Randal O'Toole

TOWARDS SAFE, COST-EFFECTIVE, AND EQUITABLE TRANSPORTATION

REVIEWING AND REFORMING PRIORITIES OF THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

locke

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Towards Safe, Cost-Effective, and Equitable Transportation

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4800 Six Forks Road, Suite 220
Raleigh, NC 27609
(919) 828-3876 | johnlocke.org

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Executive Summary

Transportation is an important part of North Carolina's economy. With a $5 billion annual budget, the North Carolina Department of Transportation (NCDOT) manages the state's transportation facilities and operations. In January 2021, a state commission recommended that NCDOT's budget be increased by 40%. The John Locke Foundation asked me to conduct a review of NCDOT to suggest whether this recommendation made sense and, if so, how it should be implemented.

This review revealed a number of problems with NCDOT's programs. Most important, 98% of NCDOT's funds come from federal or state highway user fees. That's appropriate when those user fees are spent on the roads people use, but when they are spent on non-highway programs they become a tax, one that is regressive, as low-income people pay a greater share of their incomes towards this tax than higher-income people.

In the name of economic vitality, NCDOT uses these funds to subsidize such programs as Amtrak, Charlotte light rail, other urban transit agencies, non-commercial airports, and freight railroads. The users of many of

> "All of these problems can best be solved by funding transportation exclusively out of user fees and not out of regressive taxes."

these programs tend to be higher-income people, making the taxes especially unjust.

Even NCDOT's spending on highways is not always optimal. The state legislature has designated what proportion of highway fees must be spent on new construction versus maintenance, and that proportion may not be ideal. The condition of state collector roads and some arterials is declining, suggesting the state is not putting enough money into maintenance. Some North Carolina highways are much more dangerous than others, and the department doesn't seem to be focused on reducing those dangers.

None of these issues have reached crisis proportions, but there is a danger they could get worse. The state, for example, is considering proposals to greatly expand subsidized Amtrak passenger trains that few North Carolinians use and are no longer a cost-effective mode of transportation. The state is also considering supporting a Washington-to-Florida high-speed rail line that would cost taxpayers billions to build and tens of millions of dollars per year to operate.

All of these problems can best be solved by funding transportation exclusively out of user fees and not out of regressive taxes.

Specifically, this report makes the following recommendations:

- The state should begin to transition from fuel taxes and the highway-use tax to a mileage-based user fee system that will protect people's privacy and ensure that the collected fees are spent only on highways, roads, and streets
- Cities should piggyback onto the mileage-based fee system to maintain their streets rather than using general funds

- To relieve congestion, the state should implement a variable-priced tolling system on major urban freeways. After covering the costs of maintaining those freeways, any surplus toll revenues should be dedicated to improving and expanding those freeways
- The state should place a higher priority on improving safety, particularly on the state's most dangerous roads. As appropriate, this may include providing safe sidewalks for pedestrians and alternate routes for bicycle riders. However, the state should explore the use of recreation fees to fund recreational bicycle trails and footpaths
- The state should end subsidies to Amtrak and withdraw from the Southeast Corridor high-speed rail coalition
- Public transit should be funded locally, and preferably most or all of those funds should come from transit fares
- The state should stop using highway user fees to fund publicly owned airports. Instead, like private airports, those airports should be self-funded out of landing and storage fees
- The state should continue to fund railroad grade-crossing safety improvements, but should stop funding railroad and industrial sidings
- In general, low-income people should not be used to justify programs that will also — if not primarily — serve higher-income people. Instead, any programs aimed at helping low-income people should be targeted at those people. In particular, automobile ownership has been shown to be a key element in helping people get out of poverty. While poverty reduction is outside of NCDOT's mandate, the state should consider creating a program through the Department of Commerce to offer low- or zero-interest loans to help low-income people buy a car.

INTRODUCTION

The North Carolina Department of Transportation (NCDOT) spends about $5 billion per year on highways, airports, ferries, railroads, and public transit. A recent state commission, known as North Carolina FIRST (Future Investment Resources for Sustainable Transportation) recommended that spending be increased by 40% over the next 10 years.

An implicit question is whether North Carolina really needs to increase transportation spending by 40% and how that or any increase should be funded. To prepare this report, I reviewed NCDOT's most recent budget, its two most recent long-range transportation plans (known as the 2040 and 2050 or *NC Moves* plans), its 2021 transportation improvement program, and the FIRST final report.

My qualifications for conducting such a review grow out of a career of more than 45 years reviewing government land-use and transportation plans. I am neither a transportation engineer nor a transportation planner. Instead, my expertise, gained through decades of analyzing federal, state, and local plans, is in understanding how government agencies

operate and how those operations can be improved. That understanding has been documented in my six published books as well as hundreds of plan reviews, research reports, and policy analyses. This paper will draw upon that understanding.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

The cover of the North Carolina Department of Transportation's (NCDOT) *NC Moves 2050 Plan* features photographs that apparently give similar weight to pedestrians, cyclists, public transit, airports, highways, ferries, and passenger trains. In fact, however, NCDOT is primarily a highway agency. More than 78% of its budget is spent on highway construction and maintenance. Only 6% of its budget is spent on airports, passenger rail, transit, ferries, and bike routes. The remainder went to administrative overhead (7%), transfers to other state agencies and local governments (4%, most of which went to support city street maintenance), and debt service (4%).[1]

This does not mean that other modes are neglected. In recent years, the state has spent close to $400 million supporting Charlotte light rail and promised $190 million to the Durham light-rail project that appears to have died despite that promise. It also spent around $700 million improving passenger rail service between Raleigh and Charlotte. But highways are still its dominant function.

"Increased politicization has reduced the cost-effectiveness of at least some of the money spent by NCDOT in recent years."

As a highway agency, NCDOT is rated fairly highly. The Reason Foundation's most recent review of state highway systems, which considered highway spending, pavement and bridge conditions, congestion, and fatality rates, ranked North Carolina 14th in the nation. That put it ahead of Florida, Georgia, and Virginia, but behind Kentucky, South Carolina, and Tennessee.[2]

NCDOT cannot rest on its laurels, however. It is a political agency, and the danger with political agencies is that they end up being more responsive to the needs of politicians, who want to get re-elected or elected to higher office, and less responsive to the needs of the end-users they were created to serve, who in this case want affordable, safe, and swift travel.

One major problem is that politicians are more eager to support construction of new infrastructure than maintenance of existing infrastructure. As one U.S. Department of Transportation official once said, politicians prefer ribbons over brooms, meaning they want to have their photos taken at ribbon cutting ceremonies but underfund the follow-up maintenance work.

As will be shown, increased politicization has reduced the cost-effectiveness of at least some of the money spent by NCDOT in recent years. Moreover, if safeguards aren't taken now, that ineffective spending is likely to significantly increase in future years.

Highway Conditions

According to the American Society of Civil Engineers, the United States is suffering from crumbling infrastructure that has reached crisis proportions.[3] As comedian John Oliver says, however, civil engineers "would clearly benefit from more infrastructure spending," so relying on them

"is a bit like having the state of our nation's tennis balls assessed by the American Society of Golden Retrievers."[4] The reality is that, at least with respect to highway infrastructure, both the nation's and North Carolina's highways and bridges are in fairly good shape and do not need a major rescue.

In the 1980s, several highway bridges in America collapsed due to poor or deferred maintenance. These included Connecticut's Mianus River Bridge in 1983 and Tennessee's Hatchie River Bridge in 1989.[5] These failures led Congress to require state agencies to regularly inspect and report bridge conditions. Bridge decks, superstructures, and substructures were graded to be in good, fair, or poor condition, and if any of these were in poor condition, the bridge was judged to be *structurally deficient*. After 2015, the Federal Highway Administration dropped the term "structurally deficient" and just used "poor" if any part of the bridge was in poor condition.

In 1992, 124,000 of the nation's roadway bridges — 22% of the total — and more than 3,700 North Carolina bridges — 24% of the state's total — were considered structurally deficient.[6] By 2020, though the number of bridges had grown, the number considered to be in poor condition had declined to just 45,000 nationwide (7.3% of the total).[7] Similarly, the number in North Carolina fell to just 1,460 (7.8% of the state's total).[8] This progress was made without Congress passing a giant infrastructure bill, and at the current rate of improvement, all North Carolina highway bridges will be in better-than-poor condition in less than a dozen years.

Several major bridges have collapsed since 1990, but these failures have all been found to be due to design flaws or oversized loads attempting to cross the bridges. For example, the Minneapolis I-35W bridge failure in 2007 was found to be due to a design flaw: gusset plates that were an integral part of the bridge were too thin.[9] The failure of an Interstate 5 bridge in Washington was due to an oversized load that should not have attempted to cross the bridge.[10] No amount of maintenance could have prevented these collapses, which means they don't indicate an infrastructure crisis.

Table 1: Average Pavement Roughness Index

	Nation		North Carolina	
	2009	2019	2009	2019
Rural Roads				
Interstates	78	71	77	62
Other principal arterials	88	84	88	80
Minor arterials	101	98	97	110
Major collectors	127	125	110	119
Urban Roads				
Interstates	93	84	82	72
Other freeways	101	94	88	78
Other principal arterials	134	129	111	111
Minor arterials	141	143	135	136
Collectors	159	162	134	148

NOTE: SMALLER NUMBERS INDICATE SMOOTHER PAVEMENT.

SOURCE: HIGHWAY STATISTICS 2009 AND HIGHWAY STATISTICS 2019 (WASHINGTON: FEDERAL HIGHWAY ADMINISTRATION, 2010 AND 2020), TABLES HM-63 AND HM-64. THESE TABLES PRESENT THE NUMBER OF MILES OF ROADS WITH ROUGHNESS INDICES BELOW 60, 60 TO 94, 95 TO 119, 120 TO 144, 145 TO 170, 171 TO 194, 195 TO 220, AND OVER 220. NUMBERS CALCULATED USING THE MIDPOINT OF THE RANGES AND USING 50 FOR BELOW 60 AND 232 FOR ABOVE 220.

