Transportation Priorities for North Carolina

A report prepared by The Hartgen Group and
the Reason Foundation for the John Locke Foundation

Policy Report

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Transportation Priorities for North Carolina

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Executive Summary

North Carolina has the nation's largest state-owned highway system (80,200 miles), 72 airports, 120+ transit systems, extensive intercity rail freight and passenger service, and several ocean ports. These resources are a key element in the state's economic vitality and are central to its economic progress. Recent legislative and gubernatorial changes provide an opportunity for charting new directions for transportation policy, planning and investment.

This report summarizes an effort by the John Locke Foundation to make recommendations for improving North Carolina's transportation system. The report reviews numerous prior studies, visions, plans, legislation, and the practices of other states to identify suggestions for transportation improvement. Additional suggestions come from stakeholder groups and to individuals familiar with North Carolina's transportation issues. In total, 157 separate suggestions are reviewed. These are analyzed by goal, time frame, mode, cost or savings potential, feasibility and regional equity.

Of the suggestions reviewed, 20 are recommended for immediate action, but *no new revenues are called for.* The recommendations are:

Table Ex 1: Recommendations

ID Number[1]	Brief Description	Primary Goal	Annual Saving (-) or Cost (+), $M
P-11	Constrain the STIP to needed and affordable projects	Budget constraints	-200
F-17	Develop a funding solution for I-95	Prioritizing projects	150
P-05	Build projects incrementally	Prioritizing projects	-100
MOS-05	Implement a fix-it-early policy for maintenance	Maintenance	-100
F-03	Expand Mobility Fund/fund major projects separately	Budget constraints	100
MOS-10	Improve rural safety	Safety	100
		Subtotal	***-50***
F-02	Select projects within region or district, not county	Prioritizing projects	-50
Com-06	Evaluate projects in the Logistics Report	Economic growth	50
MOS-06	Add 'maintenance needs' to some funding formulas	Maintenance	50
MOS-03	Increase performance-based contracting out of maintenance	Maintenance	-20
		Subtotal	***30***
HBC-01	Increase design-build flexibility	Org efficiency	-25
Com-05	Implement criteria for transportation investment in economic development	Economic growth	10
P-02	Increase the focus on economic benefits in project selection	Economic growth	5
P-01	Update the Long Range Transportation Plan	Long range plan	3
ENV-07	Improve communications with stakeholders	Org efficiency	2
ADM-02	Focus performance measures on service delivery	Org efficiency	2
P-08	Re-assess North Carolina's vision for transportation	Long range plan	1
MOS-07	Set maintenance performance goals	Maintenance	0.5
P-15	Consider North Carolina's changing demographics	Long range plan	0.2
ADM-13	Develop objective project delivery data	Org efficiency	0.2
		Subtotal	***-1.1***
		Total	***-21.1***

[1] Detailed descriptions are in the Appendix, organized alphabetically by function.

In the first category are six recommendations that concern *major changes to the transportation program* by increasing maintenance and concentrating expansions on statewide significance. A key step is to constrain the STIP[2] by merit-based project selection, then shifting some of the savings to maintenance, major projects and rural safety. If fully implemented these recommendations would save about $ 50 million annually, reducing expenditures in some areas and increasing them in others.

In the second category are four recommendations intended to *increase economic productivity and strengthen maintenance management and project selection,* through head-to-head project evaluation, adding maintenance needs to funding formulas, and contracting out light maintenance. If implemented fully these would increases costs by about $ 30 million annually but result in better system condition and improved economic productivity.

In the third category are 10 lower-cost recommendations intended to *strengthen long range planning* by refreshing the state's vision for transportation, preparing an updated Long Range Plan and improving communications. *Organizational efficiency* is also addressed through increased design-build flexibility and strengthened measures of performance and project delivery. If implemented fully these recommendations would save about 1.1 million annually.

In total the 20 recommendations would save about $ 21 million annually and would substantially realign and refocus the transportation program on needed and affordable activities.

In addition to these recommendations, an additional 15 suggestions are also highlighted for consideration. The report also provides expanded discussion of several current topics, including public-private partnerships, tolling, pricing and managed lanes, Interstate widening and contracting maintenance. Detailed tables and descriptions for all suggestions are provided. All suggestions are fully documented.

[2] The 'State Transportation Improvement Program' (STIP) is a federally-listing of all projects planned for the next 4-5 years.

Contents

I. Introduction

North Carolina has the nation's largest state-owned highway system (80,200 miles), 72 airports, 120+ transit systems, extensive intercity rail freight and passenger service, and several state-owned ocean ports. These resources are a key element in North Carolina's economic vitality and are central to its economic progress. While much has been accomplished in recent years to plan, maintain and improve the state's transportation system, there is still much to be accomplished. The election of Governor Patrick L. McCrory and his appointment of Secretary of Transportation Anthony Tata provide an opportunity for reviewing progress and charting new directions for transportation policy, planning and investment.

The McCrory Administration has set ambitious goals for the North Carolina transportation system, including:

- linking transportation investment to *economic growth*;
- preparing a comprehensive *long-range transportation plan;*
- implementing *merit-based selection of projects*;
- ensuring *maintenance* of the system for future generations;

while:

- improving cost-effective and *efficient government operation*;
- being sensitive to *budget constraints;*
- improving transportation *safety.*

To accomplish these goals North Carolina will have to identify practical options from among numerous suggestions and make tough choices within budget limits. This means understanding the complexity of the systems against the backdrop of the state's growth. Then, the options available and their likely impacts must be identified and analyzed. Finally, the most feasible and effective options must be identified and implemented.

This effort must be undertaken within the reality of present circumstances. First, *significant new money is unlikely* for transportation. State budgets are tight, the state's gasoline tax has recently been raised, the system is improving in condition[3] and federal funds are unlikely to increase. Second, *maintenance is paramount.* The state's vast investment in its transportation systems must be passed down to future generations in good shape. Failing this would be an abrogation of government's responsibility. Third*, priorities must be set.* North Carolina cannot afford all the transportation elements that every region wants. And there are several very large expenditures coming up, not the least of which is the rehabilitation of the state's Interstate system. The most important of these needs must be identified for the good of the state as a whole. Fourth, *we must plan for the future*. It has been almost 25 years since the prior vision was articulated. A new vision for North Carolinas transportation system should set the stage for future investment.

Recognizing these constraints and the urgency of this task, the John Locke Foundation has enlisted the help of the Reason Foundation, a California-based good-government think tank, and the Hartgen Group, a Charlotte-based transportation consultancy, to develop

[3] A recent Reason study found that North Carolina's highway system improved on four of seven key measures from 1989 to 2008. See Hartgen DT, Fields, MG, San Jose, E, *Are Highways Crumbling? State and U.S. Highway Performance Trends, 1989–2008,* Reason Foundation, Policy Study 407, February 2013, at: www.reason.org.

recommendations and suggestions for consideration by the Legislature and the new Administration. To ensure objectivity the Reason Foundation and the Hartgen Group have undertaken the assessment without input from the John Locke Foundation, and have retained final control over all study findings. Neither the Reason Foundation nor the Hartgen Group has any stake in the outcome of these recommendations, neither has contracts with agencies or interest groups in North Carolina, and neither owns land or has other interests that would be affected by the implementation of recommendations.

To ensure timely results early in the new Administration, the assessment focused largely on reviews of prior studies of North Carolina's transportation system, and current issues that need addressing.

- **Suggestions.** Materials from prior studies and recent assessments were gathered and consolidated. These include prior John Locke and Reason studies, legislative initiatives, NCDOT's documents, federal legislation, campaign platforms and suggestions from various stakeholder groups. This approach ultimately yielded 157 suggested actions covering a wide range of topics.

- **Analysis.** The suggestions were then organized by goal achievement, time frame, cost or savings, mode, DOT functions, major beneficiaries, legislative requirements, lead agency, administrative and political feasibility, and regional equity.

- **Recommendations.** Within each goal, **s**uggestions were then prioritized by time frame and cost/savings. Recommendations were then developed based on timing, cost, feasibility and criticality.

The following section summarizes our top recommendations, and also lists numerous other suggestions that have been offered. Details regarding each suggestion are provided in supporting tables. Comprehensive discussions of new approaches provide additional detail for public-private partnerships, tolling, pricing and managed lanes, Interstate widening and maintenance contracting. The Appendix also provides additional detail for each suggestion.

The recommendations are organized by goal rather than by function. This organization shows how the recommendations and suggestions relate to the stated goals of the new Administration. However, the Appendix provides a listing of suggestions by function, for ease in use by agencies.

II. Recommendations

Summary

The following table summarizes the top 20 recommendations, developed from the more detailed reviews by goal. All can be implemented within 1-2 years and are judged to be highly feasible. The recommendations are listed in order of savings (-) or cost (+).

The first six recommendations concern *major changes to the transportation program*, reducing the STIP and increasing funding for major projects, maintenance and rural safety. Three of these, if implemented fully, would save about $ 400 million annually. But some of these savings could be re-allocated to developing a solution for I-95, expanding the Mobility Fund, and improving safety, saving $ 50 million annually. The next four recommendations focus largely on *increased economic productivity and strengthened maintenance management and project selection.* They would cost about $ 30 million annually, in aggregate. Ten additional lower-cost recommendations focus on *strengthened planning and improved organizational efficiency.* If implemented fully they would save about $ 1.1 million annually.

Table 1: Summary of Recommendations

ID[4]	Brief Description	Primary Goal	Ann Saving (-) or Cost (+), $M
P-11	Constrain the STIP to needed and affordable projects	Budget constraints	-200
F-17	Develop a funding solution for I-95	Prioritizing projects	150
P-05	Build projects incrementally	Prioritizing projects	-100
MOS-05	Implement a fix-it-early policy for maintenance	Maintenance	-100
F-03	Expand Mobility Fund/fund major projects separately	Budget constraints	100
MOS-10	Improve rural safety	Safety	100
		Subtotal	***-50***
F-02	Select projects within region or district, not county	Prioritizing projects	-50
Com-06	Evaluate projects in the Logistics Report	Economic growth	50
MOS-06	Add 'maintenance needs' to some funding formulas	Maintenance	50
MOS-03	Increase performance-based contracting out of maintenance	Maintenance	-20
		Subtotal	***30***
HBC-01	Increase design-build flexibility	Org efficiency	-25
Com-05	Implement criteria for transportation investment in economic development	Economic growth	10
P-02	Increase the focus on economic benefits in project selection	Economic growth	5
P-01	Update the Long Range Transportation Plan	Long range plan	3
ENV-07	Improve communications with stakeholders	Org efficiency	2
ADM-02	Focus performance measures on service delivery	Org efficiency	2
P-08	Re-assess North Carolina's vision for transportation	Long range plan	1
MOS-07	Set maintenance performance goals	Maintenance	0.5
P-15	Consider North Carolina's changing demographics	Long range plan	0.2
ADM-13	Develop objective project delivery data	Org efficiency	0.2
		Subtotal	***-1.1***
		Total	***-21.1***

[4] Detailed descriptions are in the Appendix, organized alphabetically by function.

Overall, the 20 recommendations would save about $ 21 million annually, saving dollars in some areas (such as project prioritizing) but increasing them elsewhere (maintenance, major projects and economic growth).

The next several sections of the report discuss recommendations for each of the seven goals. Recommendations are shown in light green and highlighted suggestions in yellow. Within each section, tables show all suggestions in order by time frame and savings (-) or cost (+).

It should be noted that some suggestions complement or conflict with others. This is to be expected when many different ideas from are received from various stakeholders. The effort needed to 'sort out' or 'balance' these overlaps is beyond the scope of this study. Therefore, for the sake of inclusiveness we report all suggestions without this additional analysis. Decisions regarding specific suggestions should consider these interactions.

Economic Growth

The primary purpose of a state's transportation system is to provide cost-effective *access* so that society can pursue economic, social and other activities. North Carolina's transportation system ties its urban and rural areas together, moves commerce, and boosts tourism and travel. An improved economy and strengthened economic growth are often cited as important goals of transportation investment. Given North Carolina's economic situation – relatively high unemployment, lagging job growth, and constrained government budgets – the potential for a specific transportation proposal to improve economic activity cannot be taken as a given, but must be carefully evaluated against costs and other impacts. In this way transportation system investments will best leverage the state's future economic growth.

Of the 157 suggestions reviewed, 22 deal directly or primarily with economic growth. Of these, three are recommended for immediate implementation. These are:

#1: Increase the focus on *economic benefits* in project selection (P-02).

Economic benefits from transportation improvements are of three types: *user benefits* (primarily travel time savings, reduced operating costs, reduced accidents, and improved reliability[5]); improved *economic productivity* from better access to goods and services; and (occasionally*) increased employment* in directly affected industries. A recent national study[6] of eight cities including Charlotte found that significantly reduced congestion would improve regional productivity by 4-to-10 percent. Construction-related employment is *not* a benefit but a cost, since it is funded from taxes. Recently, North Carolina has begun to quantify user benefits and some economic impacts, among other criteria, to evaluate projects. The McCrory Administration has called for more focus on economic benefits, which now account for just 10 percent of project rating. More exact measures of all three types of economic benefits are needed, but to ensure consistency, *estimates of job impacts should be based on nationally-available methods*, not on locally-based assertions. The program should also be tracked over time to ensure accuracy and accountability.

[5] Reliability has recently been added to the three traditional user benefits (travel time saving, accident reduction, and operating costs).

[6] Hartgen DT and Fields MG, *Gridlock and growth: accessibility, traffic congestion and regional economic performance,* a Report for the Reason Foundation, October 2010.

This recommendation would be modest in its cost, estimated at about $ 5 million annually, primarily for better and objective estimation of economic impacts. It probably does not require legislative action, has high overall feasibility, and can be implemented quickly. If implemented, this action would have the effect of substantially increasing funding for those transportation projects that improve economic activity. Over time it would substantially increase economic activity and the state's economic competitiveness.

