*:*

Foregone Medical Cost = (Total transit trips) x (percent of trips forgone) x (cost of foregone medical trip)

Foregone Work Cost = (Total transit trips) x (percent of trips forgone) x (cost of foregone work trip)

Foregone Other Trip Cost = (Total transit trips) x (percent of trips forgone) x (cost of foregone other trip)

Determining foregone trip costs requires data for:

- Transit trips (from NC OpStats FY14)
- The proportion of those trips foregone (from SURTC study, CUTR study)
- Foregone medical, work, and other trip costs (from SURTC study)

3.1.3 Cost Savings Not Addressed

The cost savings considered in this research are not exhaustive, but represent a comprehensive estimate of the most significant types of savings. Benefits are not calculated for 5.4 million trips administered by transit systems but carried by other service providers. Use of urban transit also saves parking costs, which can be substantial depending on the region. The congestion cost savings only include the largest urban areas in North Carolina (Charlotte, Triad, and Triangle) and do not consider cost savings for Asheville, Wilmington, Fayetteville, and other smaller but still congested areas. In addition, impacts on land use are not included. The light rail corridor in Charlotte has experienced almost $2 billion dollars in direct investment[4]. The SURTC study also points out that agglomeration economics, community cohesion, relocation cost savings, groundwater pollution cost savings, noise pollution cost savings, land conservation benefits, and the provision of transportation service during emergencies represent additional potential cost savings from use of transit – none of which are included in this study.[5]

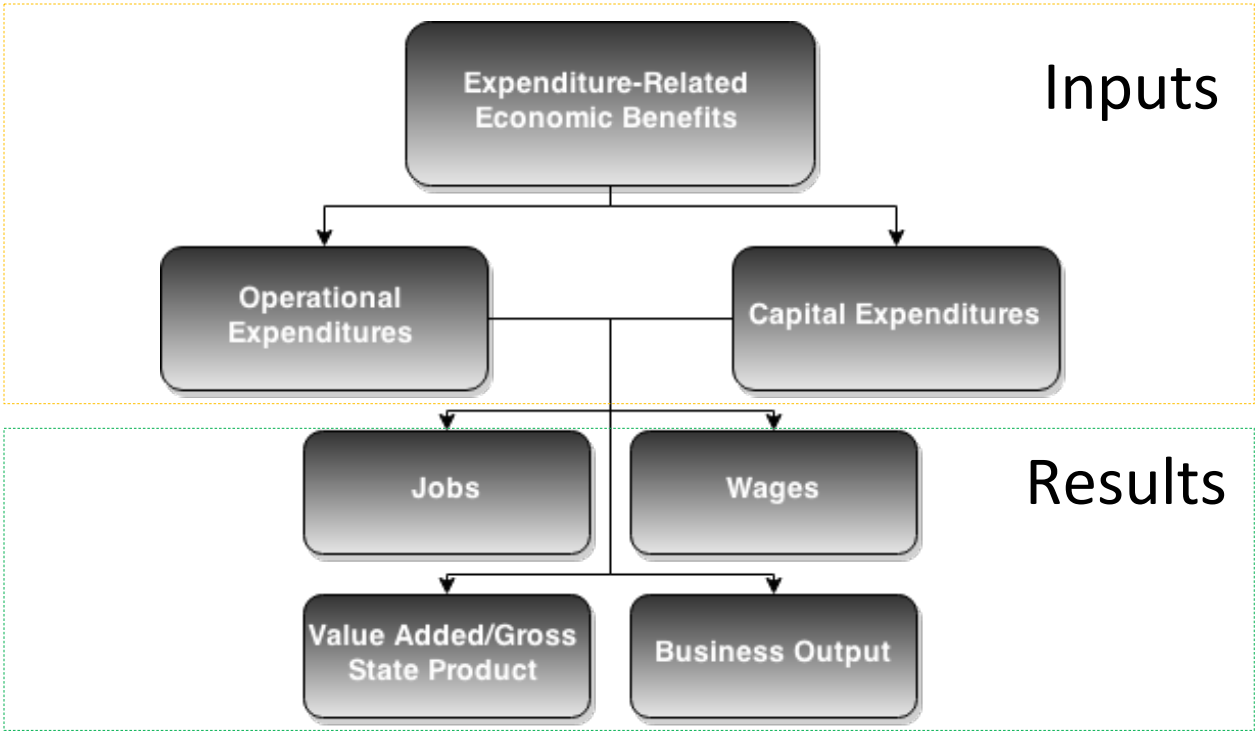
3.2 EXPENDITURE-RELATED ECONOMIC CONTRIBUTION