The data also show that agencies that are funded primarily out of user fees have a smaller proportion of bridges in poor condition than agencies that are funded out of tax dollars. In 2020, just 2.1% of bridges owned by tolling authorities, and 4.8% of bridges owned by state highway agencies — which are mainly funded out of gas taxes and other highway user fees — were in poor condition. However, 9.7% of bridges owned by city and county governments, whose transportation agencies are funded largely out of property or sales taxes, were in poor condition.[11]

The condition of roadways has also mostly improved over time and also tends to be better on roadways funded out of user fees rather than tax

dollars. One measure of road conditions is pavement roughness. Highway engineers measure the roughness of pavement using an index: the smaller the number, the smoother the pavement. The Federal Highway Administration publishes pavement roughness indices for urban and rural interstates, other freeways, and other principal arterials, minor arterials, and collector roads.

Data are not available by owner, but in general, either the states or toll road agencies own the interstates and other freeways as well as most principal arterials. Cities own most minor arterials and collectors within their boundaries. In most states, counties own most minor arterials and collectors in rural areas as well as in unincorporated parts of urban areas. But in North Carolina, the state owns these.

As shown in Table 1, the average roughness indices of roads nationwide have improved, except for urban minor arterials and collectors. These tend to be owned by cities that fund transportation mainly out of general funds, and at least some of those cities have neglected their streets. In North Carolina, both urban and rural minor arterials and collectors have declined, and since NCDOT owns most rural roads, this neglect reflects poor management on the part of the state. Note that North Carolina's rural minor arterials and collectors were in better condition than the national average in 2009, but were worse than the national average in 2019. To the extent that North Carolina owns minor arterials and collectors in urban areas, they may be declining as well.

In sum, North Carolina roadway bridge conditions are steadily improving, but the condition of rural minor arterials and collectors is declining. NCDOT needs to redirect its priorities toward restoring those roads.

NCDOT Finance

NCDOT collects revenues from two main sources. First, almost three-quarters of its revenues come from a variety of state highway user fees including fuel taxes, vehicle registration, license and title fees, and a sales tax on vehicles known as the highway-use tax. The remaining quarter

"North Carolina roadway bridge conditions are steadily improving, but the condition of rural minor arterials and collectors is declining."

comes from the federal government, most of which comes from federal highway user fees including fuel taxes and taxes on trucks and truck tires. In short, close to 98% of NCDOT's budget ultimately comes from highway users.[12]

The state legislature has divided state highway user fees into two funds: the *highway fund* is used for maintenance while the *highway trust fund* is used for construction. The construction fund gets 29% of fuel taxes, 15% of registration fees, and 100% of the highway-use tax. The maintenance fund gets the rest. These somewhat arbitrary percentages do not ensure that the ratio of new construction to maintenance is optimal, nor do any of NCDOT's plans attempt to determine if the optimal ratio would be different.

As previously noted, 78% of NCDOT's budget went to state highways, including 46% for construction and 32% for maintenance. In addition, close to 3% went to cities, mostly for street maintenance. With 11% going for administrative overhead and debt service, only 7% was left over for other modes, including airports, rail, transit, ferries, and bike-pedestrian paths.

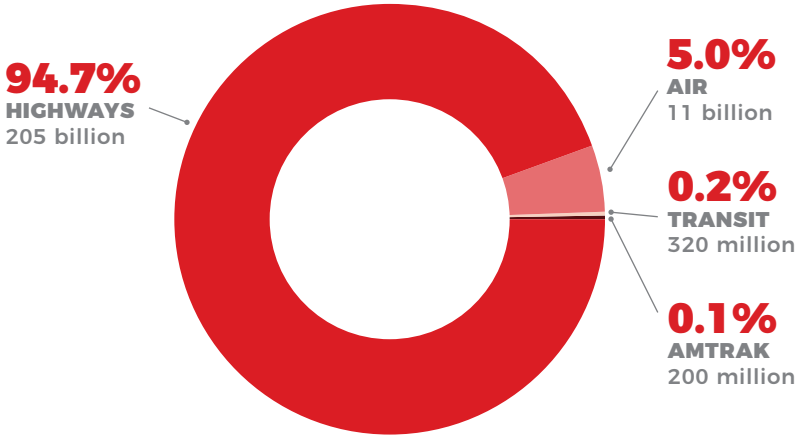
Some might say that it is unfair that highways get 80% of NCDOT's funding while other modes get only 6%. But with 98% of its budget coming from highway users, the real question is why other modes get as much as 6%. Plans to expand passenger rail service make it likely that the share going to non-highway programs will increase in the future even though the revenues from passenger rail won't cover all of those costs.

TRANSPORT IN NORTH CAROLINA

In 2019, North Carolina highways, roads, and streets moved 122 billion vehicle-miles of travel.[13] The Federal Highway Administration publishes estimates of how much traffic in each state is by motorcycle, car, light truck, bus, or heavy truck, and the average occupancies of each of those classes of vehicles.[14] Since the purpose of most heavy truck travel is shipping freight, and not passenger travel, I assume that these trucks carry no passengers. For other forms of travel, calculations based on the federal highway numbers indicate that roads carried more than 205 billion passenger-miles of travel.

According to the Federal Transit Administration, North Carolina transit systems in 2019 carried 320 million passenger-miles of travel, or about 0.16% as much as the highways.[15] Other than the Charlotte light rail and streetcar, North Carolina transit relied on roads and streets, and so all but about 45 million of the 320 million transit passenger-miles are also included in the highway numbers.

Figure 1: N.C. Passenger Travel by Passenger Miles - 2019



SOURCE: AUTHOR'S CALCULATIONS

In addition to the two Amtrak trains that receive subsidies from the North Carolina Department of Transportation (NCDOT), Amtrak operates four other trains that stop in North Carolina and one that passes through North Carolina without stopping. Amtrak says that, in 2019, 937,010 people got on or off of an Amtrak train in North Carolina.[16] The average Amtrak trip is almost exactly 200 miles, so this represents a little less than 200 million passenger-miles, or less than 0.1% as many passenger-miles as are carried on North Carolina roads.[17] This doesn't count the passenger-miles of people carried by Amtrak through the state, but — offsetting part of that — it does count the passenger-miles of people who get on or off a train in North Carolina but who spent part of their trips in South Carolina, Virginia, or other states.

Air travel is even more difficult to estimate. In 2019, the Federal Aviation Administration reported 34.3 million enplanements in North Carolina (and presumably there were a similar number of deplanements).[18] Counting both domestic and international flights, the average traveler goes more than 1,600 miles per enplanement.[19]

Of course, most of those passenger-miles would not take place in North Carolina. Considering that North Carolina is about 500 miles east to west

and 150 miles north to south, the average east-west trip within North Carolina will be about 250 miles, and the average north-south trip will be 75 miles, making the average of all trips about 162 miles. If there were 34 million enplanements and 34 million deplanements, then air travel provided about 11 billion passenger-miles of travel over North Carolina. Just as the Amtrak calculation didn't count passengers passing through the state, this doesn't count air travel that passed over the state without stopping.

Although the air and Amtrak numbers are crude, this gives us a rough estimate of the relative importance of these four modes of passenger travel: highways, 205 billion (95% of the total); air, 11 billion (5%); transit, 320 million (0.15%); and Amtrak, 200 million (under 0.09%). In other words, highways carry 640 times as many passenger-miles as transit and airlines carry more than 50 times as many passenger-miles as Amtrak.

In addition to passenger travel, North Carolina highways also carried freight. The numbers aren't yet available for 2019, but the Bureau of Transportation Statistics estimates that heavy trucks carried just over 2 trillion ton-miles in 2018.[20] The agency also estimates that heavy trucks traveled about 305 million miles, making the average payload about six and two-thirds tons. Trucks in North Carolina traveled about 8.9 billion vehicle-miles in 2019, and at six and two-thirds tons-per-mile, they would have carried about 59 billion ton-miles.[21]

We don't know exactly how much freight was carried by airlines, air cargo companies, and railroads in North Carolina, but nationwide air freight was less than 1% as much as highways, and rail freight was about 85% as much as highways. While rail freight is important, the freight railroads get almost no subsidies from taxpayers and NCDOT can't really say that it contributes a lot to this business compared to what its highway network does for trucks.

In sum, North Carolina roads and streets support 95% of passenger-miles and probably support about half of freight ton-miles. Air travel represents about 5% of passenger-miles but less than half a percent of

"Highways carry 640 times as many passenger-miles as transit and airlines carry more than 50 times as many passenger-miles as Amtrak."

ton-miles. Public transit carries only 0.15% of passenger-miles and zero freight. Amtrak carries less than 0.1% of North Carolina passenger-miles, and while the freight railroads carry lots of freight, NCDOT doesn't contribute much to that.

All of these numbers are from before the pandemic, but the pandemic reduced Amtrak, air travel, and transit by more than 60%, while driving is now around 90% of pre-pandemic levels. This is partly because people viewed driving in their personal automobiles to be safer than any form of mass transportation. The pandemic is only the most recent of several unexpected events or *black swans* that have disrupted the American economy in the past two decades, starting with the 9/11 terrorist attack and including various hurricanes, wildfires, and other natural disasters, plus the 2008 financial crisis.

Through all of these disasters, one mode of transportation — motor vehicles and highways — has proven to be the most resilient. When ridership declines, entities such as Amtrak and public transit demand increased subsidies to continue operating, but highways are there when people need them. When a natural or human-caused disaster disrupts transportation lines, America's 2.9 million miles of paved roads usually offer many alternate routes. Highways have also proven to be the best way to evacuate people and bring in rescue and recovery services after a natural disaster. It is likely that, after most people have been vaccinated against COVID-19, highways will quickly recover to their pre-pandemic use, while Amtrak and transit will remain well below that use. This is just one more reason why transportation policy should not focus on less-resilient modes such as intercity passenger trains, high-speed rail, and public transit.