#2: Implement criteria for transportation investment in 'economic development' (Com-05).

In order to know how transportation investments impact economic development, there must be clear criteria that measure the impact. Presently, the criteria are 'jobs created' versus project cost. But transportation access is only one of many factors affecting economic development. And since transportation projects serve both 'new' jobs and some existing jobs, estimates of impact should include impacts on users and productivity as well as 'new jobs'. This means that more complex impact estimation methods will be needed for most major projects. Projects should be evaluated head-to-head statewide, not within Division, and the system should be transparent and data-driven. Measures for reliability, productivity, and job creation as well as job 'diversion' from other sites should be strengthened.

This recommendation would be more costly, about $ 10 million annually for both defining criteria and gathering data for major projects and it probably requires legislative action if included in incentive grants. However its overall feasibility is judged as high. It could substantially increase the ratings for those projects that have significant impact on economic growth. However, the recommendation would also lead to rejection of some projects, with possible negative impacts on some communities.

#3: Evaluate projects in the Logistics Report (Com-06).

The Report of the Logistics Task Force, completed in 2012, identifies numerous issues and opportunities for expanding logistics in North Carolina, but does not discuss the potential demand for various actions, nor benefits versus the cost of their development or operation. To evaluate and implement the proposals, there needs to be more information on demand for services, location of markets, the cost of production, competition from other states and nations, pricing for goods, what NC makes and where is it needed. These factors are generally more important than road or air/rail/water capacity in determining freight needs. The greatest emphasis should be placed on evaluating the benefits and costs of major projects such as bottleneck removal, seaport expansion, the 7 portals, and the Global TransPark. The Logistics Report should be re-visited and expanded, and its proposals subjected to merit-based evaluation.

This recommendation would be more costly to implement, possibly up to $ 50 million annually if it results in major projects. However a preliminary evaluation for the current list of projects in the Logistics Report could be completed in about a year by DOT and the Department of Commerce (DOCM) jointly. Implementation might require legislation, and overall feasibility is judged to be moderate.

The table below, Recommendations for Economic Growth, summarizes these top three recommendations. If implemented, they would cost about $ 65 million annually. But together they would have a substantial impact over time on the state's economic growth.

Additional suggestions

The table also summarizes 19 additional suggestions that could be implemented over a longer time frame. These would cost about $ 243.5 million annually. Several are noted as likely to have substantial longer-term economic impact:

- **Removing highway bottlenecks (Com-11)** would take considerably longer, perhaps more than 3-4 years, and might cost upwards of $ 150 million annually, but could substantially ease traffic flow for both commuters and freight. Often this work can be done within operational right-of-way, which may speed environmental review. However, if implemented this recommendation might also divert funds from other projects. Part III provides additional information on several 4-lane Interstate road sections that may need widening to reduce bottlenecks, and other bottlenecks should also be identified and evaluated. .
- **Coordinating logistics improvements with other states (Com-07)** is more complicated and would involve multi-state planning, and possibly investment and legislative action. This is particularly important as North Carolina plans for the impacts of the Panama Canal widening. At about $ 25 million annually, it could benefit North Carolina's economy through improved logistics improvements in nearby states.

Table 2: Recommendations for Economic Growth.

ID (a)	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries (b)	Admin Feasibility	Political Feasibility	Regional Equity (c)	Overall Feasibility
P-02	Increase focus on economic benefits in project selection	1	5	Highway-bridges	Prioritizing	DOT	No	Job-generating projects	High	High	Moderate	High
Com-05	Implement criteria for 'economic development'	1	10	Highway, Rail, Air	Prioritizing	DOT and DOCM	Yes	All regions	High	Moderate	Moderate	High
Com-06	Evaluate projects in the Logistics Report	1	50	All	Prioritizing	DOT and DOCM	Possibly	All regions	High	Moderate	Moderate	Moderate
Com-04	Re-evaluate the need for Global TransPark	2-3	-10	Highway, Rail, Air	Prioritizing	DOT and DOCM	Yes	Eastern NC	High	Moderate	Low	Moderate
PTRAN-12	Quantify the economic benefits of transit	2-3	0.3	Transit	Planning	DOT	Probably	All regions	Moderate	High	High	High
AV-05	Develop criteria for passenger airport organization	2-3	0.5	Aviation	Administration	DOT, DOCM, Legislature	Yes	Major regions	Moderate	Moderate	Low	Low
AV-01	Re-evaluate FAA Block Grant participation	2-3	0.5	Aviation	Administration	DOT and DOCM	Possibly	All regions	Moderate	Moderate	High	Moderate
Com-13	Pre-assess accessibility for industrial sites	2-3	5	Highway	Planning	DOCM and DOT	No	All regions	High	Moderate	High	High
PF-03	Clarify maritime improvements and needs	2-3	15	Ports	Prioritizing	DOT, DOCM, Legislature	Yes	Coastal regions	Moderate	Moderate	Low	Low
Com-02	Expand 'just in case' distribution	2-3	25	Highway-bridge	Prioritizing	DOT and DOCM	Yes	All regions	High	Moderate	Moderate	Moderate
Com-03	Plan for the Panama Canal widening	2-4	0.5	Highway and Rail	Prioritizing	DOT and DOCM	Yes	Truck, rail corridors	High	Moderate	Low	Moderate
RR-06	Reduce or eliminate state role in railroads	3-4	-50	Rail freight	Planning	DOT, DOCM and railroads	Yes	Shippers and receivers	Low	Low	Moderate	Low
TECH-03	Cautiously track electric vehicle technology	3-4	0.1	DMV/ Legislature	Planning	DOT/DMV	Possibly	All regions	Moderate	Low	Moderate	Low
AV-04	Evaluate international service for GA airports	3-4	0.2	Aviation	Administration	DOT and DOCM	Possibly	All regions	Moderate	Moderate	High	Moderate

ID (a)	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries (b)	Admin Feasibility	Political Feasibility	Regional Equity (c)	Overall Feasibility
Com-08	Facilitate circumstances for 'information technology' sites	3-4	0.4	All	Administration	DOT and DOCM	Possibly	All regions	High	Moderate	Moderate	Moderate
Com-01	Review Foreign Trade Zone adequacy	3-4	0.5	Trucking-Ports	Planning	Legislature	Yes	Local manufacturers	Moderate	High	Low	Moderate
Com-10	Evaluate longer-combination vehicles in NC/connect to eastern turnpikes	3-4	0.5	Highway	Planning	DOT and DOCM	Yes	Interstate corridors	Moderate	Moderate	Low	Low
Com-07	Coordinate logistics improvements with other states	3-4	25	Trucking, rail, water, air	Administration	DOT and DOCM	Possibly	All regions	High	Moderate	Moderate	Moderate
RR-05	Expand freight railroad use	3-4	25	Rail freight	Planning	DOT, DOCM and railroads	Possibly	Railroad corridors	Low	Moderate	Moderate	Low
Com-09	Ensure/improve highway connectivity	3-4	50	Highway	Planning	DOT and DOCM	Yes	All regions	Moderate	Moderate	Low	Moderate
Com-11	Remove highway bottlenecks	3-4	150	Highway	Planning	DOT	No	Interstate corridors	High	High	Moderate	Moderate
PF-04	Develop 'niche' port services and markets	4-8	5	Ports	Planning	DOT and DOCM	Possibly	Coastal regions	Moderate	Moderate	Low	Low

a - Assigned by subject area. See Appendix for a complete alphabetic list.

b - Major groups that would benefit from the suggestion.

c - The extent to which the suggestion would equally impact all regions of the state.

Long Range Planning

Effective planning means answering three basic questions: *Where are we now? Where do we want to go? How do we get there?* North Carolina's long-range planning efforts have historically focused on only the last question, but leave unanswered a clear understanding of current conditions and most importantly, a clear articulated vision of what the future transportation system should look like. As a result, the state has a 'Plan' in search of a vision.

The McCrory Administration has called for a "*descriptive 25-year transportation and infrastructure plan…of the state's future investment in roads, railroads, bridges, ports, airports and other infrastructure…The 25-year plan will be a specific action plan to allocate money based on project worthiness and will require relative performance metrics to measure improvement over time*." [7] These steps are needed, but pre-suppose both a vision for what the plan is intended to do, and an existing assessment of the status of the system.

Of the 157 suggestions reviewed in this study, 32 directly or primarily concerned long range planning issues. Of these, we recommend three that we believe to be of highest priority:

#1: Re-assess North Carolina's vision for transportation (P-08).

Unlike the Long Range Plan, the *vision* for North Carolina's transportation system sets out what the transportation system should do for the state, and what the system should look like in the future. The vision guides and directs the Long Range Plan, which should be the roadmap for achieving the vision.

The last major vision for North Carolina's transportation system was developed in the 1980s. It posed a 3600-mile *4-lane intrastate highway system* knitting North Carolina together, *seven urban loops* around its largest cities, and *paving dirt roads* with traffic volumes over 100 vehicles per day. The state was supposed to complete that vision in ten years. A quarter-century later, only one of the three goals (paving unpaved roads) is approaching fulfillment. It is unlikely that all of the intrastate system will ever be finished, since the completion rate for those projects has fallen to one or two miles a year and repairs may soon be needed. Progress on urban loops has also slowed as more projects are added to the program. In the meantime North Carolina has changed, and numerous issues and modes have been added to the agenda. North Carolina now needs to update its vision for the transportation system, basing its updates on the US Census. This recommendation is central to the development of a cohesive Long Range Transportation Plan.

This recommendation could be accomplished at modest cost, about $ 1 million, over the next year, perhaps jointly with the initial stages of Plan development. It does not require legislative action, affects all regions, and is judged to be highly feasible. If implemented, the recommendation would set the stage for preparing a Long Range Plan that then implements the vision. Perhaps the state's universities could assist in organizing this effort.

#2: Consider NC's changing demographics (P-15).

North Carolina's transportation needs are changing. The population is aging, becoming more diverse and more urban. Some evidence suggests that the state's youth favors a less automobile-dependent lifestyle, the decennial Census and Annual Housing Surveys show increasing work-at-home but less transit and carpool commuting, and higher in-commuting from ring counties to central cities. In some counties, cross-*state* commuting is common.

[7] McCrory, P, "Principles for Fixing North Carolina's Broken Economy, Transportation and Infrastructure," at: http://www.patmccrory.com/issue/infrastructure/ (accessed March 19, 2013).

Congestion increases seem to be flattening and average commute travel times seem stable. Driver licensing peaked at 72 percent in 2005 and has now declined to about 61 percent. These trends suggest that a nuanced regional and multi-state view of travel patterns should be adopted as the basis for long range planning, rather than 'one-size-fits-all' analyses of past plans. The revised Long Range Transportation Plan should better meet the state's changing demographics and changing mobility patterns, and provide access to various transportation modes where cost-effective.

This recommendation would be low-cost to implement (estimated at $ 0.2 million annually) since it essentially calls for more detailed use of Census and other data already available. Because this recommendation is generally non-controversial and does not need legislative action, it is judged to be highly feasible. If implemented, this recommendation would provide the regional variation in demographics and travel behavior that is now missing form the state's Long-Range Plan.

#3: Update the State's Long Range Transportation Plan (P-01).

NCDOT's 2040 Plan (and the studies that preceded it) should be reviewed and updated, building on the vision and demographic variations. The revised Plan should also include a prudent assessment of fiscal capabilities and should prioritize what is most important. The current Plan assumes that all 'needs' are equally important, essentially 'adding up' the plans of the state's urban regions and other areas. Yet there are maintenance and capacity improvements that outpace the likely available resources. This problem will only get worse over time. The revised Plan should balance needs with available resources.

This recommendation is estimated to cost about $ 3 million annually, but some of this cost is already being expended by planning-related functions within DOT. The development of a revised Long Range Plan, built on a sound and compelling vision, a clear understanding of the various travel patterns and demographics, and on prioritized needs, would go a long way toward setting the stage for cost-effective transportation investments.

Table 3 below, Recommendations for Long Range Planning, summarizes these three recommendations. If implemented, they would cost about $ 4.2 million annually, but would significantly clarify the state's long range transportation planning objectives.

Additional suggestions

Table 3 also summarizes 29 additional suggestions that could be implemented over the next 2-8 years. If fully implemented these might cost about $ 145.8 million annually. All of these suggestions, many from solicited comments, are thoughtful and worthy of consideration. Several are likely to have substantial longer-term impact:

- **Resolve the 'Monroe Bypass' traffic forecasting issue (P-19).** This issue, a technical question involving land use forecasts for 'no-build' alternatives, if not resolved, could delay numerous major road projects in the state. Its resolution might cost $ 5 million annually for several years, but could pay back many times that in the progress of projects.
- **Select clear road performance measures (HBC-04).** The development and use of clear and easy-to-understand measures of road performance (road and bridge condition, traffic, congestion, travel time, safety), usable at the Division and county level, would substantially improve the state's understanding of the differential status of the road system across the state. It would also help communications with stakeholders.

Table 3: Recommendations for Long Range Planning.