For this study, transit expenditure-related economic contribution refers to statewide economic effects generated from the capital and operational expenditures of North Carolina's transit systems. These impacts include direct and indirect spending and induced economic activity. The direct effects include jobs created by North Carolina transit systems – drivers, dispatchers, mechanics, bookkeepers, program directors, etc. The indirect effects result from jobs supported and income spent in industries that supply inputs to public transit, such as fuel, repairs, insurance, etc. Induced economic activity results from the income generated through both the direct and indirect effects. These induced effects occur when people who work for the transit system or earn income by providing inputs to the transit agency spend their income in North Carolina. This spending supports additional jobs in the state.

[4] *Peter Zeiler, "Charlotte LYNX Blue Line Economic Development Impact and Land Use Patterns," City of Charlotte Economic Development Division, http://www.nga.org/files/live/sites/NGA/files/pdf/1012TRANSPORTZEILER.PDF.*

[5] *Ranjit Godavarthy, Jeremy Mattson, and Elvis Ndembe, "Cost-Benefit Analysis of Rural and Small Transit," National Center for Transit Research: North Dakota State University Upper Great Plains Transportation Institute – Small Urban and Rural Transit Center, October 2014. http://www.nctr.usf.edu/wp-content/uploads/2015/01/77060-NCTR-NDSU03-508.pdf*

Exhibit 9: Transit Expenditure-Related Economic Benefits



The Transportation Economic Development Impact System (TREDIS) software version 4.0 was used to derive the expenditure-related economic benefits associate with North Carolina transit system operations, maintenance, and capital expenditures. TREDIS is NCDOT's current modeling tool. Operational (operations & maintenance) and capital expenditures were inputs into TREDIS.[6] The TREDIS software then used these inputs to derive the jobs, wages, business output, and gross state product supported by these transit expenditures. Exhibit 9 shows how expenditures are used as inputs in TREDIS to generate expenditure-related economic contribution.

3.3 Leverage Potential of State Funds

In addition to benefits from the use of transit and expenditure-related economic benefits, transit investment at one level of government has the potential of spurring transit investment at other levels of government. For this study, North Carolina Operating Statistics (FY2014) were used to determine the leverage potential of North Carolina investment. The following method was used to determine the state's leverage potential:

State's leverage potential = ((federal investment) + (local investment)) / (state investment)

Determining the leveraging potential of state funds requires funding data for federal, state, and local investment. NC Operating Statistics data from fiscal year 2014 (NC OpStats FY2014) provided this information.

[6] Capital and operational expenses were taken from North Carolina's Transit Operating Statistics (NC OpStats), fiscal year 2014. A five-year average for capital expenditures was used to smooth out variation from one-time grants.

3.4 North Carolina Transit Benefits per Trip

The sum of North Carolina transit benefits divided by the total number of transit trips provides a value for the benefit per trip. The following method was used to determine transit benefits per trip:

NC Transit Benefits = (sum of transit benefits) / (total number of trips)

3.5 Cost of Transit Operations per Trip

In order for North Carolina transit to operate, funding is necessary to pay for an administrative staff, maintenance needs, and capital investments. The following method was used to determine the cost per trip of North Carolina transit operations.

NC Transit Costs = ((operation & maintenance costs) + (capital costs)) / (total transit trips)

Determining the cost per trip of North Carolina transit operations requires operation & maintenance costs, capital costs, and the total number of transit trips taken in North Carolina. NC OpStats FY2014 provided this information. Capital costs are the five-year average from OpStats and NTD. The five-year average is used to smooth out annual variations.

4 RESULTS

North Carolina invests $65 million of state revenue in transit annually. The state's investment leverages an additional $386 million in direct federal and local investment. That is, every $1 of state investment results in approximately $6 of direct investment from all sources. This level of combined state and federal/local investment in public transit provides benefits for both those who use transit and the state economy at large. Benefits of transit use include those provided in the following subsections.