THE NC MOVES 2050 PLAN

Congress requires that state transportation agencies prepare long-range (20 years or more) transportation plans that are supposed to guide project selection as well as short-range (two to four years) plans that list the projects to be funded in the next few years.[22] North Carolina's most recent long-range plan is called *NC Moves 2050*; its most recent short-range plan is called the *NCDOT 2020-2029 Current State Transportation Improvement Program (STIP).*

The *NC Moves 2050 Plan* starts out with a vision: "NC Moves 2050 will strengthen North Carolina's multimodal transportation system by prioritizing safety, economic vitality, high quality of living and sustainability by integrating technological innovations and demographic shifts."[23] This sounds pretty, but it contains several terms whose definitions are vague and questionable.

The dictionary definition of *sustainable*, for example, is "able to be maintained at a certain rate or level." But, as used by many transportation planners, *sustainable transportation* means any form of transportation

"The plan provides no clear reasons why a particular level of spending on any part of the state's transportation system is better than another level of spending."

that does not rely on fossil fuels and, in particular, forms of transportation other than automobiles.[24] The inclusion of the term *sustainability* in the vision represents an implicit bias against autos and highways.

Economic vitality is also questionable. It is one thing if it means helping poor people out of poverty, but too often "economic vitality" or "economic development" becomes an excuse to subsidize transportation for wealthy people and corporations. Executive jetports, for example, hardly sound like they are used by low-income people, yet they are supported by NCDOT.

Another questionable term is *multimodal*. North Carolina highways and streets support pedestrians, bicycles, cars, buses, and trucks, but apparently that's not multimodal enough. To many transportation planners, multimodal means passenger rail transport such as streetcars, light rail, and Amtrak. For example, the Missouri Department of Transportation's "Multimodal Division administers the state's railroad program."[25]

Proponents of passenger rail say they want to give people "choices," and *choices* is a term frequently used in the *NC Moves 2050* plan. But they don't say why people need more choices than bicycles, cars, light trucks, buses, and planes. Compared with all of these choices, rail is an expensive, inflexible technology that cannot easily respond to changes in travel patterns. If people need more choices, why not stagecoaches, dirigibles, or helicopters? These can use existing infrastructure and don't require huge up-front costs to show whether or not they are likely to succeed.

Terms like these become a substitute for analysis. "Sustainability" implies that North Carolina must spend hundreds of millions of dollars on electric light-rail transit, even if it could do more to save fossil fuels

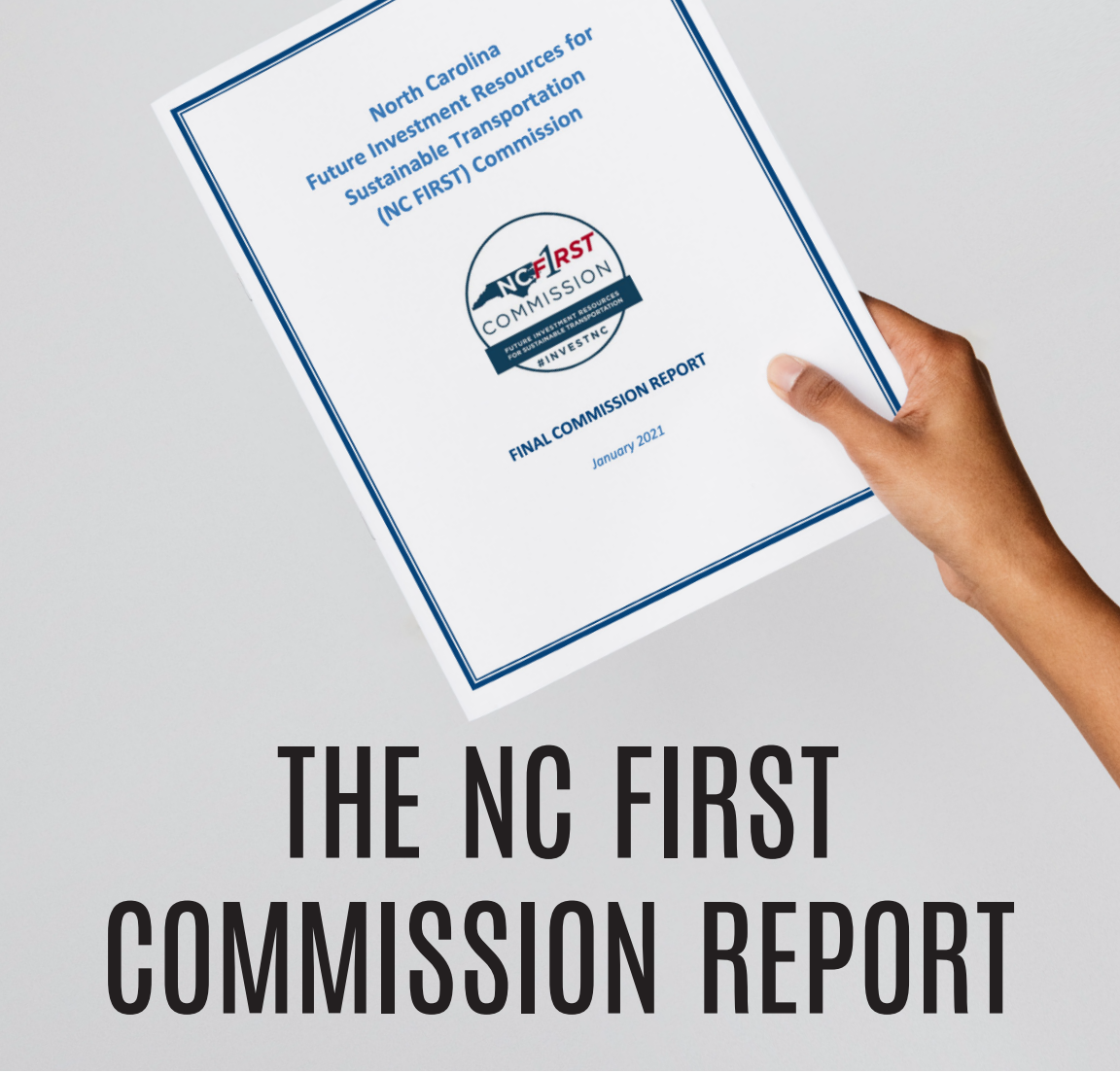
and reduce greenhouse gas emissions by spending that same amount of money on highway improvements that would relieve traffic congestion. "Economic vitality" means the state must spend money subsidizing profitable freight railroads and airports used only by owners of private planes. "Multimodal" implies that it must spend hundreds of millions of dollars supporting Amtrak trains, even though it could move those same people for less money on buses.

NC Moves proceeds to assess the state's transportation "needs" by estimating the future trend and then developing four alternative futures with vague names: *innovative*, *renewed*, *globally connected*, and *unstable*. The unstable future is the only one that spends less than the trend. Based on criteria that are not made entirely explicit, it estimates the state will need $108 billion over the next 10 years, or more than twice what it spent in the last 10 years.[26]

NC Moves also projects revenues. Due to population growth, state transportation revenues are expected to greatly increase over the next decade. "However," the plan adds, "NCDOT will need over 3.5 times more funding to keep pace with transportation needs."[27]

Finally, the plan includes a list of 32 recommendations. yet many of these are more slogans than concrete proposals: they include things like, "Consider accessibility and affordability when expanding multimodal options and connections" and "Consider technology applications in all transportation decisions."[28]

In sum, *NC Moves* is less of a plan than a part of a media campaign. The plan provides no clear reasons why a particular level of spending on any part of the state's transportation system is better than another level of spending. Instead, it merely argues that the state shouldn't reduce NCDOT's budget because that would be "unstable." Rather, it should increase the budget in order to be "innovative" or even "globally connected."



THE NC FIRST COMMISSION REPORT

Like the *NC Moves* plan, the NC FIRST Commission final report proposed the appropriate goals of the North Carolina Department of Transportation (NCDOT) in the form of a vision: "North Carolina's vision is that its transportation system will ensure the state's economic vitality, competitiveness, and overall safety and welfare for many years to come."[29] To implement this vision, the report used the same methodology as the *NC Moves* plan: first assessing need and then estimating revenues. Unlike the *NC Moves* plan, the FIRST Commission report presents its assessment of needs in detail.

Those needs are presented as four scenarios or grades, A, B, C and D. These four spending scenarios are developed for several major categories, including road and bridge maintenance, road construction, airports, rail, ferries, and public transit and pedestrian/bicycle facilities. Grade A represents the most expensive scenario and would yield the highest rates of improvement, grade B the second most expensive, etc. This means that if grade D is acceptable in terms of safety and performance improvements, A, B, and C represent more *wants* than *needs*.[30]

For maintenance purposes, roads and bridges are graded to be in good, fair, and poor condition. The four maintenance scenarios are judged by the percentage of roads and bridges are in good condition under each scenario. Grade D, which can be achieved with current funding, would keep 74% of roads and 42% of bridges in good condition; grade C, which would cost $1.5 billion more over the next 10 years, would be 79 and 42%; grade B would cost $2.25 billion more than D to be 85 and 70%; while grade A would cost $3 billion more than D to be 90 and 98%.[31]

The shares of roads and bridges that are in poor condition in each scenario are not disclosed. If, say, grade C can reduce those shares to nearly 0%, then the benefits of going to grades B or A would be much smaller than if high percentages remained in poor condition under D or C. Failing to disclose this information makes the choice of grades fairly subjective.