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
P-08	Re-assess North Carolina's vision for transportation	1	1	All	Planning	DOT	No	All regions	Moderate	High	High	High
P-15	Consider NC's changing demographics	1-2	0.2	All	Planning	DOT	No	All regions	High	Moderate	High	High
HBC-04	Set clear measures of road performance	1-2	0.2	Highway	Pavements	DOT	No	All regions	High	Moderate	High	High
P-18	Conduct strategic research initiative	1-2	0.2	All	Planning	DOT	No	All regions	High	Moderate	High	High
P-01	Update the Long Range Transportation Plan	1-2	3	Planning	Planning	DOT	No	All regions	High	High	Moderate	High
P-19	Resolve the "Monroe Bypass" traffic forecasting issue	1-2	5	Highway	Planning and EIS/ Environment	DOT	No	All regions	High	High	Moderate	High
PTRAN-13	Consider the needs of transit dependent citizens	1-2	15	Transit	Planning	DOT and Legislature	Possibly	All regions	Moderate	Moderate	High	Moderate
HBC-06	Compare peer state road performance data	2	0.2	Highway	Pavements	DOT	No	All regions	High	Moderate	High	High
HBC-05	Develop additional measures of road system performance	2	1	Highway	Pavements	DOT	No	All regions	High	Moderate	High	High
PBK-01	Clarify state role in pedestrian-bike facilities or lanes.	2-3	0.2	Ped-Bike	EIS/Environment	DOT and Legislature	Possibly	All regions	High	Moderate	High	High
PBK-02	Clarify use of state funds for bike trails	2-3	0.2	Ped-Bike	EIS/Environment	DOT and Legislature	Possibly	All regions	High	Moderate	High	High
PBK-03	Establish criteria for 'road diets'	2-3	0.2	Ped-Bike	EIS/Environment	DOT	No	All regions	High	Moderate	High	High
PTRAN-15	Evaluate long-distance intercity bus service	2-3	0.3	Intercity bus	Planning	DOT	No	All regions	Moderate	Moderate	High	Moderate
P-17	Repeal STIP, Vision Map and Equity Formula	2-3	1	Highway-bridge	Planning	Legislature and DOT	Yes	All regions	Moderate	Low	Low	Low

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
P-04	Minimize design variations from community preferences.	2-3	2	All	Planning and Design	MPOs and DOT	No	MPO regions	Moderate	Moderate	High	Moderate
HBC-12	Conduct research on the rates and causes of deterioration	2-3	2	Pavements	Planning and prioritizing	DOT	No	All regions	High	High	High	High
HBC-13	Implement a comprehensive asset management system	2-3	3	All assets	Planning and prioritizing	DOT	No	All regions	High	High	High	High
PTRAN-05	Conduct periodic surveys of transit riders	2-3	5	Transit	Planning	DOT	No	All regions	High	Low	High	Moderate
AV-08	Include aviation in long range planning	2-3	10	Aviation	Planning	DOT	Possibly	All regions	High	Moderate	High	High
RES-02	Determine trends in access	2-4	0.3	All	Planning	DOT	No	All regions	High	High	High	High
P-12	Initiate a multi-state planning effort	2-4	2	All	Planning	DOT	No	All regions	Moderate	Low	High	Moderate
F-15	Increase Powell Bill funding	2-4	15	Highway-bridge	Funding	DOT and Legislature	Yes	Municipalities	High	Low	High	Moderate
ENV-04	Reduce CO2 emissions with cost-effective measures	3-4	-10	Highway	Planning	DOT, DENR*, and MPOs	Possibly	All regions	Moderate	High	Moderate	Moderate
PTRAN-16	Statewide transit trip planner	3-4	1	Transit, rail, intercity bus	Planning	DOT	No	Large urban areas	Moderate	Moderate	High	Moderate
Com-12	Detailed surveys of freight flows	3-4	2	Truck, air, rail, water	Planning	DOT	No	Localities	Moderate	Low	High	Moderate
P-09	Review MPO/RPO structure/Coordinate reg'l plans/Uniform plan formats	3-4	5	All	Planning and MPO relations	DOT	No	Urbanized areas	High	Low	Moderate	Moderate
PTRAN-06	Require independent transit ridership forecasts	3-4	5	Transit	Planning	DOT	No	Large urban areas	Moderate	Low	Moderate	Low
PTRAN-14	Implement bus commuter routes	3-4	10	Transit	Planning	DOT	No	Large urban areas	High	Moderate	Moderate	Moderate

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
	before commuter rail											
RR-02	Require that governments obtain railroad cooperation *before* proposing track use	3-4	10	Rail passenger	Planning	DOT, Railroads, govts	Possibly	Raleigh, Durham, Charlotte	Moderate	Low	Low	Low
P-21	Improve intra- and inter-urban access	3-4	50	All	Planning	DOT and MPOs	Possibly	All regions	High	Moderate	Low	Moderate
ENV-05	Reduce stormwater impacts of sprawl	4-8	5	Highway-bridge	Planning	DOT and MPOs	No	Urban areas	Moderate	High	Moderate	Moderate
P-03	Coordinate long range plans and STIPs	4-8	5	All	Planning	MPOs and DOT	No	MPO regions	Moderate	Moderate	High	Moderate

*DENR: Department of Environment and Natural Resources

Prioritizing Projects

A key goal of the new Administration is that "*new projects must be dictated by worthiness*," with criteria for new project selection weighing "*each project's potential for congestion relief, safety improvements, environmental impact and economic development opportunities*."[8] Prioritizing projects is a key way to get the most out of limited revenues, but it is essential that 'worthiness' be assessed objectively.

Along with other measures, project benefit-cost ratios are an important tool for such an assessment. NCDOT has recently calculated benefit-cost ratios for non-maintenance highway projects in the 10-year Program and Resource Plan. Table 4 summarizes data from the state's 'major projects list'[9]. Almost 29 percent of the cost is estimated to be for projects with a benefit-cost ratio of less than 1.0, and another 12 percent for projects with benefit-cost ratios between 1.0 and 1.5. This does not mean that these projects should not be constructed or that they have no benefits, just that the costs appear to be higher than, or close to, the estimated benefits. The table suggests that not all projects are equally worthy and that judicious selection of projects with higher benefit-cost ratios could both save money and increase value. Eliminating all highway projects with benefit-cost ratios below 1.0 would save over $11 billion (over 10 years) or 29 percent of total project costs, but even setting a limit (e.g. 15 percent) on the percent of project costs under a B/C of 1.0) would save considerable funds. In the discussion of maintenance, below, we suggest that some of these savings might be reinvested in increased maintenance.

Table 4: Summary of Major Highway Projects by Benefit-Cost Ratio[10]

Benefit-Cost Ratio	Project Count	Project Cost $B	Percent of Total
0.0 - 1.0	273	11.2	28.7
1.0 - 1.5	92	4.9	12.4
1.5 - 2.0	67	4.4	11.3
2.0 - 3.0	95	4.3	11.0
3.0 - 5.0	117	5.8	14.8
> 5.0	253	8.5	21.8
Totals	**897**	**39.1**	**100.00**

Of the 157 suggestions reviewed 19 deal directly or primarily with prioritizing projects. Of these, three are recommended for immediate implementation:

#1: Build projects incrementally (P-05).

It is often possible to complete road projects incrementally, in stages over time or distance, thus significantly increasing benefit-cost. For instance, a commercial section that may ultimately need widening to four lanes (in 20+ years) might initially be widened to a 3-lane commercial section, or a 15-mile stretch of 2-lane rural road targeted for widening to four lanes might initially be widened to four lanes for that portion of the route with higher traffic

[8] McCrory, P, "Principles for Fixing North Carolina's Broken Economy, Transportation and Infrastructure," at: http://www.patmccrory.com/issue/infrastructure/ (accessed March 19, 2013).
[9] NCDOT, SPOT program, Prioritization 2.0, January 31, 2012, at: https://connect.ncdot.gov/projects/planning/Pages/StrategicPrioritization.aspx.
[10] NCDOT Strategic Prioritization Process, at: https://connect.ncdot.gov/projects/planning/Pages/StrategicPrioritization.aspx.

volumes. Although inflation, right-of-way costs, and administrative efficiency must be considered, economic principles (e.g. widen a road section when the amortized travel time saving from expanding the highway is larger than the amortized capital cost of the expansion plus maintenance) should generally be applied to determine when and where to schedule widening projects. Part III discusses widening Interstates in more detail and suggests some locations where it might be considered.

This recommendation could initially be completed in about a year, but might take longer. Ultimate savings of about $100 million annually could be achieved by deferring expenditures until when (or if) they are needed. No legislation appears to be needed. Although regional equity is high, feasibility is judged to be moderate. Some projects may be extended in time, which might likely cause concerns from localities that later stages might lag.

#2: Select projects by Distribution Region or Division rather than County (F-02).

Historically NCDOT has applied the STIP formula to counties even though the legislation allocates funds only to Distribution Regions. This method often means that allocated funds are in such small amounts that some counties do not get adequate funding for major projects that pass through them. If projects were prioritized within Division or Distribution Region, larger projects could probably be funded. However, smaller projects within counties might be delayed or deleted. NCDOT has already taken steps in this direction, by reducing Board responsibility for project selection and by beginning the SPOT program. But project selection by Division or Region should be formalized by directive.

This recommendation could be fully implemented within a year. Administrative feasibility is high but local concerns might impede implementation. Smaller counties with major project needs would be the main beneficiaries, but other counties might be concerned about losing some projects. Annual savings in the $50 million range could be gained through improved efficiencies and better system management.

#3: Develop a funding solution for I-95 (F-17).

I-95 is a 40-50 year-old highway with current traffic volumes between 40,000-50,000 AADT. Although traffic volumes are generally below 6-lane levels, I-95 is nearing its projected lifespan and will need to be re-built and possibly widened where future volumes warrant. The cost for a full widening has been estimated at over $4 billion, far above the state's ability to fund or finance. Yet a solution for repairs must be found. Costs may be reduced or 'stretched out' through incremental or partial widening. Revenues other than direct funding or financing may be pursued. Tolling has been suggested, but Virginia and South Carolina are opposed. Tolling is also vehemently opposed locally, and legislative bills have been introduced to prohibit tolling without legislative approval. Yet tolling may be part of the answer, as may be partial state funds, PPP arrangements, and other approaches. A large study of the economic impacts of tolling is now underway. Part III discusses various approaches to tolling, pricing, privatization and widening, and notes the importance of developing a solution to rehabilitate I-95 soon and other Interstates later.

This issue is vitally important to the state's economy and the coastal plain in particular, and should be resolved within the next two years but the sooner the better. Legislation will probably be needed, and annual costs will be in the $150 million range as the various stakeholders study and debate various approaches. There may also be some resistance from other regions because of the project's magnitude. But I-95 is too important a thoroughfare to

remain unaddressed, particularly with the expanded Panama Canal and expected increases in east-coast trucking traffic.

The table below, Recommendations for Prioritizing Projects, summarizes these three recommendations. If implemented together they would be revenue-neutral: two would save about $150 million annually, while one would cost about the same. However all three projects are important steps toward stewardship.

Additional suggestions

The table also summarizes 16 additional suggestions that could be implemented over a slightly longer time frame and cost about $ 385 million annually. All are sound managerially, and several merit consideration for early implementation:

- **Increasing project solutions within current right-of-way (ENV-02).** New federal legislation (MAP-21) significantly reduces environmental analysis for projects within operational right-of-way. If fully implemented, this recommendation would save about $100 million annually through reduced project costs and reduced time spent in environmental assessment. Projects could be fast-forwarded so that their benefits could be realized more quickly. Feasibility is high and no legislation would be required.
- **Adding measures of need to other road funding formulas (F-12)** would tie funding directly to need, by allocating various road funds partially on the basis of measures of condition or need. The potential savings are in the range of $50 million annually, largely through limiting funding to needed projects only.
- **Establishing criteria for funding light rail, bus-rapid-transit, and commuter rail services (PTRAN-02)** is a necessary first step in balancing the competing needs of the major metropolitan areas in the state, as well as objectively assessing transit proposals against national competition. As with highway projects, transit projects should also meet objective benefit-cost criteria. Standardized criteria would not require legislation and could be developed by the DOT relatively quickly.

Table 5: Recommendations for Prioritizing Projects.

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
P-05	Build projects incrementally	1	-100	Highway-bridge	Prioritizing	DOT	No	All regions	Moderate	Moderate	High	Moderate
F-02	Select projects within Distribution region or Division rather than by county	1	-50	Highway-bridge	Prioritizing	DOT Sec	Probably Not needed	Major projects in smaller counties	High	Moderate	Moderate	Moderate
P-06	Select projects based on merits	1-2	-100	All	Prioritizing	DOT and Legislature	Possibly	All regions	High	Moderate	Moderate	Moderate
ENV-02	Increase use of project solutions within current right-of-way	1-2	-100	Highway-Bridge	EIS/Environment	DOT and DENR	No	Mid-sized projects	High	High	High	High
P-16	Scale projects to match identified transportation need	1-2	-50	All	Planning and design	DOT	No	All regions	High	Moderate	High	High
F-12	Add measures of need to other road funding formulas	1-2	-50	Highway-bridge	Prioritizing	DOT and Legislature	Yes	All regions	High	Low	High	Moderate
HBC-09	Implement rules for when to do projects	1-2	-25	Highway	Pavements	DOT	No	All regions	High	Moderate	High	Moderate
F-17	Develop a funding solution for I-95	1-2	150	Highway-bridge	Funding	DOT and Legislature	Yes	I-95 Corridor	High	Moderate	Low	Moderate
P-07	Improve the SPOT project selection process	2	-100	All	Prioritizing	DOT	No	All regions	High	Moderate	High	High
AV-03	Implement merit-based project evaluation	2	-5	Aviation	Prioritizing	DOT and DOCM	Possibly	All regions	High	Moderate	High	High
F-01	Add congestion and other measures of need to the STIP Formula	2	150	Highway-bridge	Prioritizing	Legislature	Yes	Urbanized areas receive larger shares	High	Low	Low	Low
ADM-11	Set co-district targets for road condition	2-3	-20	Highway-bridge	Pavements and Bridges	DOT and Legislature	Possibly	All regions	High	Moderate	Low	Moderate
PTRAN-09	Review transit capital expansions	2-3	-10	Transit	Prioritizing	DOT and Legislature	Probably	All regions	High	Moderate	High	High

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
PTRAN-02	Establish criteria for funding LRT, BRT and CR services	2-3	-5	Transit	Planning and funding	DOT	No	Large urban areas	High	Moderate	Moderate	Moderate
P-14	Increase priority for widening 4-lane freeways with traffic >40-50K	2-4	100	Highway-bridges	Funding and Prioritizing	DOT	Possibly	4-lane freeway corridors	Moderate	Moderate	Moderate	Moderate
AV-06	Balance GA airport improvements with demand	3-4	-5	Aviation	Prioritizing	DOT	Possibly	All regions	High	Moderate	Moderate	Moderate
F-13	Close the loop' between condition and spending	3-4	5	Highway-bridge	Prioritizing	DOT	Possibly	All regions	Low	Moderate	Moderate	Low
ENV-10	Incremental I-85 widening by lane management within ROW	3-4	500	Highway-bridge	Planning and Design	DOT	Possibly	Gaston Co Commuters	Moderate	Moderate	Low	Moderate
ADM-10	Ensure equal road quality everywhere	4-8	100	Highway-bridge	Pavements and Bridges	DOT and Legislature	Possibly	All regions	Moderate	Moderate	Low	Low

Maintenance

Noting that "*the longer maintenance costs are deferred, the greater the eventual repair costs will be,"*[11] maintaining existing facilities is a top priority of the McCrory Administration. A well-maintained system provides benefits to people and businesses that go far beyond maintenance costs. Benefits include less wear and tear on vehicles, faster and more reliable travel times, better fuel efficiency and ease of access.