4.1 BENEFITS OF TRANSIT USE

The benefits of transit use are determined by deriving the savings that result when transit is used in place of another mode (transportation cost savings), and when trips are made that would otherwise be foregone (affordable mobility benefits).

In North Carolina, transit operations generate the following annual transportation cost savings:

Exhibit 10: Transportation Cost Savings

Transportation Cost Savings Categories	Total Urban Benefits	Total Small Urban Benefits	Total Rural Benefits	Total Benefits
Vehicle Ownership & Operation Cost Savings	$46,800,000	$2,200,000	$800,000	$49,800,000
Chauffeuring Cost Savings	$63,900,000	$4,600,000	$7,400,000	$76,000,000
Taxi Cost Savings	$73,900,000	$7,400,000	$3,600,000	$84,900,000
Travel Cost Savings	($56,500,000)	($1,900,000)	($3,200,000)	($61,600,000)
Collision Cost Savings	$20,500,000	($500,000)	$1,600,000	$21,600,000
Emission Cost Savings	$7,700,000	($600,000)	($4,500,000)	$2,600,000
Congestion Cost Savings	$44,000,000	-	-	$44,000,000
Total Transportation Cost Savings	$200,300,000	$11,300,000	$5,600,000	$217,200,000

Sources: SURTC, CUTR, and NC OpStats

In North Carolina, transit operations generate the following annual affordable mobility benefits:

Exhibit 11: Affordable Mobility Benefits

Foregone Trip Cost Categories	Total Urban Benefits	Total Small Urban Benefits	Total Rural Benefits	Total Benefits
Medical Trips	$224,700,000	$21,800,000	$30,400,000	$276,900,000
Work Trips	$200,700,000	$22,300,000	$22,900,000	$245,900,000
Other Trips	$33,500,000	$4,000,000	$3,800,000	$41,400,000
Total Foregone Trips	$458,900,000	$48,200,000	$57,000,000	$564,200,000

Sources: SURTC, CUTR, and NC OpStats

4.2 EXPENDITURE-RELATED ECONOMIC CONTRIBUTION

Expenditure-related economic contribution includes transit operations, maintenance and capital expenditures. These expenditures generate the following economic contribution in North Carolina:

Exhibit 12: Expenditure-Related Economic Contribution

Systems	Urban Systems	Small Urban Systems	Rural Systems	Statewide
Business Output	$679,000,000	$79,000,000	$216,000,000	$975,000,000
Value Added	$162,000,000	$19,000,000	$51,000,000	$232,000,000
Jobs	6,330	740	2,260	9,340
Wage Income	$248,000,000	$29,000,0000	$79,000,000	$356,000,000

Sources: NC OpStats, TREDIS

4.3 BENEFITS PER TRIP

The sum of North Carolina benefits of using transit divided by the total number of transit trips provides the following value for benefits per trip:

Exhibit 13: Average Transit Customer Benefit per Trip

	Statewide
Average Benefit per Trip	$10.80

Sources: SURTC, CUTR, and NC OpStats

4.4 COSTS PER TRIP

In order for North Carolina transit to operate, costs are incurred for administrative staff, maintenance needs, and capital investments. In North Carolina, transit operations incur the following average annual transportation costs per trip:

Exhibit 14: Average Transit Cost per Trip

	Statewide
Average Cost per Trip	$6.20

Sources: SURTC, CUTR, and NC OpStats

4.5 BENEFITS AND COSTS PER TRIP

Benefits and costs result from North Carolina transit operations. The magnitude to which transit costs are lower than North Carolina transit system benefits, demonstrates the overall value of transit. The following table shows average North Carolina transit benefits per trip (this does not include expenditure-related economic contribution) and transit costs per trip:

Exhibit 15: Average Transit Customer Benefit and Transit Cost per Trip

	Statewide
Average Benefit per Trip	$10.80
Average Cost per Trip	$6.20

Sources: SURTC, CUTR, and NC OpStats

4.6 Leverage Potential of State Funds

Transit investment at one level of government has the potential of spurring transit investment at other levels of government. Each $1 the state of North Carolina invests in transit generates approximately $6 of total investment in North Carolina transit from federal, state and local sources.