The report does offer some quantitative estimates, saying that poor road conditions will cause annual damage to vehicles ranging from $50 per household under grade A, to $122 per household under grade D. Simple calculations could have determined a least-cost solution, that is, which scenario has the lowest combined cost of vehicle damage plus maintenance budgets. However, the report did not make such a calculation.

For road construction, NCDOT scored hundreds of potential projects according to their potential to reduce congestion (30%), benefit-cost ratios (25%), freight benefits (25%), economic competitiveness (10%), and safety (10%).[32] The projects with the highest scores were included in scenario D, the next highest were in scenario C, and so forth. The total costs of the scenarios ranged from $1.6 billion for grade D to $27.6 billion for grade A.[33] The FIRST Commission offered no criteria for determining which of these scenarios is optimal, so any selection among them is arbitrary.

The Texas Transportation Institute's 2019 report on congestion estimates that the time wasted in congestion is worth about $18 per hour to North Carolinians. The institute combines this with the value of gasoline wasted in congestion to calculate the total cost of congestion.[34] NCDOT could similarly estimate the number of hours and gallons that would be saved

by each of the projects to determine which ones were worth doing. Neither NCDOT nor the FIRST Commission seem to have done this.

North Carolina has 10 commercial **airports**, 62 public non-commercial airports, and more than 300 private airports, heliports, and landing areas.[35] For the public non-commercial airports, NCDOT made a list of nearly $900 million worth of potential improvements and scored that list. The projects receiving the highest scores totaling $240 million in costs were included in grade D; with successively lower-scored projects included in C, B, and A, the latter of which cost $880 million.[36] The First Commission again offered no criteria for deciding between these scenarios.

For rail freight, NCDOT manages a fund to "award competitive grant funds to short line railroads, make crossing and signal improvements, improve industrial access, and preserve and reactivate rail corridors."[37] The scenarios range from $770 million for grade D to $2.89 billion for grade A, of which the vast majority — $650 million to $2.59 billion — would be spent on class I railroads, not short lines.

For passenger rail, NCDOT contributes to the operating costs of Amtrak trains and makes capital improvements such as building new stations. Scenario D would buy new passenger railcars for existing trains, while C, B, and A would all expand passenger train service to more cities and routes. Scenarios range from $170 million under grade D to $1.78 billion under grade A.[38]

NCDOT operates one seasonal and eight year-round ferry routes. Compared with other modes, the range of spending on these ferries under the four scenarios is relatively narrow, from $200 million to $270 million. Unlike airports and Amtrak, the primary users of many of these ferries are auto drivers, so it is more appropriate to use highway user fees to pay for ferry operations and improvements.

For its analysis, the FIRST Commission conflates **public transit** with **pedestrian and bicycle facilities** in a single set of scenarios. For example, grade D includes constructing sidewalks on a state highway, building a bus-rapid transit line in the Research Triangle area, and constructing

several greenways (which presumably include bike and pedestrian paths), without breaking out the costs of these individual projects.

The scenarios also include the electrification of transit buses and construction of a Great Trails network to all 100 counties in the state, with grade D achieving 25% of these goals, grade C 50%, and so forth. The trails cost about three times as much as electric buses which in turn cost two to three times as much as the other transit/pedestrian/greenway projects in the scenarios. In total, the scenarios range from $1.3 billion for D to $5.1 billion for A.

The commission offers no objective criteria for selecting among the four scenarios for any of the categories of spending. The commission also completely ignores some obvious options to having state taxpayers pay for many of these things.

For example, why not privatize the 62 publicly owned non-commercial airports and let them fund themselves out of landing and storage fees? Private airplane owners are not likely to be low-income people, yet a significant portion of state taxes used to fund these airports comes from low-income people, so state airport funding is socially unjust.

Why should the state spend up to $27 billion on new roads to reduce congestion when it could do much more to relieve congestion at very little cost by implementing a dynamic road pricing system (as will be explained in more detail later). This system not only greatly reduces congestion, it provides revenues for any future road expansions that are proven to be necessary as travel grows. The FIRST Commission briefly mentions this possibility in two places but does not seriously consider it as an alternative in its A-B-C-D scenarios.[39]

Why should the state spend billions of dollars funding activities for private railroads, particularly class I railroads? Funding grade crossing improvements is an appropriate state function, but funding of industrial access, improving signaling systems, and preserving rail corridors should be done by the railroads and industries that use those corridors, not general taxpayers.

Why should the state spend up to $1.78 billion on passenger rail, which is 6% of the most it proposes to spend on new road construction, when intercity passenger trains carry less than 0.1% as many passenger-miles as the state's road system?

Is electrification of transit buses really worthwhile considering that North Carolina electrical generation plants produce almost 800 pounds of carbon dioxide per megawatt hour?[40] For that matter, why should the state spend any money on public transit agencies that strictly serve local areas?

> "NCDOT could similarly estimate the number of hours and gallons that would be saved by each of the projects to determine which ones were worth doing. Neither NCDOT nor the FIRST Commission seem to have done this."

In short, the report's conclusion that NCDOT needs a substantial increase in revenues is unpersuasive. Instead of trying to find ways to streamline NCDOT operations, the report devotes too much effort to suggesting new revenue sources to fund projects and programs whose validity is uncertain.

It is worth asking why the North Carolina FIRST commission was even necessary since it essentially replicated the work of the *NC Moves* plan and the two final reports were published only a few weeks apart. There must be something wrong with the congressionally mandated long-range planning process if the state transportation secretary felt it was necessary to conduct a completely separate but parallel process.

More important, however, is whether the process used in both plans — first assess needs, then revenues, then search for a way to close the gap between the two — is the correct methodology. Transportation companies such as CSX or Norfolk Southern don't assess what infrastructure they need to build and maintain independent of their revenues. Instead,

their revenues and potential revenues are an integral part of their decision-making. If the revenues generated by a particular improvement won't cover the cost of that improvement, then the improvement must not have been really necessary.

NCDOT's separation of "needs" from "revenues" is a symptom of the increased politicization of transportation. Some government agencies, such as police or the courts, can't depend entirely on their own revenues to support their operations. But transportation is a completely marketable activity, so any assessments of "needs" should relate directly to the revenues that can support those needs.

Problems Disguised As Solutions

Having created a long list of "needs" that in many cases are completely arbitrary, the FIRST Commission suggested a number of ways to fund these needs, including increasing the highway-use tax on motor vehicle sales, increasing state and local general sales taxes, dedicating existing sales taxes on transportation-related good to transportation, taxing ride hailing, and something called value capture, which is basically a property tax on properties near transportation facilities. Other than the fact that these taxes wouldn't have been necessary if the FIRST Commission had taken revenues into account when it considered the state's transportation needs, there are problems with many of these proposed taxes.

The idea of dedicating sales taxes on transportation-related goods and services to the state transportation system undermines the basis of a sales tax, which is meant to be a consumption tax to pay for essential social services such as fire, police, and courts that would not ordinarily be funded out of user fees. If the sales taxes on transportation are dedicated to transportation, the sales taxes on food are dedicated to farm subsidies, the sales taxes on home construction and improvement materials are dedicated to affordable housing, and so forth, there will be nothing left to pay for the essential social services that depend on those taxes.

Special taxes on ride hailing are equally objectionable. Ride-hailing drivers

already pay fuel taxes, vehicle registration fees, highway-use taxes, and tolls. Transit agencies with obsolete business models are upset they have to compete with new business models, but they should not be allowed to use the monopoly power of the government to tax their competition.

> "The report's conclusion that NCDOT needs a substantial increase in revenues is unpersuasive."

Value-capture taxes are also questionable. While new transportation facilities often boost the value of nearby properties, this is usually offset by a decline (or a slowing of the rate of increase) in the value of properties further away from the facility. Thus, no net new value is created by the facility, and any taxes on nearby properties will be offset by reduced taxes elsewhere.

The best suggestion offered by the FIRST Commission for North Carolina highways is a mileage-based user fee (MBUF), which the report notes "is viewed by many as the most viable and durable alternative to the Motor Fuels Tax." The report adds that "Oregon and Utah operate the only permanent programs for light vehicles."[41] As an Oregon resident, I participate in this program.

Oregon had been the first state to fund highways with a gasoline tax in 1919. Gas taxes made sense before the development of electronic tolling, as toll collection costs were too expensive to use tolling to pay for all roads. But fuel taxes have considerable weaknesses.

First, unlike sales, income, and property taxes, they don't automatically adjust for inflation. Second, they don't automatically adjust for more fuel-efficient vehicles. Since passenger vehicles today use less than half the energy per mile as vehicles 50 years ago, increased fuel efficiency has put a crimp in state highway budgets.[42]

Third, most fuel taxes are collected either by the states or by the federal government which then distributes them to the states. North Carolina shares less than 3% of its transportation funds with the cities.[43] This was

far from adequate to maintain city roads and streets, and North Carolina cities had to spend $384 million out of property or other general taxes on streets in 2019.[44] City use of general funds for roads is an unnecessary subsidy to driving that ought to be corrected.

Finally, fuel taxes do little to cure congestion, and specifically do nothing to fix the problem that the throughput of roads declines when use exceeds a certain level, a problem that will be described in more detail in the section on congestion that follows.

The Way Forward

Mileage-based user fees solve all of these problems. Once a user-fee system is set up, it can be used by all road owners — federal, state, city, or private — to pay for their roads. They can also vary by the amount of traffic, thus providing the benefits of variable-priced toll roads without setting up special infrastructure.

The premise of MBUF is that people should pay proportionate to their road consumption and the potential damage they do to the roads. This means large, heavy vehicles should pay more than light vehicles, and Oregon has a separate weight-mile tax for heavy trucks. According to the Oregon highway division, however, unless it has chains or studded snow tires, a Cadillac Escalade doesn't do significantly more damage to a road than a Toyota Prius, so Oregon charges both the same mileage fee.[45]

Some people think that owners of more fuel-efficient vehicles should pay lower fees as a reward for saving energy, but they already are rewarded for doing so by having lower fuel bills. This would also be inequitable as, so far, electric cars tend to be owned mainly by high-income people. Such a reward also violates the basic point of MBUFs, which is to cover the cost of road use and wear-and-tear with user fees.