In January 2009, NCDOT adopted a Policy to Projects Process, which begins with the 30-year Statewide Long-Range Plan (the 2040 Plan), followed by the 10-year Program and Resource Plan, and ending with the 5-year Work Program. The 10-year plan shows proposed funding allocations for all transport modes for the years 2013-2023. Of the $48 billion in 10-year projected spending, 60 percent is allocated to construction and engineering, 30 percent to maintenance, and 10 percent to operations and administration.[12] The maintenance share of this, $14 billion or $1.4 billion annually, is for all modes, but most of the fund goes to bridges and highways. For example, in FY 2012-2013, the state allocated about $953 million toward highway maintenance and $235 million toward bridge preservation, or $1.18 billion (23 percent) of the total $5.2 billion budget.[13] Estimations of highway-bridge maintenance allocations over the next ten years are about $14.0 billion.

These annual maintenance budgets may not be sufficient. The 2012 Report on the Condition of the State Highway System[14] forecasts an annual shortfall of about $80 million for SFY 2013-14 through SFY 2022-23, even if projected funding materializes. Clearly additional monies for maintenance, or maintenance efficiencies, are needed.

Table 6: Projected Maintenance Costs and Funding Need (in millions)

Maintenance Program Needs	**2013-14 thru 2022-23**
Highway Routine Maintenance	$7,150.1
Bridge Maintenance	$992.3
Highway Operations	$743.9
Disasters & Emergencies	$150.0
Contract Resurfacing	$4,971.6
Pavement and Bridge Preservation	$2,276.4
Total Maintenance/Preservation Needs	**$16,284.4**
Supplemental Funds	$1,520.0
Estimated Highway Allocations	$13,966.8
Total Projected Budget Shortfall	**$797.7**
System Rehabilitation	$3,733.8

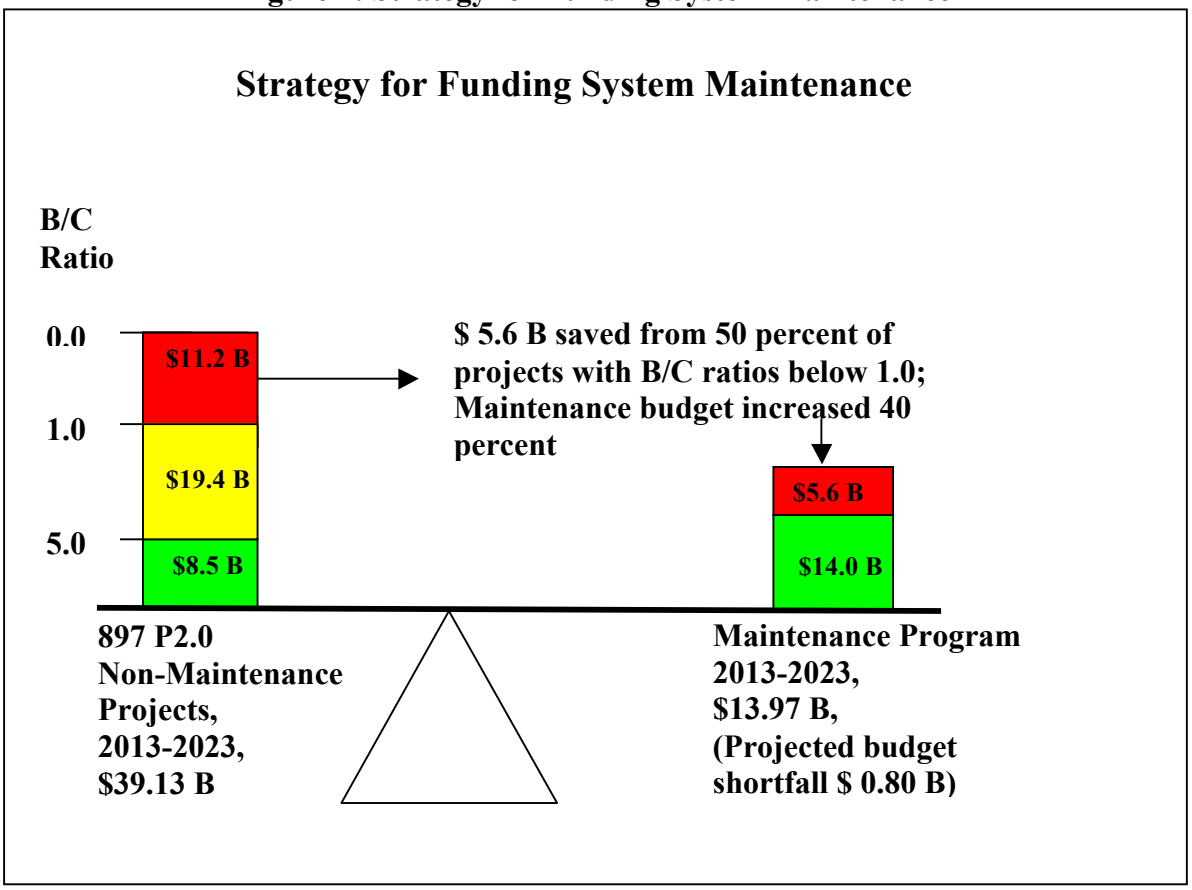
Source: NCDOT, 2012 Report on the Condition of the State Highway System, Appendix 4

One source of additional funds could be money redirected from less cost-effective capital projects. The following figure, drawing from Tables 4 and 6 (above), indicates that about $ 11.2 billion of the $ 39.1 billion in 10-year major capital needs is for projects with a benefit-cost ratio of less than 1.0. If just 50 percent of those funds were shifted to maintenance,

[11] McCrory, P, "Principles for Fixing North Carolina's Broken Economy, Transportation and Infrastructure," at: http://www.patmccrory.com/issue/infrastructure/ (accessed March 19, 2013).
[12] NCDOT Policy to Projects Process, at: http://www.ncdot.gov/performance/reform/
[13] Projected Uses of NCDOT Appropriations 2012-13, at: http://www.ncdot.gov/about/finance/
[14] NCDOT, 2012 Report on the Condition of the State Highway System, at: https://connect.ncdot.gov/resources/stateroads/Pages/MCAP.aspx

North Carolina could increase the money spent on maintenance over the next 10 years by about 40 percent ($5.6 billion). If a 50 percent reduction in lower benefit-cost projects is not feasible, then as an alternative, reducing lower benefit-cost projects by just 7.2 percent would be sufficient to eliminate the entire projected maintenance budget shortfall ($0.80 billion).

Figure 1: Strategy for Funding System Maintenance



This is just one approach to increasing maintenance resources – others include contracting out of some maintenance functions, legislative increases in maintenance allocations, improved maintenance efficiency, and of course deferred maintenance. But some re-allocation of funds from lower benefit-cost projects to maintenance may be an element of the solution.

Twelve of the 157 suggestions reviewed deal directly or primarily with system maintenance. Four of these are specifically recommended:

#1: Implement a "fix-it-early" policy for maintenance (MOS-05).

It is well known that early maintenance extends road and bridge life more effectively than delayed work. Fix-it-early policies allocate transportation funding in a manner that prioritizes the preservation and repair of the existing highway system, over new construction. This approach stretches limited resources, ensures the safety of a state's citizens and maintains the value of the state's past investments. Making minor repairs on roads early in their life cycle (say, at 7-8 on a 10-point scale with light 1"-2" overlays) will extend pavement life and save

money. Two light overlays over a 15-20 year period are significantly cheaper than rebuilding the entire pavement. Although expansion will be needed for new projects or added lanes, and for major rehabilitation as with I-95, the primary responsibility of NCDOT's focus should be on 'stewardship'.

This recommendation would be fairly straightforward and relatively quick to implement. It is feasible administratively and politically, requires no legislation and is regionally equitable. Moreover and perhaps most importantly, a fix-it-early policy would save the state about $100 million annually, primarily through reduced later rehabilitation costs.

#2: Set maintenance performance goals (MOS-07).

NCDOT should set performance goals and target dates (e.g., X number or percent of miles with rating >80, by 2015) for each division and county. Division and county supervisors would recommend projects based on traffic and condition, and when allocated funds would then spend it on these recommended projects and track road improvements over time. Linking funding with performance allows NCDOT to reward Divisions/counties for superior performance, and to identify locations that need additional attention.

This recommendation could be implemented in 1-2 years at a relatively low cost; $ 0.5 million annually initially but tapering off over time as the process is adopted. It may require legislation to change some procedures.

#3: Add "maintenance needs" to some funding formulas (MOS-06).

Several of NCDOT programs allocate maintenance money by lane-miles, centerline miles or population. These programs should be modified to allocate maintenance money based on maintenance *needs*; for example, allocating funds to counties by road condition (worse gets more), traffic (higher gets more), or cost to repair. This recommendation would direct maintenance funds toward those roads with the greatest maintenance need, but also should require expenditure as planned.

This recommendation could be implemented in 1-2 years at an annual cost of $50 million, which will diminish over time as repairs are completed. Some new resources may be needed, at least initially, and some of the initial costs may also involve formula change. It will also require legislation to change funding formulas.

#4: Increase performance-based contracting out of maintenance (MOS-03)

Performance-based highway maintenance contracting can lower maintenance costs and deliver better value for taxpayers. Currently, North Carolina contracts out mowing and litter removal. Best practices in highway maintenance contracting rely on long-term, multi-year performance-based maintenance contracts (PBMC). The public agency defines an end outcome goal, and the contractor decides how best to achieve the desired outcome. The contract creates clearly defined performance measures, outcomes and timetables, and it allows for new and innovative delivery methods, opportunities for value engineering, and improved efficiencies. The Virginia Department of Transportation became the first to adopt this approach in the U.S in 1996, outsourcing over 250 miles of Interstate maintenance to one contractor in a 5.5-year, $130 million fixed-cost contract that covered all maintenance (including routine repairs, preventive treatments, rehabilitative and restorative maintenance, labor, materials, and

equipment) necessary to meet the contractual performance standards.[15] PBMC and the experiences of several states and foreign countries are discussed in more detail in Section III below.

As with other new ideas, the best approach to contracting is to 'start small' by contracting out the programs that have the best chance of success. These may include maintenance of rest areas, which Virginia has successfully contracted out, or landscaping, which is similar to mowing. Both are relatively simple services that other states have successfully bid out. Another area where performance-based maintenance contracting may have early success is on Interstates, where performance standards may be easier to set.

If implemented, this recommendation could initially save about $ 20 million annually with higher potential savings in the 6-20 percent range that Virginia has experienced. However given its complexity it probably would take 2+ years to implement, perhaps initially by trial, and might also need legislative authority. Overall it is judged moderately feasible.

The table below, Recommendations for Maintenance, summarizes these four recommendations. If implemented together, they would save about $70 million annually. All four of these projects go directly to the idea of addressing needs early and systematically and further the goal of responsible stewardship.

Additional suggestions

The table also summarizes nine additional suggestions that could be implemented over a slightly longer time frame and if implemented fully would cost about $ 13.3 million annually but lead to better maintenance management. These suggestions are all worthy of review, but one is highlighted:

- **'Bundling' bridge maintenance contracts (MOS-04)** would likely save about $ 20 million annually, but is judged to be more complex than contracting road maintenance. NCDOT is beginning to adopt this approach; there is a request for bids for "Pressure Washing Steel Beams & Bearing Plates on various bridges throughout Division 10."[16]

[15] Ybarra, S, "Virginia Saving Money With Fixed-Price Interstate Maintenance Deal," May 8, 2008, http://reason.org/news/show/virginia-saving-money-with-fix (accessed March 18, 2013).

[16] North Carolina Department of Transportation, Division 10 Bridge Maintenance Contract Proposal, March 6, 2013, at: https://connect.ncdot.gov/letting/Pages/Letting-List.aspx?let_type=10

Table 7: Recommendations for Maintenance.

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
MOS-05	Implement a "fix-it-early" policy for road and bridge maintenance	1	-100	Highway-bridges	Maintenance	DOT	No	Rural low-volume roads	High	High	High	High
MOS-07	Set maintenance performance goals	1-2	0.5	Highway-bridges	Maintenance	DOT	Possibly	Maintenance function	Moderate	Moderate	High	Moderate
MOS-06	Add maintenance needs to some formulas	1-2	50	Highway-bridges	Maintenance	Legislature	Probably	Maintenance function	High	Moderate	High	Moderate
MOS-03	Increase performance-based contracting out of maintenance	2	-20	Highway-bridges	Maintenance	DOT	Possibly	Maintenance function	Moderate	Moderate	High	Moderate
MOS-04	Bundle' contracts for bridge maintenance	2	-20	Bridges	Bridge maintenance	DOT	Possibly	Bridge managers	High	Moderate	High	High
MOS-13	Review 'superstreet' experience	2	0.3	Highway	Operation	DOT	No	All regions	High	Low	High	High
MOS-01	Road and bridge condition forecasting model	2	2	Highway-bridge	Prioritizing	DOT	No	Maintenance projects	High	Moderate	High	High
MOS-08	Increase public involvement in maintenance reporting	2-3	5	Highway-bridges	Maintenance	DOT	No	Maintenance function	Moderate	High	High	Moderate
AV-09	Develop airport facility management plans	2-3	10	Aviation	Maintenance	DOT, municipalities, counties	Possibly	All regions	Moderate	Moderate	High	Moderate
MOS-12	Optimize pavement repair strategies	3-4	1	Highway	Maintenance	DOT	No	All regions	Moderate	Moderate	High	Moderate
MOS-09	Tie maintenance records to condition reporting	3-4	5	Highway-bridges	Maintenance	DOT	No	Maintenance function	Low	Moderate	High	Moderate
MOS-02	Municipal road condition surveys	3-4	10	Highway-bridge	Prioritizing	DOT and municipalities	Possibly	Municipalities	High	Moderate	High	Moderate

Organizational Efficiency

Given the state's fiscal circumstances, the tight budget and many other needs, each functional area must organize and operate at maximum efficiency. For transportation this means effectively and efficiently maintaining and operating the transportation system, and improving project selection, planning and other activities.

Of the 157 suggestions reviewed, 48 deal primarily or directly with organizational efficiency. While most of these are modest in their initial savings or costs, several are estimated to save or cost over $ 20 million annually. For the larger items, future savings would have to be substantial to justify the expenditure. For instance, using 'lane rent' bidding (bidding projects on the basis of construction costs *and* societal travel time savings) would probably increase construction costs but save society time and commuting costs.

From the 48 suggestions four are recommended for immediate implementation:

#1: Develop objective 'project delivery' data (ADM-13).

NCDOT's actual project delivery rate remains unknown. The present STIP contains projects from the 1990s, and some projects first included in the 1980s or earlier. Some projects have been through the NEPA process once, twice, or even three times. Some of these projects are strategic and still needed while others are less needed. All projects that have been in the STIP for more than ten years should be evaluated for continued viability. Projects that solve 'yesterday' problems should be removed. The Annual Performance Report should include the number of projects in development and the number of projects that have completed NEPA and permitting during the previous year. Some steps in this direction have been recently taken, as the 'project prioritization' process moves forward.

This recommendation would be relatively low-cost, at most $ 0.2 million annually, because the data needed to implement it are already in place. It does not require legislation, is judged to be highly feasible and can be implemented quickly. If implemented, the recommendation would give management and the public a much clearer understanding of the agency's efficiency in moving projects forward, and is basic to an objective understanding of agency activities.

#2: Improve communications with stakeholders (ENV-07).

It sometimes appears that NCDOT has difficulty communicating effectively with stakeholders, and is just 'going through the motions' of public involvement. Dissenting opinions in stakeholder committees can go unaddressed. Staff members can sometimes appear dismissive of the public, consultants, elected officials and other agencies. Documents seem to be written to communicate between internal stakeholders, or other participants in interagency processes, whereas elected officials and residents need simpler and clearer communications. NCDOT needs to review, and modify if needed, all elements of its communication strategies. Developing training programs organized through universities and community colleges might be a way to deal with this issue.

This recommendation, put forward by a number of comments, addresses the view held by some that the agency is sometimes perceived as distant and non-communicative. Its cost, about $ 2 million annually, is relatively low considering the importance of the issue. It requires no special legislation and is judged highly feasible and can be implemented quickly. If fully implemented it would likely lead to a smoother and less adversarial relationship with various stakeholder groups.

#3: Focus performance measures on service delivery (ADM-02).

In management science it is axiomatic that 'what gets measured gets managed'. New federal legislation (MAP-21[17]) creates performance measures for conditions on the National Highway System, safety, freight, congestion mitigation, and air quality. NCDOT has made considerable progress recently in implementing performance measures. However, of the six NCDOT Executive Performance Measures (for SFY 2013) that address the goal of "efficiency", two deal with changes in customer behavior (increase transit ridership levels, and increase port cargo movements). Measures of system use are not appropriate as agency performance measures because they imply modal bias and are not subject to agency actions. Revise these to address the quality of service delivery (e.g., percentage of buses running on time, and speed of movement of container and break-bulk cargo), or rates of use that reflect system efficiency. Ensure that measures comply with MAP-21.

This recommendation is also relatively low-cost, about $ 2 million annually, but sharpens agency performance measures and brings them into line with federal performance monitoring. It is generally noncontroversial, does not require legislation, can be done quickly and is judged to be highly feasible. If implemented, this recommendation would bring NCDOT's performance measures into line with standard practice and with federal requirements.

#4: Increase "design-build" flexibility (HBC-01).

'Design-build' (DB) projects integrate project design with other steps such as construction, and occasionally operation and maintenance[18]. How does DB compare with the most commonly used practice, design-bid-build, and are there any current players who might not be competitive under this approach? A 2006 review of highway and building projects[19] found that DB projects enjoyed a significant advantage over design-bid-build projects in project completion time (4-60% faster) and a variable advantage in cost (18% less to 23% more) with no discernable difference in quality. Small businesses were not overly disadvantaged in the DB process since opportunities existed for subcontractors to perform substantial portions of design-build projects.

While most DOTs contract out construction, fewer contract out design, and in some cases legislative restrictions prohibit contracting out design and construction jointly. When design is contracted or integrated into DB, NCDOT sometimes does up to 70 percent or more of the design internally, leaving little room for contractors to be innovative and lower costs. Increase DB projects and decrease amount of NCDOT 'design' for projects. NCDOT should pick the alignment/routes for road projects, but leave to potential DB contractors the opportunity to do the rest and leverage innovation. This would likely accelerate project timing from 'concept' to 'bid', lowering costs and also help to right-size staff.

This recommendation, a solicited comment, calls for greater use of design-build contracting in highway projects. Although it might require enabling legislation, the

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[17] MAP-21 (Moving Ahead for Progress in the 21st Century Act, Public Law 112-141, 216 Stat. 405, July 6, 2012, at: http://gpo.gov/fdsys/pkg/PLAW-112publ141/pdf/PLAW-112publ141.pdf (accessed march 19, 2013).

[18] In the usual design-bid-build) process, NCDOT or contractors design the projects, and then contractors bid to build it. In 'build-operate-transfer' projects, contractors build and operate the project, then transfer it to NCDOT control.

[19] AECOM Consult Team, *Design-Build Effectiveness Study*, a report for the Federal Highway Administration, January 2006, at: http://www.fhwa.dot.gov/reports/designbuild/designbuild.pdf (accessed March 19, 2013).

recommendation is estimated to save about $ 25 million annually, can be implemented relatively quickly, and is judged to be moderately feasible. If implemented it is likely to lead to faster project development and faster construction at a lower overall cost, but might have negative impacts on smaller general contractors.

The table below, Recommendations for Organizational Efficiency, summarizes the features of these four recommended projects. If implemented their potential savings is estimated to be about $ 20.8 million annually.

Additional suggestions

Although all of the additional suggestions in Table 8 are worthy of discussion, several are highlighted for consideration:

- **Eliminate annual vehicle safety inspections (ENV-03)** would likely save NC residents about $ 100 million annually. NC has eliminated the emissions inspection for newer (3 newest model years, or <75,000 miles) cars, effective 2014 (EPA requirements require retaining emissions inspections for older cars). States that have eliminated or have no safety inspection have not observed negative impacts on safety, but there are impacts on auto-repair industry employment. In the current session of the Legislature, HB # 59 would eliminate the annual safety inspection.
- **Improve environmental stakeholder coordination (ENV-01)** reflects concerns that agency coordination regarding environmental issues should be improved.
- **Bundling bridge repairs into larger contracts (HBC-03)** utilizes a very positive experience from Missouri that fast-forwarded bridge repairs, a nagging problem in North Carolina.
- **Increase flexibility/consolidate road funds (F-05)** suggests reducing the 'stovepipe' structure of the road program and increasing flexibility among funding categories.

Table 8: Recommendations for Organizational Efficiency.

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
ENV-03	Eliminate the annual vehicle **safety** inspection (keep the emissions inspection)	1	-100	Highway	EIS/Environment and Administration	DOT and DENR	Yes	Vehicle owners	High	High	High	High
ADM-13	Develop objective project delivery data	1	0.2	Highway-Bridge	Administration	DOT	No	All regions	High	High	High	High
ADM-17	Examine state aircraft leasing	1	0.2	Air	Administration	DOT	Possibly	All regions	High	Moderate	High	High
ADM-01	Ensure that modal advocacy is not a goal of any DOT office	1	0.5	All	Performance	DOT	No	All regions	High	High	High	High
ENV-07	Improve communications with stakeholders	1	2	All	Communications and Administration	DOT	No	All regions	High	High	High	High
ADM-02	Focus performance measures on service delivery	1	2	All	Performance	DOT	No	All regions	High	High	High	High
HBC-01	Increase 'design-build' flexibility	1-2	-25	Highway-Bridge	Design-Construction	DOT	Possibly	All regions	Moderate	Moderate	High	Moderate
ADM-07	Expand the suggestion reward program	1-2	0.1	All	Performance	DOT	No	All regions	High	High	High	High
P-20	Improve consultant selection process	1-2	0.1	All	Administration	DOT	Possibly	All regions	High	High	High	High
AV-02	Re-establish the NC Aeronautics Council	1-2	0.2	Aviation	Administration	DOT	Yes	All regions	Moderate	Moderate	High	Moderate
ADM-03	Add an 'effectiveness' goal	1-2	0.2	All	Performance	DOT	No	All regions	High	High	High	High
RR-03	Strengthen NCRR reporting	1-2	0.2	Rail freight	Performance	DOT,NCRR and Legislature	Yes	NCRR corridor	High	Moderate	Low	Moderate
ADM-12	Ensure that performance measures guide management	1-2	0.2	All	All modes	DOT and Legislature	Possibly	All regions	High	High	High	High

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
ADM-05	Compare NC programs to similar states	1-2	0.2	All	Performance	DOT	No	All regions	High	High	High	High
PF-01	Review ferry tolls	1-2	0.3	Water	Operation	DOT and Legislature	Yes	Coastal regions	High	Low	Low	Low
ADM-16	Re-evaluate management of the Turnpike Authority	1-2	0.3	Highway	Administration and Funding	DOT and Legislature	Possibly	4 regions	Moderate	Moderate	Low	Moderate
ADM-20	Improve DMV-DOT-customer training	1-2	2	All	Administration	DOT	No	All regions	High	High	High	High
ENV-01	Improve environmental stakeholder coordination	1-2	5	Highway-Bridge	EIS/Environment	DOT and DENR	No	Major projects	High	High	High	High
ENV-09	NC regulations conform to federal rules	2	-20	Highway	EIS/Environment	DOT and DENR	Possibly	All regions	High	Moderate	High	Moderate
ENV-08	Streamline environmental regulations	2	-15	Highway	EIS/Environment	DOT and DENR	Possibly	All regions	High	High	High	High
RES-01	Comparative performance data with other states	2	0.2	All	Performance	DOT	No	All regions	High	High	High	High
PF-02	Evaluate privatization of the ferry system	2	0.3	Water	Operation	DOT, DOCM and Legislature	Yes	Coastal regions	Moderate	Low	Low	Low
ENV-06	Control erosion during construction	2	15	Highway-Bridge	Construction	DOT and DENR	No	All regions	High	High	High	High
HBC-03	Bundle bridge repairs into larger contracts	2-3	-10	Bridges	Contracting	DOT	Possibly	All regions	Moderate	Moderate	High	Moderate
PTRAN-01	Consolidate transit funding categories and systems	2-3	-5	Transit	Funding	DOT and Legislature	Yes	All regions	Moderate	Moderate	High	Moderate
HBC-10	Fast-forward' bridge condition data	2-3	0.2	Bridges	Bridges and Maintenance	DOT	No	All regions	High	Moderate	High	Moderate
P-10	Evaluate web-based transportation services	2-3	0.2	All	Planning and Communications	DOT	No	All regions	Moderate	Low	High	Moderate
ADM-04	Add a 'planning success' goal	2-3	0.2	All	Performance	DOT	No	All regions	High	High	High	High

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
RES-04	Implement a 'research scan' program	2-3	0.3	All	Administration	DOT and Universities	No	All regions	High	Low	High	High
ADM-06	Evaluate the e-procurement system	2-3	0.3	Highway and bridges	Contracting	DOT	No	All regions	High	High	High	High
TECH-02	Evaluate public uses for location-based travel data	2-3	0.3	Highway-bridge	Administration	DOT and DOCM	Yes	All regions	Moderate	Moderate	High	Moderate
AV-07	Re-organize the Division of Aviation	2-3	0.5	Aviation	Administration	DOT	Yes	Airports	Moderate	Moderate	Moderate	Moderate
ADM-19	Develop comprehensive recruitment//development program	2-3	1	All	Administration	DOT	No	All regions	High	Moderate	High	Moderate
HBC-11	Verify road inventory data	2-3	2	Pavements	Planning	DOT	No	All regions	High	Moderate	High	Moderate
ADM-14	Improve staff training	2-3	2	All	Administration	DOT	No	All regions	High	High	High	High
HBC-07	Audit/revise pavement condition survey	2-3	2	Highway	Pavements	DOT	No	All regions	High	High	High	High
PTRAN-17	Evaluate public transportation use for school attendees	2-3	2	Transit	Planning	DOT, Public Instruction, Legislature	Probably	Large urban areas	Low	Low	Low	Low
HBC-14	Bid major projects on 'lane rent' principles	2-3	50	Highway-bridge	Design-Construction	DOT	Possibly	Interstate corridors	High	High	Moderate	Moderate
ADM-08	Realign Divisions/Expand Div functions	2-4	-15	All	Performance	DOT and Legislature	Yes	All regions	Moderate	Moderate	Low	Low
RR-04	Improve railroad-government coordination	2-4	0.5	Rail freight	Planning	DOT, DOCM and railroads	Possibly	Railroad corridors	Moderate	Moderate	Low	Low
F-05	Increase flexibility/ consolidate road funds	3-4	-25	Highway	Funding	DOT	Yes	Mid-sized projects	High	Moderate	High	Moderate
ADM-18	Examine functional privatization	3-4	-25	All	Administration	DOT and Legislature	Probably	All regions	Low	Moderate	High	Moderate
HBC-02	Standardize designs for small rural bridge replacement	3-4	-15	Bridges	Design-Construction	DOT	No	All regions	Moderate	Low	High	Moderate

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
HBC-08	Connect pavement condition data and work records	3-4	-15	Highway	Pavements	DOT	No	All regions	Low	Low	Moderate	Low
ADM-21	Sell unneeded right-of-way parcels	3-4	-5	Highway	Administration	DOT	No	All regions	High	Moderate	High	Moderate
ADM-09	Reduce DOT Board Membership	3-4	-5	All	Performance and Administration	DOT and Legislature	Yes	All regions	Moderate	Low	Low	Low
ADM-15	Expand use of GIS tools	3-4	3	All	Administration	DOT	No	All regions	High	Moderate	High	Moderate
HBC-15	Evaluate performance-based contracting	3-4	50	Highway	Design and	DOT	Possibly	All regions	Moderate	Moderate	High	Moderate

Budget Constraints

The state's budget circumstances are a backdrop for all programs. The McCrory Administration has moved to deal with major fiscal issues regarding unemployment insurance and the Patient Protection and Affordable Care Act ('Obama-care') and agencies have been told to expect budget cuts. Given this situation, it is important that the transportation program recognize the realities of the current fiscal environment.