Participants in Oregon's program are allowed to simply submit odometer readings to the state and to pay for miles driven. However, this requires that they pay for all out-of-state driving and doesn't allow highway

owners other than the state to charge for driving on their roads.

> "Mileage-based user fees solve all of these problems."

Most participants instead install a GPS device in their car that reports how many miles they drive in the state each month. Potentially it can report how many miles are driven by ownership of road and eventually allow for variable fees depending on traffic. Since Oregon has an insurance program that allows people to pay for auto insurance by the mile, many residents already had such devices installed in their cars.

Oregon fuel taxes that drivers pay at the pump are currently 36 cents per gallon and the mileage fee is 1.8 cents per mile. The estimated fuel taxes, based on the average reported fuel economy of each car, are deducted from the monthly payment. For example, owners of vehicles that are rated to get 20 miles per gallon end up paying zero in mileage-based fees after deducting the fuel tax credit; owners of vehicles that rated at 30 miles per gallon pay a net of 0.6 cents per mile.

To protect privacy, miles of driving are not reported to the state. Instead, the GPS device reports miles to the insurance company or, for people who don't have pay-by-mile insurance, another private company. These companies collect the fees and pay the state a lump sum each month, so the state has no idea who paid or how many miles anyone drove, much less when or where they drove. Users are given their choice of provider and providers compete with one another to guarantee users privacy. Use of an intermediary adds to the cost of the system, but the state estimates those added costs will be small when the system, is implemented on a large scale.

An alternative system of protecting privacy would be to have an intelligent GPS device that gathered current road fees from the cell phone network. The device, which could easily be a smartphone with a downloaded app, would keep track of where people drove and total the costs. When connected to each automobile's navigation system, drivers could

see in advance how much any particular route would cost at any particular time.

At the end of each month, users would pay the bill tallied by the device. If they disagreed with the amount, they could use the record kept by the device to show whether they really drove those miles. If they agreed with the amount, they could erase the records to keep them private.

Initially, Oregon's system applied only to volunteers. More recently, the Oregon legislature significantly increased license fees for electric and plug-in hybrid vehicles. Those increases are waived for people who join the MBUF program. Eventually, the state hopes to completely phase everyone into the program and to phase out fuel taxes.

Washington state also had a pilot MBUF system and the states tested their systems together to ensure interoperability. When Oregon participants drove on Washington roads, they paid into the Washington system and vice versa. Participants in Washington's system, however, report that the state did not protect the privacy of users as well as Oregon did, which is the fault of the designers of the Washington system.[46]

The FIRST Commission supported a mileage-based fee system "if it can be incorporated equitably and not create a disproportionate burden, especially to low-income citizens."[47] However, the worry that a mileage-based system would burden low-income citizens is a red herring. Such people are already burdened by regressive sales taxes, which the FIRST Commission suggested as an alternate way to raise funds for transportation. A pay-as-you-go system relieves this burden and ensures the people pay for only what they use.

If there is a concern that low-income people are burdened by transportation costs in general, the solution is not to maintain an inefficient and regressive tax system. Instead, the state should offer transportation vouchers that low-income people could use for any form of transportation: transit, Amtrak, ride-hailing, gasoline, air travel, and even purchasing automobiles.

SAFETY

The North Carolina Department of Transportation (NCDOT) lists "safety" as the first and, implicitly, most important of its "values."[48] Yet, as noted previously, safety was given only 10% weight in the FIRST Commission's prioritization of potential highway projects. The commission gave congestion, benefit-cost, and freight much greater weight, while economic competitiveness was ranked equal to safety. An assessment of highway fatalities suggests that there is more that NCDOT can do to improve state road safety.

U.S. Department of Transportation (USDOT) data show that, between 2015 and 2019, 11.2 people have died on North Carolina roads for every billion vehicle-miles. That's slightly better than the national average of 11.4.[49] What's significant, however, is that the average varies tremendously depending on the type of highway.

U.S. DOT data are separated by urban and rural. Within each area, data are available for interstate highways, other freeways, other principal arterials, minor arterials, collectors, and local roads. As the name implies, arterials

"An alarming trend in recent years has been an increase in pedestrian and bicycle fatalities, which has run counter to the general decline in fatalities among vehicle occupants."

are the major arteries of travel and generally have speeds of 45 miles-per-hour or greater. Local roads are narrow and generally have speeds of 25 miles-per-hour or less. Collectors connect the local roads with the arterials and generally have speeds of 30 to 40 miles-per-hour.

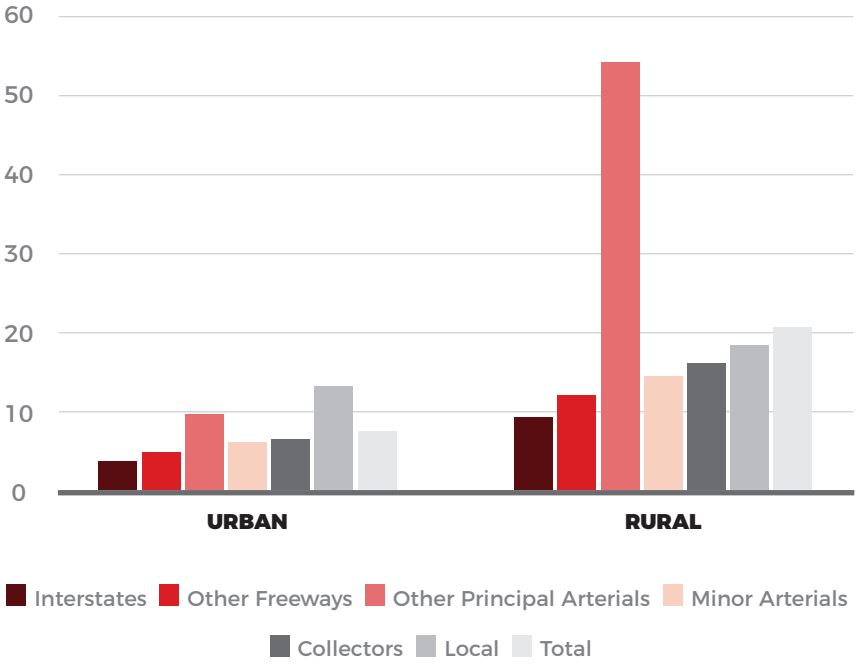
In general, rural roads are more dangerous than urban roads, being involved with 20.6 fatalities per billion vehicle-miles compared with 7.4 for urban roads. This is probably because speeds are higher in rural areas.

Among either urban or rural roads, some types of roads are much more dangerous than others (Table 2). Although most local streets in urban areas are owned by the cities, of those roads within NCDOT's jurisdiction, the greatest safety benefits could be gained by focusing on non-freeway arterials and local rural roads.

One caveat from Table 2: reported fatalities among other principal arterials have recently varied widely from year to year, particularly in rural areas where they ranged from 77 in 2018 to 636 in 2016. It seems likely that this variation is due more to reporting mistakes (urban fatalities being recorded as rural, or arterial fatalities being reported as collectors) than to actual changes in the safety of these roads. To minimize the effect of this, Table 2 averages the numbers over five years.

An alarming trend in recent years has been an increase in pedestrian and bicycle fatalities, which has run counter to the general decline in fatalities among vehicle occupants. One solution is *vision zero*, a planning program aimed at improving safety by slowing traffic speeds. For example, the City of Charlotte's vision zero plan notes that "Charlotte is experiencing an epidemic of speeding" and that such "speeding accounts for

Table 2: Fatalities Per Billion Vehicle-Miles (2015-2019)



SOURCE: CALCULATED FROM FATALITY AND INJURY REPORTING SYSTEM TOOL, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, 2021 AND HIGHWAY STATISTICS FOR 2015 THROUGH 2019, TABLE VM-2.

44% of traffic fatalities in Charlotte." The plan calls for "reduc[ing] speed limits across Charlotte."[50]

Reducing speed limits, however, comes with an economic and environmental cost: slower traffic reduces economic opportunities, consumes more fuel, and emits more pollution and greenhouse gases. If the problem is illegal speeding, then reducing speed limits may not even be the best solution; enforcing existing limits may work better. For example, radar-activated speed signs that report speeds to drivers and flash if the

drivers are exceeding the limits have been shown to effectively reduce speeding at a low cost.[51]

Charlotte's vision zero plan also calls for redesigning streets to make them safer for pedestrians and cyclists. Too often, however, such redesigns reduce the capacity of the streets to move people by converting general purpose lanes into exclusive bike lanes. Most such reductions take place on collector streets, ignoring the arterial streets that tend to be bigger safety problems. As an alternative, bicycle safety can be increased with no loss to street capacities by converting parallel streets into bicycle boulevards, which means minimizing the stop signs for cyclists on such streets.[52]

The best solution for non-freeway arterials, the most dangerous roads in North Carolina, may be to separate uses. Urban freeways are the safest roads partly because they don't have intersections with cross traffic, but also because they separate pedestrians and cyclists from motor vehicles. North Carolina has about 1,800 miles of freeways and 3,600 miles of non-freeway principal arterials. Converting some of those non-freeways to freeways would greatly increase their safety. Providing pedestrians and cyclists with alternate routes parallel to major arterials would add further to safety.