Of the 157 suggestions reviewed, 20 deal primarily or directly with budget constraints or closely related funding sources. These vary widely in dollar amount, and some would cost money initially or increase costs in other state programs. Of the 20 suggestions, two are recommended for immediate implementation:

#1: Constrain the STIP to needed and affordable projects (P-11).

Several prior reviews of the highway program in recent years have concluded that the State's STIP is too optimistic, is over-programmed, and understates future costs. This leads to inevitable funding delays and dashed local hopes as construction prices rise and funds tighten. The STIP should be a balanced document that is only slightly over-programmed, accounting for likely increases in project costs and revenue flows as well as project delays. The DOT has already begun quantifying the selection of projects (the 'SPOT' process) using objective and transparent data; this effort should be accelerated.

This recommendation, if implemented fully, has the potential to save about $ 200 million annually, largely through deferred and deleted projects that have low overall benefit-cost ratios. These funds could then be diverted to higher-priority actions, major projects in the Mobility Fund, and maintenance. The recommendation is generally within the NCDOT's purview, probably does not need legislative action and can be implemented relatively quickly. However, it would need objective and transparent data, and of course a willingness to drive project selection by merit rather than geography.

#2: Expand Mobility Fund/fund major projects separately/reduce STIP (F-03).

Currently North Carolina funds some projects in separate categories (Loop funds, Mobility Fund, Turnpike Authority) separately from the STIP. The intent of this action is to move those projects ahead more rapidly. However, very large projects such as I-95 repairs, substantial Interstate widenings, other major projects of interstate significance, and some major bridge projects are still difficult to fund. A consolidated funding category for very large projects of statewide significance could better fund major projects, which would be evaluated and prioritized head-to-head statewide. However, funding for smaller projects might suffer unless the state finds new resources. North Carolina should consider financially expanding the Mobility Fund and funding it separately, for quicker action to address projects of truly statewide significance[20]. The funds for this can be obtained from reducing the STIP through project prioritizing, as noted above; however some additional funding from other present sources may be needed.

This recommendation, if fully implemented is estimated to cost about $ 100 million annually (after diversion from deleted STIP projects). However the importance of a few truly statewide projects is such that we deem the additional expenditure appropriate, and believe that it can be made up largely through deferred or deleted STIP projects with low benefit-cost ratio.

[20] The Legislature recently moved three projects from the Turnpike Authority to the Mobility Fund.

This recommendation would, however, require legislative action and so could probably not be accomplished within 1 year.

The following table summarizes the features of these two recommendations. If fully implemented, they are estimated to save about $ 100 million annually.

Additional suggestions

In addition to these two recommendations, the table also provides details for an additional 18 suggestions. Of these, the following three are highlighted for consideration:

- **Re-assess the need for the 'Loop Program' (P-13).** The Loop Fund was established as part of the 1989 Highway trust fund legislation, along with intrastate System, paving unpaved roads, and the equity formula. This suggestion is based on several comments to the effect that the Loop program as now structured has become diluted by too many projects, is unlikely to be completed, and is draining resources needed for projects of statewide significance.
- **Prohibit the use of transportation funds for other purposes (F-09)** is a suggestion regularly heard concerning the usage of highway funds for other purposes. Highway funds should be used for highway purposes, but this might require other resources for shifted programs.
- **Actively review and evaluate alternative funding mechanisms (F-04) is** based on the experiences of other states that other funding mechanisms, such as tolls, pricing, bonding, TIFIA, GARVEEs, and PPP initiatives, can be useful for selected major projects. Part III contains a more extensive discussion of several frequently mentioned options, including tolls, pricing, and public-private-participation.

Table 9: Recommendations regarding Budget Constraints.

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
P-11	Constrain the STIP to needed and affordable projects	1	-200	All	Planning and Prioritizing	DOT	No	All regions	High	High	High	High
F-03	Expand Mobility Fund/ Fund major projects separately/Reduce STIP $	1-2	100	Highway-bridge	Funding	Legislature	Yes	Very large projects	High	Moderate	Moderate	Moderate
RR-01	Fund NC AMTRAK service consistent with ridership share	2-3	-10	Rail passenger	Funding	DOT and Legislature	Possibly	Might reduce Raleigh-Charlotte service	High	Moderate	Low	Moderate
PTRAN-04	Riders pay fair share of transit operating costs	2-3	-10	Transit	Funding	DOT	No	All regions	High	Moderate	High	Moderate
PTRAN-03	Limit state transit operating assistance to 10 percent of op costs	2-3	-10	Transit	Funding	DOT	Possibly	All regions	High	Moderate	Moderate	Moderate
F-04	Actively review and evaluate alternative funding mechanisms	2-3	100	Highway-bridge	Funding	DOT Sec	No	State road funds	High	High	Moderate	High
F-09	Prohibit use of transportation funds for other purposes	2-4	-200	All	Funding	Legislature	Yes	State transportation projects	High	Low	Moderate	Low
P-13	Re-assess the need for the 'loop' program	2-4	-200	Highway-bridges	Funding	DOT and Legislature	Yes	Urbanized areas	Moderate	Moderate	High	Moderate
F-14	Adjust the fuel tax for inflation	2-4	25	Highway-bridge	Funding	DOT and Legislature	Yes	All regions	High	Moderate	High	Moderate
F-06	Cautiously increase use of debt	2-4	50	Highway-Bridge	Funding	DOT	Yes	Major projects	High	Moderate	High	Moderate
F-08	Permit local tax increases for "all modes', not just transit	2-4	100	All	Funding	Legislature	Yes	Localities	High	Moderate	Moderate	Moderate

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
F-16	Establish a State Infrastructure Bank for local road repairs	2-4	100	Highway-bridge	Funding	DOT and Legislature	Yes	Municipalities	Moderate	Moderate	High	Moderate
F-18	Expand funding thru PPPs, bonding and pass-thru funds	2-4	150	Highway-bridge	Funding	DOT and Legislature	Probably	All regions	Moderate	Moderate	Moderate	Moderate
PTRAN-07	Fund transit from general funds	3-4	-125	Transit	Funding	DOT and Legislature	Yes	All regions	High	Moderate	High	Moderate
PTRAN-10	Cost-justify 'new start' and 'small start' submittals	3-4	-10	Transit	Funding	DOT and Legislature	Probably	All regions	Moderate	Moderate	High	High
PTRAN-11	Expand private-sector transit operations	3-4	-10	Transit	Funding	DOT and Legislature	Probably	All regions	Low	Moderate	High	Moderate
PTRAN-08	Set growth limits on operating assistance	3-4	-5	Transit	Funding	DOT and Legislature	Yes	All regions	Moderate	Moderate	High	Moderate
F-10	Investigate revenues from alternative-fueled vehicles	3-4	5	Highway-Bridge	Funding	Legislature	Yes	State highways	Moderate	Moderate	High	Moderate
F-07	Lift the cap on NC's fuel tax	3-4	50	Highway-Bridge	Funding	legislature	Yes	Localities and State	High	Low	Moderate	Low
F-11	Cautiously implement toll road and pricing strategies	4-8	-50	Highway-bridge	Funding	DOT	No	A few corridors	Moderate	Moderate	High	High

Safety

Improved transportation safety is implicit in maintaining an infrastructure capacity that is a "*key element in attracting business and investment*."[21] Along with driver training, enforcement and vehicle features, a well-designed and well-maintained system is a foundation of safety, and many of the recommendations we are making in other areas will have an impact on safety as well.

Of the four safety suggestions reviewed, one in particular deserves focus:

#1: Improve rural safety (MOS-10).

People living in rural areas are disproportionately likely to die traveling on US roads. According to the 2009 data, 23 percent of the US population lived in rural areas, but rural fatalities accounted for 57 percent of all traffic fatalities. This translates into a national fatality rate of 1.96 deaths per 100 million vehicle miles in rural areas, 2.7 times higher than the 0.73 fatality rate in urban areas. North Carolina's fatality rate is 25 percent above the national average, and about ¾ of NC highway fatalities are on rural roads[22]. Within North Carolina, fatality rates vary widely by county, even within Division, but safety funds are distributed equally by county. As accidents are often the result of driver actions within road conditions, rural safety can be improved by increasing pavement and shoulder widths on narrow rural curves (providing an extra 'margin of safety' for drivers), straightening rural road curves where feasible, and improving lines of sight in areas where vision is restricted.

This recommendation (summarized in the table below, Recommendations for Safety) could be implemented within two years, at an annual cost of $100 million. Some of these costs can be found from deleted or deferred STIP project. Feasibility is expected to be high, even though legislation might be required to shift some resources.

Additional suggestions

The table also summarizes three other suggestions that could be implemented within a few years, and would have a substantial safety impact. Two involve new technologies and the other expands the focus of a known problem. All three offer potential for improved highway safety.

[21] McCrory, P, "Principles for Fixing North Carolina's Broken Economy, Transportation and Infrastructure," at: http://www.patmccrory.com/issue/infrastructure/ (accessed March 19, 2013).

[22] Highway Safety Research Center, North Carolina Crash Data, at: http://www.hsrc.unc.edu/crash/datatool.cfm

Table 10: Recommendations for Safety.

ID	Brief Description	Finish By (years)	Ann Cost (+) or Savings (-) $M	Mode	Functional Area	Lead Agency(s)	Legislation Action Needed	Major Beneficiaries	Admin Feasibility	Political Feasibility	Regional Equity	Overall Feasibility
RES-03	Evaluate safety issues in the Naturalistic Driving Study	2	2	Highway	Safety	DOT and Universities	No	All regions	High	Moderate	High	Moderate
MOS-10	Improve rural safety	2	100	Highway-bridges	Safety	DOT and Legislature	Possibly	Rural roads	High	High	High	High
TECH-01	Prepare NC response to 'self-driving cars'	2-3	1	DMV	Safety and Administration	DOT and DOCM	Yes	All regions	Low	Moderate	High	Moderate
MOS-11	Improve incident removal services	3-4	15	Highway-bridges	Safety	DOT	No	All regions	Moderate	High	High	High

III. New Approaches

This section of the report discusses important options for transportation financing, widening Interstates, and contracting maintenance.

Public-Private Partnerships

Like several dozen other states, North Carolina has enabling legislation for public-private partnerships (PPPs) in transportation. In this discussion, the focus is on long-term PPPs to design, finance, build, operate, and maintain transportation infrastructure such as highways and bridges. Internationally, these kinds of long-term PPPs are termed "concessions," and each is governed by a very detailed "concession agreement" which spells out the obligations and requirements of both parties - generally the state DOT and the concession company.

Some PPP laws allow a private company to submit an unsolicited proposal, which is then opened up to competitive proposals if the DOT thinks the project idea has merit. More commonly, the DOT identifies a project as suitable for a PPP concession and engages in a two-stage process to enlist private-sector participation. The first step is to release a Request for Qualifications (RFQ) inviting interested firms (or consortia of firms) to submit their qualifications and track records for the kind of project the DOT wants developed. The DOT uses objective criteria to select the best three to five teams and invites those pre-qualified teams to respond to a detailed Request for Proposals (RFP) explaining how it would carry out the project, including a proposed financing model. After an objective scoring of the proposals, the DOT selects the best one and engages in detailed negotiations to work out the terms of a long-term concession agreement. Once the agreement is signed ("commercial close"), the concession company must go to the financial markets to finance the cost of final design and construction ("financial close").

There are two basic types of concession structures: toll concessions and availability payment concessions. In a *toll concession*, the company itself decides on the toll rates (within the limits set by the concession agreement) and is fully responsible for generating the revenue to repay its lenders and (it hopes) to make a return on the equity it has invested in the project. In this type of structure, it is the private sector that takes on the traffic and revenue risk—i.e., it can only make money if it is able to attract enough traffic and charge the right prices such that all its costs are covered and there is something left over for a positive return on its equity investment (profit).

In an *availability-payment concession*, the company is still responsible for raising the capital, designing and building the project, and operating and maintaining it, just as in a toll concession. But in this case, its revenue comes from the state DOT, which agrees to make annual payments during the entire term of the concession (anywhere from 35 to 75 years, depending on the project). These payments are somewhat variable, depending on the company meeting various performance standards, such as keeping the road open to traffic and in good condition. In this type of concession, the company bears no traffic risk and very little revenue risk (assuming it is competent to operate and maintain a highway or bridge). The state is responsible for providing the revenue.

One of the main reasons states pursue long-term PPPs is to attract private investment into transportation infrastructure. A long-term concession is mostly a project delivery method, not inherently a major new source of funding. But if a state is trying to address a major transportation funding shortfall, a *toll concession* does generate a large new source of

revenue—from tolls. By contrast, if it proceeds with a pure *availability payment concession* instead, the state itself must come up with the entire cost of the project from its existing transportation funding sources (except that this cost is spread out over many years instead of being required up-front). In other words, availability-payment concessions are not a solution to major transportation funding shortfalls.

It is possible to combine the two approaches in a hybrid model. In this case, such as the Florida DOT procurement of the reconstruction of I-595 in Florida, reversible express toll lanes are being added to the rebuilt freeway, but the concession company is being compensated via availability payments. Florida DOT will collect the tolls and use the revenue, in addition to conventional state highway (fuel tax) funds, to make the payments. In this type of hybrid concession, the state is taking on the traffic and revenue risk, as in a pure availability-pay concession, but at least it has a new revenue stream to cover a portion of those payments.

It takes considerably more time (and consulting services) to procure a highway or bridge project as a PPP concession. Therefore, this method is generally used for large or very large projects, where those administrative costs are still a small fraction of the total project cost. Thus, the types of projects that lend themselves to PPP concessions include:

- New toll roads
- New toll bridges
- Adding express toll lanes to a congested freeways
- Major reconstruction of existing highways
- Major bridge replacements.

In addition to having PPP enabling legislation, North Carolina also has its own toll agency, the North Carolina Turnpike Authority, a division of the NCDOT. It can finance, build, operate, and maintain toll roads and bridges, generating new toll revenue and financing the capital costs of projects up-front, just as can be done via a toll concession. So a logical question is: why should North Carolina make use of PPP concessions, rather than doing all toll projects via its own toll agency? This question has come up in Florida, Texas, and Virginia, each of which has several government toll agencies but also makes good use of concessions. Here are some of the reasons why toll concessions can add to what state toll agencies can do:

- Lower-risk funding: State toll agencies finance projects 100 percent with debt (typically tax-exempt toll revenue bonds), but concessions typically use a mix of debt and equity. It can be easier to finance a toll project if the backers invest their own equity capital into the project. That's because in the early years of a toll road or bridge, revenue may fall short of projections. Providers of debt (the bonds) must get paid the promised amount every year or the project goes into default. But providers of equity only get paid if there is enough toll revenue to first cover the debt service. So if toll revenue falls short in the early years, the equity holders get nothing and the project remains solvent. This "cushion" provided by equity (typically 20 to 30 percent of the project budget) reduces early-years risk to bond buyers, making it easier to finance the project than if it were 100 percent debt-financed.
- More total funding: Global infrastructure funds have amassed over $200 billion to invest in infrastructure over the past decade.[23] This is mostly equity capital, which represents a net addition to the amount of infrastructure that could be financed only with debt. One practical result is that in some cases, a toll concession model can

[23] Poole, RW Jr., "Transportation Infrastructure Financing," *Privatization 2012*, Reason Foundation, March 2013.

finance a larger project (e.g., 150 miles of toll road vs. 100 miles) than a state toll agency, as happened in Texas with the concession for SH 130 between Austin and San Antonio.

- Greater risk transfer: A toll concession typically transfers the risks of construction cost overruns, late completion, and inaccurate traffic and revenue forecasts to sophisticated investors. If any of those risks eventuates, the concession company must bear them, not the DOT or the toll authority. This is especially important for transportation mega-projects, which have a higher risk of cost overruns, late completion, and over-estimation of traffic and revenue.[24]
- Guaranteed maintenance: Just about all toll financings, public or private, include bond covenants requiring proper ongoing maintenance for the life of the bonds. Rational toll road operators also have an incentive to do this in any case, since few people will pay to drive on a road that is not well-maintained and in better condition than alternative non-tolled routes. With concessions, the assurance can be further guaranteed via enforceable condition and performance standards included in the concession agreement.
- Minimized life-cycle cost: State DOTs generally get two separate budgets from the legislature—one for capital projects and another for maintenance. There are strong political preferences for new construction, which encourages the DOT to make its capital budget cover as many projects as possible. Construction projects are therefore awarded on a low-bid basis. But the cheapest initial construction may turn out to be far less durable and therefore incur much greater lifetime maintenance costs. By contrast, a toll road is more likely to be designed and built in a more durable manner, to minimize *life-cycle costs*, all of which must be covered out of toll revenue. This is true of both state toll agencies and toll concessions.
- Innovations: The private sector appears to have a stronger incentive to "think outside the box" to come up with innovative ways to solve design and operational problems. It was a toll concession in California that implemented the world's first all-electronic congestion-priced toll road, the 91 Express Lanes. It was a toll concession in France that resolved a decades-old controversy about the missing link in the A86 Paris ring road by financing and building it as a deep-bore toll tunnel beneath the historic town of Versailles. And it was a toll concession that brought congestion-priced managed lanes to the Capital Beltway in northern Virginia, coming up with a design that avoided hundreds of property takings and cost about 40 percent less than Virginia DOT's unfunded plan to add an equivalent number of HOV lanes to that corridor.[25]
- Companies as taxpayers: Perhaps the least appreciated benefit of concessions is the fact that to the extent that these companies succeed as businesses, they pay corporate taxes like any other business—in contrast to a state toll agency. Cintra, the company developing $4.9 billion worth of priced managed lanes in Dallas and Fort Worth as toll concessions, estimates that it will pay $2.6 billion in corporate taxes over the 50-year life of those concessions—in contrast with zero that would have been paid if those projects were developed and operated by the local toll agency.[26]

[24] Flyvbjerg, B et al., *Megaprojects and Risk*, Cambridge University Press, 2003.
[25] Poole, RW Jr., "Fixing America's Freeways," *Reason*, March 2012.
[26] "Misconceptions About Texas Toll Roads," *Public Works Financing*, November 2011.

As noted previously, concessions are typically financed with a combination of debt and equity. In straightforward projects, such as the replacement of an existing toll bridge or reconstruction of an existing highway with toll finance, the structure would likely be 20 percent equity and 80 percent debt, mostly in the form of toll revenue bonds. Congress, in the SAFETEA-LU legislation, recognized the value of toll concessions and authorized the issuance of up to $15 billion of tax-exempt "private activity bonds" (PAB) for concession projects. This is important, because state toll agencies are always allowed to issue tax-exempt toll revenue bonds. Without the PAB legislation, toll concessions would be at a financial disadvantage, having to pay the higher interest rates that are required for taxable revenue bonds.

Some toll projects are higher-risk, meaning that it is difficult to finance them entirely out of toll revenue. Managed lanes mega-projects are often in this category, since the toll revenue is highly dependent on the extent of congestion over 35 to 75 years in the adjacent non-tolled lanes—and the costs of adding new lanes to major urban freeways can be very high. Typical financial structures for this type of project may include the state DOT making an equity contribution (with no guarantee of any return), essentially buying down the amount that must be financed based on toll revenue. In addition, the federal government via the TIFIA program can provide subordinated debt at low interest rates to supplement the amount raised by toll revenue bonds. Table 11 summarizes the financing of three recent managed lanes megaprojects.

Table 11: Financing of Three Toll Concession Managed Lanes Mega-Projects

Project Cost and Fund Sources	LBJ I-635, Dallas	North Tarrant Express, Ft. Worth	Capital Beltway, I-495, Virginia
Project Cost, $ billion	$2.8	$2.1	$1.9
Percent by:			
Equity	24 %	20 %	18 %
Private Activity Bonds	22 %	19 %	29 %
TIFIA Loan	33 %	33 %	30 %
State highway funds	18 %	27 %	21 %
Interest Income	3 %	1 %	2 %

Source: Goodin, G et al., *Expert Review Panel Final Report, I-405/SR 167 Corridor Tolling Study,* Washington State DOT, December 2010

Questions about PPP Concessions

Aren't toll roads developed via toll concessions a bad idea, because their cost of capital is higher than that of a state toll agency?

The cost of debt, which is 65-80 percent of the project's capital cost, is very close to equal between tax-exempt toll agency bonds and tax-exempt private activity bonds. But it is true that equity is invested in such projects in hopes of earning a return, typically in the low double digits (e.g., 12 percent). The key relevant question is what does the public get in exchange for the possibility of investors getting an equity return? The answer is the substantial risk transfer discussed previously, which is especially critical for transportation mega-projects. Sparing toll agencies and taxpayers from such risks is a very significant benefit.

How can the public interest be protected from what will be, to some degree, a kind of private-sector monopoly provider?

The public interest is protected by the terms and conditions in the hundreds of pages that comprise the long-term concession agreement. The state DOT needs professional legal and financial assistance in negotiating these agreements, since a great deal of specialized knowledge is required. These agreements typically include controls on either the toll rates or the overall rate of return, numerous performance standards and requirements (with penalties for non-compliance), hand-back requirements (in specified condition) at the end of the concession term, provisions dealing with possible future needs (such as a new interchange), and termination provisions.

What happens if the concession company goes bankrupt?

Over-optimistic traffic and revenue forecasts, construction cost overruns that the company has to absorb, or bad management might lead to the company declaring bankruptcy. In this case the equity is wiped out, and the lenders generally have the contractual right to seek a replacement company to operate and maintain the highway or bridge in compliance with the terms and conditions of the concession agreement. This has occurred several times with toll concessions in Australia, and twice in the United States (in California and in Texas). In every such case, a replacement firm acquired the assets at a much lower price than the initial cost, and with this lower cost base, has been able to operate the facility on a viable basis. In no case has such a toll facility been taken out of service.

Why do international companies seem to lead most U.S. toll concession projects?

In a word, because the United States has had no private-sector toll companies, the expertise in designing, building, and especially operating and managing toll concession facilities exists largely in companies that have been engaged in this business for decades – especially in Australia, France, Italy, and Spain. Increasingly these global companies are forming joint ventures with U.S. design and construction firms, traffic and revenue forecasters and electronic toll system suppliers, to bid on concession projects. As this market expands, it is likely that a U.S. private sector toll industry will emerge. It is worth noting that although the operational expertise as of 2013 is still mostly with overseas companies, 55 percent of the capital in global infrastructure investment funds comes from North America (Canada and the United States).[27]

Tolling

Similar to every state, North Carolina currently depends heavily on per-gallon fuel taxes as its principal highway funding source. But as numerous expert bodies have concluded since at least 2006, the fuel tax is not a dependable long-term funding source.[28] Federal fuel-economy standards mandate that all new vehicles achieve 54.5 mpg by 2025, about double the current average. That means the revenue per mile driven will, on average, be cut in half as vehicles sold from 2025 onward become the majority of the vehicle fleet. In most states, fuel taxes are also not indexed for inflation, but the cost of building and maintaining highways will continue rising with inflation.

[27] "Nationality of Top 30 Infrastructure Funds, 2012," *Infrastructure Investor*, June 2012

[28] National Research Council, *The Fuel Tax and Alternatives for Transportation Funding: Special Report 285*, Washington, DC: The National Academies Press, 2006.

These points led the National Surface Transportation Infrastructure Finance Commission to recommend that fuel taxes be replaced as the primary funding source for highways.[29] After reviewing numerous options, the Commission recommended a gradual shift from charging per gallon of fuel consumed to charging *per mile driven*. This type of charging has become known as mileage based user fees (MBUFs).

There is no consensus on how best to implement MBUFs, and there is considerable opposition to any system that would involve the government tracking vehicles' every movement. There is growing support among transportation researchers for simple systems that can be implemented with existing technology. One promising approach would be a basic per-mile charge based on annual odometer readings, to pay for most of a state's streets and roads. This could be paid as part of the annual vehicle registration fee. For a car driven 12,000 miles per year, a one cent per mile charge would total $120 per year.

For the more costly highway facilities—urban expressways and long-distance Interstates—a separate system is gaining support. Since those highways (a) cost far more to build and maintain, and (b) are limited-access (with only a small number of entry and exit points), they lend themselves to electronic toll collection using today's low-cost transponders (such as the E-ZPass system that now covers most of the Northeast and Midwest and is being extended to North Carolina). Per-mile tolling could replace fuel taxes as the funding source for all expressways and Interstates at a relatively low cost.

Traditional cash-based tolling, with large toll plazas and a small army of toll collectors, is rapidly being replaced by nonstop open-road tolling, in which motorists can simply drive beneath a gantry that communicates with the E-ZPass transponder to identify the vehicle and debit the owner's toll account. A growing number of toll agencies, including the Florida Turnpike and the North Texas Tollway Authority, are going beyond that to eliminate all cash collection on the toll road. That is the approach used on North Carolina's recently opened Triangle Expressway, the first modern toll road in the state. Under the new approach called all-electronic tolling (AET), most people will pay via transponders. But those who only make occasional trips on tolled highways (or who don't wish to have a transponder) are charged via license-plate tolling: the same video cameras needed for enforcement purposes record the license plate number the vehicle owner is charged accordingly.

Some have expressed concerns about what they believe is a much higher cost to collect highway revenue by tolling, compared with the cost of collecting fuel taxes. Conventional wisdom puts the cost of collecting toll revenue at 20 to 30 percent of the funds collected, versus about 1 percent for collecting fuel taxes (which is collected at the wholesale level). But that conventional wisdom is wrong. A recent study by a team of experts on all-electronic tolling found that 21st-century all-electronic tolling, if implemented with a simple business model, should cost about 5 percent of the revenue to collect.[30] As for fuel taxes, when the additional administrative costs and the lost revenue due to exemptions and evasion are included, the net yield of fuel taxes is only about 95 percent of the nominal amounts collected, i.e., a net cost of 5 percent of the revenue. Thus 21st century AET is competitive with fuel taxation when it comes to the overall cost of raising a given annual highway budget.