CONGESTION

Congestion is one of the biggest problems associated with the nation's highway systems. According to the Texas Transportation Institute (TTI), congestion cost Americans $179 billion in 2017.[53] Congestion affects both autos and trucks, and these costs do not include the extra costs borne by shipping companies that have to buy more trucks, hire more drivers, and build more distribution centers to deal with congested roads.[54]

TTI has estimated 2017 congestion costs for 18 North Carolina urban areas, ranging from New Bern to Charlotte. According to these estimates, commuters and trucks in these urban areas wasted more than 160 million hours sitting in traffic in 2017. While stuck in congestion, these vehicles unnecessarily burned more than 66 million gallons of fuel while emitting 1.2 billion pounds (575 million kilograms) of greenhouse gasses. Based on TTI estimates of the value of people's time and fuel, 2017 congestion cost North Carolina residents more than $3.4 billion.[55]

The pandemic has changed traffic patterns, especially by increasing the number of people working at home.[56] Yet, despite the reduction in

commuting, miles of driving in North Carolina have recovered to about 90% of what they were before the pandemic.[57]

It appears that people who work at home end up driving as many miles per day as when they commuted to a workplace, but they do it at different times of the day, mainly in the afternoons. A study in Australia found that driving on freeways during the pandemic declined, but driving on non-freeway arterials increased, particularly "during the middle of the day and the early stage of the afternoon peak." As a result, traffic during the morning rush hour has diminished, but traffic in the afternoon has been extended over a longer period of time.[58] Evidence indicates that the same thing is happening in the United States.[59]

It seems likely that, after the pandemic, somewhere around half the people now working at home will return to a workplace. This will lead to a return of morning congestion, though it won't be as bad as before the pandemic, while afternoon congestion may be worse as people working at home use their afternoons to conduct errands, go to coffee shops, or attend various meetings.

While building more roads could reduce congestion, highway opponents argue that more roads simply lead to more driving. This is an absurd argument: any industry that could guarantee more sales simply by increasing its productive capacity would effectively earn infinite profits. The reality is that building any new transportation facility increases economic opportunities for people using that facility, but there is no guarantee that they will make use of those opportunities. Any facility that leads to more economic activity should be rated a success, not a failure.

Few people understand the real reason why roads get congested: roads are the only resource whose supply declines when demand increases. More accurately, throughput declines when use exceeds a certain level.

Actual measurements of the traffic a typical freeway lane can move at various speeds show that the number of vehicles reaches a maximum of about 33 cars or light trucks per minute at free-flowing speeds (the number may vary from 30 to 36, depending on the highway, and larger

vehicles may count as two or more cars). If more than that number try to use the lane, then traffic "breaks down," slowing as drivers respond to increased numbers.

The problem is that, as traffic slows, the potential throughput declines, falling to around 18 vehicles per minute at 25 miles-per-hour and 12 at 20 miles-per-hour. Once it has slowed down to, say, 20 miles-per-hour, throughput won't be restored to 33 per minute until the number of vehicles trying to use the lane falls below the lane's 12 vehicle-per-minute throughput at that speed, which may take hours.

"The only sure way to keep traffic from exceeding a lane's capacity is through variable pricing, either in the form of tolls or as a part of a mileage-based fee program."

As a result, a freeway lane might be able to move less than half of its real capacity for most of both morning and afternoon rush hours. In other words, highways lose capacity at just the times of day when people need them the most. If highway managers can keep traffic from breaking down in the first place, then they can greatly increase the ability of highways to move traffic during rush hours.

Keeping Traffic Moving

Ramp metering is one attempt to do this. In many urban areas, states have posted traffic signals at on-ramps, allowing no more than a few cars a minute to enter the freeway. This can help, but eventually the freeway reaches the point where it is moving 30 to 33 vehicles a minute and allowing even one or two vehicles per minute at an on-ramp leads to breakdown, which is then transmitted back several miles.

The only sure way to keep traffic from exceeding a lane's capacity is through variable pricing, either in the form of tolls or as a part of a mileage-based fee program. A large share of vehicles on the road at rush

hour are not commuters. Charging a higher fee to use a road during rush hour than at other times of the day will signal people whose schedules are more flexible to use it at another time.

Note that such variable pricing is not curing congestion by pricing people off the road. In fact, it is curing congestion by pricing people onto the road, because it can roughly double the road's capacity to move vehicles during rush hour by making sure that the number trying to use the road never exceeds the road's maximum capacity.

Unfortunately, as in any case where someone proposes to charge for something that had been available for free, road pricing is controversial. Opponents claim that they have already paid for the roads and shouldn't be forced to pay twice. They argue that pricing will hurt low-income people. They worry that electronic road pricing will allow the government to track where people go. And they fear that the revenues collected from road tolls will be diverted to various political slush funds.

All of these arguments are refutable. Existing gas taxes may have paid for road construction, but those roads still need regular maintenance and improvements with population growth. Road tolls can be dedicated to such expenses, but the main purpose of the tolls is not to raise funds but to keep the roads uncongested and performing at optimal levels.

Low-income people are disproportionately harmed by traffic congestion as working-class jobs are less likely to be done at home and to have flexible work hours to allow people to avoid rush hour. Thus, low-income people will actually be among the greatest beneficiaries of policies that relieve congestion.

Electronic tolling can easily be done while preserving privacy. Anyone may obtain a toll or mileage-based fee transponder, but they aren't necessarily the one who uses it. As discussed previously, there are at least two ways of designing mileage-based fee systems to preserve privacy.

Finally, worries about where the money will go can be relieved by state constitutional requirements that all road user fees, whether fuel taxes,

vehicle registration fees, tolls, or mileage-based user fees, be spent exclusively on highways, roads, and streets. Many states used to have such constitutional limitations for fuel taxes and some still do, but it is time that they are updated to include tolls and mileage-based user fees.

Variable pricing is sometimes called congestion pricing, but that term has also been applied to a policy of charging a fee to vehicles entering a downtown or other specific area. This should more properly be called cordon pricing. Unlike variable pricing, cordon pricing is not a long-run solution to congestion. Instead, it is mainly a fund-raising tool to support central city governments and/or urban transit agencies.

Congestion costing North Carolinians more than $3 billion per year exists because roads are inefficiently used and because of their unique attribute that highway throughput declines when use is at its highest. Variable pricing can solve this problem for a lot less than $3 billion per year while providing funds for necessary improvements.

NON-HIGHWAY MODES

The North Carolina Department of Transportation (NCDOT) uses state funding that nearly all comes from highway users to assist public transit, Amtrak, freight rail, bike routes, and airports. When used to build and maintain highways, highway revenues are true user fees, with people generally getting what they are paying for. But when used on other modes, they are a tax, one that is almost certainly regressive as low-income people are likely to pay a higher percentage of their incomes on such taxes than high-income people. Highway users should not be expected to pay such costs, especially when such things as executive airports, industrial rail sidings, and intercity passenger trains are largely used by higher-income people.

Transit

Urban transit is often promoted as a way to reduce energy consumption and greenhouse gas emissions, help low-income people, and relieve traffic congestion. Yet it does none of these things. Instead, the transit industry has become more interested in capturing dollars from taxpayers

than in actually serving transportation users. Subsidies from NCDOT to North Carolina transit agencies actually have the effect of helping shield the industry from operating efficiently and innovating in response to the changing needs of transportation users.

In 2018, the most recent year for which data are available, the average car in the United States used 2,840 British thermal units (BTUs) of energy per-passenger-mile while the average light truck (pickups, vans, and SUVs) used 3,388, with both amounts declining each year.[60] Assuming these cars and light trucks were powered by gasoline, cars emitted about 200 grams and light trucks 240 grams of carbon dioxide per-passenger-mile.

By comparison, in 2019, transit systems in North Carolina used 5,330 BTUs and emitted more than 360 grams of carbon dioxide per passenger mile.[61] Charlotte's light rail emits just 135 grams of CO2 per passenger mile, and vanpools in Charlotte, Durham, Greensboro, and Wilmington are more energy efficient than private cars. Otherwise, no transit system in North Carolina is anywhere close to being as energy efficient or climate friendly as automobiles. Indeed, if the primary goal is to save energy or reduce greenhouse gas emissions, the best thing to do would be to shut down all other transit.

Low-income workers (people who earn under $25,000 per year) in North Carolina are a little more likely to commute to work by transit than middle- ($25,000 to $75,000) or high-income (over $75,000) workers. But only small percentages of workers in any income bracket relied on transit to get to work in 2019. The highest percentage was among workers who earned under $10,000 per year, yet only 2.3% of this income class rode transit to work. Counting just urban areas, less than 3.5% of workers in every income bracket took transit to work. In the Charlotte urban area, it was less than 4.5%.[62]

In short, more than 95% of low-income workers don't rely on transit for commuting. Yet the taxes used to support transit are highly regressive, meaning low-income workers are actually more likely to be harmed by transit than to benefit.

As far as congestion goes, transit simply carries too few riders to have an impact on traffic congestion. In fact, transit vehicles probably add more congestion to the roads than is subtracted by the few cars they take off the roads. Transit buses in Durham carry an average of 7.6 people over the course of a day. Buses in Charlotte average 6.2 people and Greensboro buses average just 3.5.[63] Most of the buses used in these cities are more than twice as long as a typical car or light truck and, because they accelerate slowly and often exit and enter traffic to drop off and pick up passengers, they have a significant impact on traffic. Of course, these buses will carry more people during rush hours, but not enough to significantly reduce congestion.

> "No transit system in North Carolina is anywhere close to being as energy efficient or climate friendly as automobiles."

Overall transit ridership in North Carolina peaked in 2011, falling almost 7% by 2019. This is partly because low-income people responded to low fuel prices after 2014 by buying cars. But long-term ridership declines are mainly due to transit agencies' reliance on a century-old business model of bringing workers to downtown jobs even though most jobs are no longer located in downtown areas. Less than 6% of jobs in the Charlotte metropolitan area, for example, are located in downtown Charlotte.[64]

Rather than change this business model, transit agencies like the Charlotte Area Transit System have become even more dependent on it by building expensive light-rail lines whose principal aim is to bring more workers to downtowns. Light rail hasn't prevented a ridership decline in Charlotte; ridership peaked in 2013 and had dropped by more than 15% by 2019 despite opening a new light-rail extension in 2018.[65] This extension was built with the help of $299 million in state funds.[66] This is on top of the $100 million provided by the state for Charlotte's original light-rail line that opened in 2007.[67]

Light rail is, in fact, functionally obsolete. Using the same amount of land, buses can move more people per hour, in greater safety, with greater reliability and more flexibility to serve more destinations for a lot less money.

Light rail is often billed as "high-capacity transit" because a two- or three-car light-rail train can carry more people than a bus. But for safety reasons, most light-rail lines can move no more than 20 trains per hour, which means, if the line uses three-car trains with each car carrying 150 people, it can move 9,000 people per hour. By comparison, the Istanbul Metrobus line moves more than 250 100-passenger buses per hour during rush-hour periods, each stopping at every station, thus moving nearly three times as many people per hour as light rail.[68] Unfortunately, transit agencies have been enticed to build light rail not because it is efficient or modern or high capacity, but because the federal government has, since 1991, covered half the cost.

In 2019, North Carolina transit fares covered only 14% of operating costs. When capital costs are included, transit received almost half a billion dollars in subsidies. Counting just operating costs, taxpayers provided more than $5.50 in subsidies for each transit trip. Most of these subsidies did not come from NCDOT, but NCDOT's contribution made the problems of non-responsiveness to transit user needs even worse than they would have been.

The pandemic has worsened transit's outlook in every way. While North Carolina driving in January 2021 had recovered to nearly 90% of 2020 levels, North Carolina transit ridership was less than 40% of 2020 numbers.[69] After the pandemic, many people will continue working at home, which is likely to keep transit ridership well below 2019 levels. As noted in a recent report by noted transit expert Steven Polzin, these changes make transit's business model more obsolete than ever.[70]

A review of North Carolina's transportation improvement program shows that most state transit funding is currently being used to supplement federal and local funds for transit administration, planning, operations, and purchases of buses. Typically the federal government provides 80% of the cost and transit agencies are responsible for the other 20%.

By funding half of that 20%, the state reduces the burden on transit agencies. At the same time, however, it reduces the incentive for transit agencies to operate efficiently and to make responsible capital purchases. For example, as previously noted, Greensboro transit fills less than half as many seats as Durham transit, yet both use the same 40-foot, 40-passenger buses. So long as the state and federal governments subsidize 90% of the cost of buses, Greensboro Transit and other agencies have minimal incentive to size their buses for their passenger loads.

Amtrak

With the help of a $695 million federal grant, NCDOT funded improvements that allowed Amtrak to increase service between Charlotte and Raleigh from two trains a day in 2009 to four trains a day in 2019. Although the federal grant came from a fund meant for high-speed rail, NCDOT's improvements saved only 2 minutes on the trip, increasing average speeds from 54.1 to 54.6 miles-per-hour. The main improvement was the increase in frequencies.

The increase in frequencies did increase riders, but there are clear diminishing returns. Calculating ridership is problematic because one of the four trains continues from Raleigh to Washington and New York City. But Amtrak publishes state fact sheets that report how many people boarded or alighted from trains in each city. Amtrak regularly deletes older information from its website but still has fact sheets for 2018 and 2019 online. I previously downloaded fact sheets from 2008 and 2017, which I use as reference.

In 2008, when there were only two trains a day, 523,775 people boarded or deboarded from trains in Charlotte, Raleigh, and the seven Amtrak stops between them. In 2017, when service had been increased by 50% to three trains per day, passenger numbers increased to 676,272, or 29% more. In 2019, when service had been increased another 33% to four trains per day, passenger numbers increased to 757,699, or 12% more than in 2017.

Passenger train supporters hope that increasing frequencies will have synergistic effects so that, say, a 33% increase in service results in more than a 33% increase in ridership. But that clearly isn't working in North Carolina. A private business would increase service, despite diminishing returns, so long as the marginal revenues from the service increase exceed the marginal costs of that increase. But the marginal revenues were exceeded by the marginal costs of Charlotte-Raleigh rail service from the very beginning, so there is no economic justification for increasing service.

Note that the 757,699 passengers in 2019 amount to just 2,076 per day. Since this counts both boardings and alightings, 2,076 per day represents only a little more than 1,100 actual passengers per day (depending on how many traveled out of state). By comparison, different segments of Interstates 40 and 85 between Raleigh and Charlotte carried anywhere from 66,500 to 153,000 vehicles per day in 2019.[71] About three-fourths of the vehicles on interstate highways are cars and light trucks with an average of 1.67 people per vehicle.[72] This suggests that, at its least-used point, about 83,000 people a day travel on the interstate route between the two cities, and for much of the distance it is many more. Amtrak's share of travel was no more than about 1% of this amount.

North Carolina-subsidized Amtrak trains also compete with at least nine non-stop planes a day between Charlotte and Raleigh, three Greyhound buses a day, and one Megabus per day between Charlotte and Durham.[73] In the absence of the subsidized trains, Greyhound and other bus companies would probably provide more frequent service. Intercity buses, incidentally, are more energy efficient and climate-friendly than passenger trains.[74]

The pandemic has had an even bigger impact on Amtrak than on transit. As of January 2021, ridership on the trains supported by North Carolina subsidies was only 36% of January 2020.[75] It seems likely that long-term fears about disease combined with increased use of electronic meetings over face-to-face meetings will keep Amtrak ridership depressed long after most people have been vaccinated.

The social benefits of subsidizing Amtrak service in North Carolina are nil. The willingness of the state to do this raises questions about how well the transportation planning process sets priorities. This is especially true considering the state has proposed to extend passenger train service to Asheville and Gastonia in the west, and Fayetteville, Goldsboro, and Wilmington in the east. These extensions make even less sense than the current service.

Even worse, North Carolina is also part of a four-state Southeast high-speed rail coalition that is planning trains between Washington and Florida with top speeds of 110 miles-per-hour or higher.[76] Such a program would cost tens of billions of dollars yet still not be competitive with other modes of transportation. Even the fastest high-speed trains are slower than flying and less convenient than driving. Because they require expensive infrastructure that must be built and maintained to highly precise standards, they are more expensive than either flying or driving. This means they require huge government subsidies that cannot be justified based on any social or environmental criteria.

Freight Rail

NCDOT spends money on improving grade crossing safety. Such spending is appropriate because it benefits the highway users who pay for such improvements. Less appropriate, however, is using highway trust fund money to improve freight rail service.

America's private railroads are the most efficient and most profitable railroads in the world. In fact, they are almost the only profitable railroads in the world because, in most countries, the railroads are owned by the government and those governments have, for the most part, dedicated them to passenger rather than freight service. Even in countries like China, whose population densities are high and auto ownership rates are low, state-owned railroads have a difficult time competing for passenger business against highways and airlines, and so the railroads lose money. China's state railway, for example, has run up an $850 billion debt that it will probably never be able to repay.[77]

Being as efficient and profitable as they are, freight railroads don't really need subsidies, but won't turn them down if they are offered. Yet NCDOT regularly spends millions of dollars of highway trust funds helping CSX and Norfolk Southern build industrial sidings and other freight rail projects. These expenditures are probably done in the name of economic development, but if the railroads themselves didn't think they were worthwhile without government assistance, they probably weren't worthwhile.

Aviation

North Carolina has 10 commercial airports, 62 other public airports, and 300 private airports. NCDOT regularly uses highway trust funds for expanding and paving runways and making other improvements to the 62 public airports. For example, the 2020 transportation improvement program includes $354,000 in state highway trust funds for buying land to expand the Wayne Executive Jetport, with plans to spend $3.7 million more out of the highway trust fund extending the runway onto this acquired land.[78]

The vast majority of North Carolinians cannot afford to use the services of a general aviation airport. It is unfair and inequitable to use what amounts to a regressive tax to subsidize such airports. Most of the state's private airports are funded out of landing and storage fees. Public, non-commercial airports should be able to fund themselves out of those same fees instead of highway funds.

Bicycle and Pedestrian Routes

Bicycle riders and pedestrians used North Carolina roads before the invention of the automobile, and they deserve to have safe places to travel in the automobile age. That may mean providing adequate sidewalks for pedestrians, bike lanes, or alternate routes. The question, of course, is who should pay for these facilities.

People cycle and walk to reach specific destinations such as work or shops. But they also cycle and walk for recreation and exercise. It is appropriate to use highway funds to ensure that roadway improvements for automobiles do not create dangerous conditions for cyclists and pedestrians. However, cyclists and pedestrians should be asked to pay a large share of the costs of facilities that will be used primarily for recreation.

This has not been a major issue in North Carolina as most of the money spent on bicycle and pedestrian facilities comes from federal or local sources, not the state. However, the state is planning a "great trails" program of recreation trails to all 100 counties that could cost as much as $3.6 billion. The state also has plans to turn some former railroad rights-of-way into recreational bike paths. The state should explore ways of charging recreation user fees to help pay for such recreation trails and bike routes.

ECONOMIC DEVELOPMENT AND POVERTY

North Carolina's 2019 poverty rate of 13.6% was higher than the national average and higher than the state's poverty rate had been in 2000.[79] The North Carolina Department of Transportation's (NCDOT) funding of industrial railroad sidings and general aviation airports is supposed to contribute to the agency's vision of promoting economic vitality, but these projects do little or nothing to reduce the state's poverty rate.

In truth, neither economic development nor poverty reduction should be a part of NCDOT's mandate. "Government will malperform if an activity is under pressure to satisfy different constituencies with different values and different demands," management expert Peter Drucker once wrote. "Performance requires concentration on one goal."[80]

At the same time, transportation can do much to reduce poverty. Numerous studies have shown that one of the best ways to help a family rise out of poverty is to make sure they have access to an automobile.[81]

Automobiles can do far more to help low-income people than urban transit because they can reach far more destinations in a given amount of time. According to the University of Minnesota's Accessibility Observatory, the typical resident of the Charlotte urban area can reach more jobs in a 10-minute auto drive than a 50-minute transit ride and 80 times as many jobs in a 20-minute auto drive than a 20-minute transit ride.[82]

This explains why most low-income people don't take transit to work. Even most workers who live in households without cars don't rely on transit to get to work. In North Carolina, just 13% of workers whose households have zero automobiles take transit to work while three times that amount, 39% drive alone to work, probably in vehicles supplied by their employers. Even in the Charlotte urban area, only 22% of workers who lack automobiles take transit to work while 31% drive alone to work.[83]

Although 92% of American households have access to at least one car, data from the 2017 National Household Travel Survey indicate that about 7 million low-income households do not own an automobile. The survey found that about 10 million households lack automobiles, and this included about 3% of households in all income classes above $25,000 per year. Below $25,000 per year, however, about 26% of households didn't own an automobile. Based on the other income classes, it is likely that a few of these households wouldn't own a car even if they could afford to, but about 7 million probably would. While the travel survey numbers are not broken down by state, North Carolina's share of this 7 million is probably around 250,000.[84]

One of the major barriers to low-income people who need the mobility provided by an automobile is the cost of an auto loan. While people with high credit ratings can get low-interest or even zero-interest loans for buying a new car, banks will charge close to 20% interest to someone with a poor credit rating who wants to buy a used car.

To solve this problem, a number of nonprofit groups have started programs of offering low- or zero-interest loans to help low-income people buy or repair a car. These groups have universally found that auto

ownership was key to helping people find jobs with higher pay than earned by people without cars. "Ownership of a private automobile is a key element of success" in getting people better educations or jobs, one study found.[85] As of 2012, at least 50 nonprofit programs in 23 states were helping low-income people buy cars.[86]

As suggested previously, poverty reduction is outside the scope of NCDOT's mandate. But if the state of North Carolina is sincerely interested in promoting economic vitality, it should start a program offering low- or zero-interest loans to help low-income people buy automobiles. Such a program should probably be housed in the Department of Commerce, whose mission is to promote economic, community and workforce development.[87] Since most of the loans would be repaid by borrowers, this program would cost taxpayers little. Unlike the taxes used to support freight railroad sidings and executive jetports, what costs there would be would not be regressive because they would be targeted at low-income people.

CONCLUSION

The appropriate mission for the North Carolina Department of Transportation (NCDOT) should be to enhance mobility in a safe, cost-effective, and equitable manner. This will result in a multi-modal system that includes pedestrians, bicycles, cars, buses, trucks, and trains, but multi-modalism itself should not be a goal. This vision will also improve the economic vitality of the state, but economic vitality itself should not be a goal. Making multi-modalism or economic vitality goals leads to inequitable spending on projects that benefit higher-income people and corporations while they do little to solve real mobility problems.

This report has identified a number of problems with NCDOT's management of the state's transportation system, many of which stem from a misplaced emphasis on economic vitality, multi-modalism, and similar catch phrases.

Problems To Be Rectified

- NCDOT appears to have fallen behind in maintaining minor arterials and collectors that it owns
- City-owned roads are also deteriorating, partly because the state doesn't give the cities a share of the highway user fees that it collects that is proportionate to the amount of driving people do on city streets
- Some roads are far more dangerous than others, and it isn't clear from NCDOT's various plans that safety is enough of a priority for it to rectify this disparity
- NCDOT has spent too much on public transit, light rail, and intercity passenger trains given the small returns they produce
- NCDOT's projects that supposedly promote economic vitality are socially unjust because they use regressive taxes to support facilities that mainly benefit high-income people and corporations
- NCDOT plans make it appear that the agency is more interested in capturing as many tax dollars as possible than in providing a safe, efficient, and congestion-free transportation system

None of these problems have reached crisis proportions, but they indicate misplaced priorities and could get worse in the future. This is especially true if NCDOT expands intercity passenger trains, supports the expansion of Charlotte light rail, or joins in plans to build high-speed rail.

User Fees Are The Answer

Most of these problems would be corrected by following a simple basic principle: fund various transportation modes exclusively out of their user fees. User fees have numerous advantages over tax dollars when funding transportation.

- First, transportation users are the chief beneficiaries of the facilities they use, and it is only fair and appropriate that they should be the ones to pay for those facilities. While transportation may produce some side benefits, just about everything produces side benefits, including housing, food, and entertainment. If we accept that things should be subsidized because of their side benefits, then producers of every good and service will have incentives to fabricate and exaggerate the side benefits they provide in order to be eligible for those subsidies.

- Second, user fees provide valuable signals to both users and producers about costs and values. A toll that varies with the amount of traffic signals to users that it costs more to provide the infrastructure needed to meet peak-period demand than to provide only the infrastructure needed to meet average demand. People's willingness to pay user fees for transportation signals to providers which transport modes and routes they should focus on. Subsidies to transportation weaken these signals and make transportation providers more beholden to politicians than to users.

- Third, funding transportation strictly out of user fees gives transportation providers incentives to be efficient and disincentives to propose grandiose megaprojects that have little value. Agencies that can simpy turn to higher taxes to make up for their inefficiencies or worthless projects have little incentive to fix those problems.

- Fourth, infrastructure that is paid for out of user fees tends to be better maintained than infrastructure that is paid for out of tax dollars. The nation's fabled crumbling infrastructure wouldn't be crumbling if it were all funded out of user fees. As noted, bridges and roads funded out of user fees tend to be in better condition than bridges and roads funded out of tax dollars. This extends to other modes as well. Urban transit, which gets less than 25% of its funding from fares, has a $176 billion maintenance backlog.[88] Amtrak, which covers only about half its costs with fares, has at least a $52 billion maintenance backlog.[89] Moreover, its fleet of passenger

cars, which private railroads would normally have replaced about every 25 years, averaged nearly 33 years in 2019, meaning many are in desperate need of replacement.[90]

- Fifth, user fees are a more equitable and socially just way to pay for transportation. If subsidies are needed to help low-income people, they should be targeted to those people and not to general programs like light rail or intercity passenger trains which are mainly used by higher-income people. North Carolina and NCDOT should discard any proposals to use sales taxes, property taxes, or other general funds on highways and other transportation facilities.

The most important step North Carolina can take towards putting transportation on a user-fee basis would be to begin to phase in the use of mileage-based user fees as a replacement for fuel taxes and the highway user tax. Mileage-based fees are more equitable than fuel taxes and the highway user tax because they charge people for what they actually use, not for what they potentially use.

The state could start by inviting people to voluntarily join a mileage-based user fee system that exempts them from fuel taxes and the highway user tax on any vehicle they purchase that they put under the mileage-based fee system. The next step would be to encourage or mandate that electric cars and plug-in hybrids use the mileage-based system. Later, all new vehicles would be put under the system. Eventually, owners of older vehicles would be encouraged or possibly required to join the system, allowing North Carolina to stop charging taxes at fuel pumps.

The mileage-based fee system should be designed to preserve privacy and with guarantees to residents, perhaps written into the state's constitution, that such fees will only be used for highways, roads, and streets. Such a fee system will allow all of the different owners of roads and streets to piggyback onto it so they can fund their roads and streets out of user fees rather than general funds.

The mileage-based user fee system can also allow for variable fees in order to reduce congestion. Until the system is fully implemented, NCDOT

should introduce variable tolls to major urban freeways in the state. Such tolls would be designed to ensure that traffic flows never break down, thus allowing the roads to operate at their full capacities at all hours of the day. If such tolls produce more revenue than is needed to maintain and operate those roads, such revenues should be dedicated to improving and expanding the roads to meet the demand for travel.

Beyond this, NCDOT should place a higher emphasis on reducing the safety problems found on North Carolina's most dangerous roads. This would include adding sidewalks and parallel bike routes aimed at safely facilitating destination-oriented (as opposed to recreational) walking and cycling. North Carolina should also explore the possibility of various recreation user fees in order to fund recreation trails and bicycle paths.

The state of North Carolina should end subsidies to public transit, Amtrak, freight rail, and airports. These subsidies lead to inefficient management and perpetuation of obsolete forms of transportation. The freight railroads and their customers should be able to fund sidings on their own. Airports should be funded out of landing and storage fees. Using the highway trust fund to pay for Amtrak, freight sidings, and airports is inequitable and unjust.

While poverty reduction is not an appropriate goal for NCDOT, the state of North Carolina should consider offering low- or zero-interest loans to low-income people to buy a car, perhaps through the state Department of Commerce.

The North Carolina Department of Transportation is far from the worst state transportation agency in the nation. But it could be better and some of the current trends are going in the wrong direction. Focusing on user fees will help correct these problems and make transportation safer, more cost-effective, and equitable.

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About the Author

Randal O'Toole is a transportation and land-use policy analyst. As a senior fellow with the Cato Institute, he has written several books about transportation issues, including "Gridlock: Why We're Stuck in Traffic and What to Do About It" and "Romance of the Rails: Why the Passenger Trains We Love Are Not the Transportation We Need." Before working for the Cato Institute, his research on environmental issues led to fellowships or visiting professorships at Yale, the University of California, Berkeley, and Utah State University.

FOR MORE INFORMATION, CONTACT

Brian Balfour
Senior Vice President of Research
John Locke Foundation
bbalfour@lockehq.org
919-828-3876

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4800 Six Forks Rd., #220
Raleigh, NC 27609
919-828-3876
johnlocke.org

johnlockefoundation **@johnlockenc**

John Locke Foundation **johnlockefoundation1** **johnlockefoundation**

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