[29] National Surface Transportation Infrastructure Financing Commission, *Paying Our Way: A New Framework for Transportation Finance*, Washington, DC, February 2009.

[30] Fleming, DS et al., "Dispelling the Myths: Toll and Fuel Tax Collection Costs in the 21st Century," Policy Study No. 409, Reason Foundation, November 2012.

Making the transition from fuel taxes to MBUFs would be challenging. The following principles are offered as a guide to making such a transition politically feasible for limited-access highways such as urban expressways and long-distance Interstates:

1. **Do not** put a per-mile charge on existing, unimproved highways.
2. **Do** use per-mile charges for *new* limited-access highways.
3. **Do** use per-mile charges for optional, congestion-relief lanes added to congested urban freeways (express toll lanes, HOT lanes)
4. **Do** use per-mile charges to pay for major reconstruction and modernization of existing highways.

Point number 4 is especially relevant to the Interstate highways in North Carolina. These are the state's premiere facilities. In North Carolina, the Interstates carry 20 percent of all vehicle miles of travel (VMT) on just 2.1 percent of the state's lane-miles. Even high-end highways like the Interstates do not last forever. As designed and built largely in the 1960s and 1970s, Interstate highways had a design life of about 50 years, with proper ongoing maintenance. When a highway reaches the end of its design life, it needs to be reconstructed, with all-new pavement capable of providing good service for another 50 years (or longer, if designed to be more durable).

Using data on highway reconstruction cost from the Federal Highway Administration,[31] the Reason Foundation has estimated the cost of reconstructing all of North Carolina's Interstates at $11.3 billion (in 2010 dollars). But that cost estimate covers *only* the cost of replacing the existing lanes. It does not include widening in corridors where traffic will exceed the capacity of the existing lanes within 10, 20, 30, or 40 years. The cost of lane additions is far higher than the cost of rebuilding existing lanes; the same FHWA table on which the reconstruction cost estimate is based puts the cost of lane additions at two to four times as much as reconstructing existing lanes. That is due to several factors, such as in some cases needing to purchase additional right of way and in many cases needing to rebuild bridges and overpasses. In urban areas added right of way is especially costly, which may require new lanes to be built elevated above the existing lanes (as was done several years ago on a Tampa, Florida expressway).

There is no current estimate of when each of North Carolina's Interstates will need reconstruction or what this would cost, especially considering that the best time to add capacity to an Interstate is when it is being reconstructed. But with reconstruction alone costing in excess of $11 billion, it would not be surprising if a complete revamp of North Carolina's Interstates (including any needed widening and any needed reconstruction of bottleneck interchanges) approached or exceeded $20 billion. And given that most of these Interstates will reach or exceed their initial 50-year design lives within the next decade or two, planning for Interstate reconstruction and modernization should be one of NCDOT's top priorities over the next few years.

Funding even an $11 billion reconstruction plan - let alone a broader modernization plan costing upwards of $20 billion - is far beyond the capacity of current and projected fuel tax revenues. But as noted previously, since North Carolina needs to begin planning its transition from paying for highways per gallon consumed to paying per mile driven, Interstate modernization offers an opportunity to begin this transition. Many other states financed a significant fraction of their Interstates by issuing toll revenue bonds to obtain the capital up-

[31] Federal Highway Administration, "Typical Costs per Lane Mile Assumed in HERS, by Type of Improvements, *2010 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance*, Appendix A, p. 9

front, and paying for both the debt service on the bonds and all operating and maintenance costs from the toll revenues. As discussed above, this can be accomplished far more efficiently today, thanks to 21st century all-electronic tolling.

Several years ago North Carolina applied for and received one of only three slots available in a federal pilot program that allows three states to each reconstruct one Interstate highway using toll finance. (Federal law otherwise prohibits using tolling on "existing" Interstate lanes, except for converting HOV lanes to HOT lanes.) NCDOT put forward a plan to reconstruct and widen the 182 miles of I-95 under this program, at an estimated cost of $4.4 billion. That plan has generated considerable political opposition.

Whether I-95 is the Interstate corridor most in need of reconstruction and widening should be examined carefully by the new Administration. Among the factors to be considered are the relative age and condition of each Interstate and the projected growth in traffic on each, especially truck traffic. Table 12 shows data on truck traffic from FHWA's Freight Analysis Framework for the six principal North Carolina Interstates. As can be seen, I-40 carries the highest total truck traffic, followed by I-85 and then I-95. FHWA forecasts truck traffic on all three to be 85-88 percent higher by 2040—i.e., nearly double today's level.

Table 12: Projected NC Interstate Truck Traffic

Interstate	Route Miles	Lane Miles	Average Lanes	Daily Truck VMT 2007	Daily Truck VMT 2040	Percent Increase, 07-40
I-26	53	227	4.3	306,341	568,667	86 percent
I-40	420	1990	4.7	3,512,460	6,562,304	87 percent
I-73/74	59	276	4.7	145,796	285,622	96 percent
I-77	101	472	4.7	1,056,176	2,111,719	100 percent
I-85	205	1127	5.5	1,913,215	3,546,645	85 percent
I-95	182	725	4.0	1,205,750	2,276,330	89 percent

Source: FHWA Freight Analysis Framework

Table 13 presents aggregated data for all six NC Interstates, projecting their traffic growth—both cars and trucks—through 2050, using growth rates estimated by FHWA. Overall Interstate traffic will increase 86 percent by 2040 and by 131 percent by 2050.

Table 13: Projected NC Traffic on All Interstates

Year	Light Vehicles Annual VMT (M)	Heavy Vehicles Annual VMT (M)	Total Annual VMT (M)	Percent Trucks	VMT Percent Increase from 2010
2010	17,605	3,298	20,903	16 percent	0
2020	21,043	4,585	25,628	18 percent	23 percent
2030	25,153	6,375	31,528	20 percent	51 percent
2040	30,065	8,863	38,928	23 percent	86 percent
2050	35,937	12,322	48,259	26 percent	131 percent

Source: Calculations based on FHWA estimated growth rates, R. Poole.

As one of America's fastest-growing states, North Carolina will continue to depend on its Interstates for both personal and freight transportation. Ensuring that these vital arteries are expanded and modernized for the next 50 years is essential to the state's continued growth and

prosperity. And since (1) fuel tax revenues will be grossly inadequate to pay for Interstate reconstruction and modernization and (2) North Carolina needs to start planning for the transition from fuel taxes to mileage-based user fees, financing the needed Interstate program via mileage-based all-electronic tolling is a highly promising approach.

Pricing and Managed Lanes

Traffic congestion is a chronic problem in North Carolina's largest urban area, Charlotte, and is also a problem in Raleigh-Durham and the Triad area (Greensboro and Winston-Salem). Some dimensions of the problem, as of 2012, are provided in Table 14. In Charlotte, the average commuter wastes 40 hours per year stuck in traffic congestion. While that might not sound like much, the cost of this wasted time and fuel averages $898 per commuter per year in Charlotte, and from $435 to $588 per year in the other three urban areas. The nearly 29 million hours per year wasted in Charlotte add up to a direct economic cost for the area of $635 million a year, and nearly $400 million a year in Raleigh-Durham.

The travel time index (TTI) measures how much longer it takes to travel a given route during peak periods, compared with uncongested times. Charlotte's TTI is 1.20; that means on average, it takes 20 percent longer to get somewhere during rush hours than at other times. But that average masks the large *variation* in traffic delays. The planning time index (PTI) is a measure of how much drivers have to add to planned commuting time to have a 95 percent probability of getting there on time. For Charlotte, the PTI is a whopping 3.20, meaning drivers should plan on more than three times as much time as the trip would take during uncongested hours to be sure to arrive on time 19 times out of 20. In both Raleigh-Durham and Winston-Salem the PTI tells the driver to plan more than twice as much time as the trip would take during uncongested hours.

Table 14: Congestion in North Carolina Urban Areas, 2011

	Charlotte	Raleigh-Durham	Greensboro	Winston-Salem
Annual Delay Hours/ Commuter	40	23	27	20
Annual Cong Cost /Commuter	$898	$502	$588	$435
Travel Time Index (TTI)	1.20	1.14	1.10	1.11
Total Hours of Delay (millions)	28.97	17.92	6.62	5.38
Total Congestion Cost ($M)	$653	$396	$146	$119
Planning Time Index (PTI)	3.20	2.34	1.59	2.09

Source: *2012 Urban Mobility Report*, Texas Transportation Institute, Dec. 2012

Until recently, the only feature on many U.S. freeway systems aimed at reducing congestion was to set aside certain lanes for higher-occupancy vehicles. The intent was to reward those who changed their behavior from driving alone to sharing rides with others, thereby leaving their car at home and reducing the number of vehicles on the freeway during peak periods. Unfortunately, most HOV lanes are failures in this regard.

First, in nearly all urban areas over the last three decades, the fraction of work trips made via carpool has trended downward, even as more and more miles of HOV lane have been added. Driving alone remains the overwhelming choice of commuters, with its share of work

trips virtually the same as 30 years ago.[32] Second, the large majority of HOV lanes are poorly utilized. New lanes are very costly to add to a freeway, so if such a lane carries far less than its full capacity, part of that investment of highway funds has been wasted. On the other hand, a minority of HOV lanes, especially in very large urban areas like Los Angeles and San Francisco, are overcrowded and fail to meet the federal standard of maintaining at least 45 mph during peak periods 90 percent or more of the time. HOV lanes that are as slow and congested as general-purpose (GP) lanes don't offer much of a reward for carpoolers. Finally, survey data reveal that in most metro areas, a majority of those using HOV lanes are either family members who would be traveling together anyway[33] (and therefore are not reducing the number of cars at rush-hour) or violators who usually don't get caught. In Charlotte, the I-77 HOV lanes are restricted to 2+ person vehicles, but are significantly under-utilized while the adjacent general-purpose lanes are congested during the peak hours.

As these failures became increasingly visible, a growing number of urban areas have desired to convert their HOV lanes. Federal law does not permit converting them to general-purpose (GP) lanes, but allows and even encourages converting HOV lanes to high occupancy/toll (HOT) lanes. In such lanes, carpools are still allowed to use them, but the unused capacity is sold, at a variable price, to drivers who would not qualify based on vehicle occupancy. In other cases, new express toll lanes are being financed based on toll revenue and added to congested freeways. These newer lanes generally require at least three people in the vehicle to qualify for free or reduced-rate usage of the lanes. Such lanes are in operation in Orange County, CA, Miami, and northern Virginia near Washington, DC; similar express toll lanes are under construction in Baltimore, Dallas, and Fort Worth. The generic term for specialized lanes—as opposed to the traditional GP lanes—is "managed lanes." Increasingly, this term is used to refer to priced lanes, such as HOT lanes and express toll lanes.

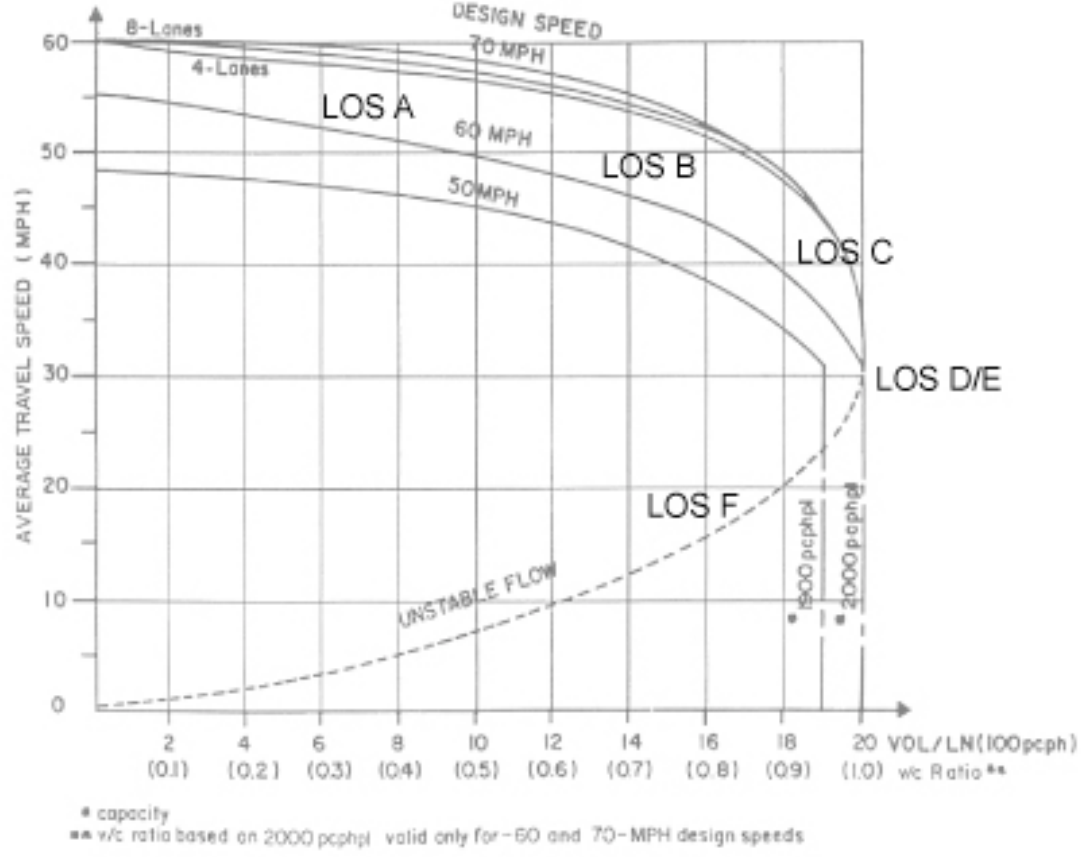
All versions of priced managed lanes make use of all-electronic tolling (AET) and variable pricing. AET is required because toll booths would be totally impractical on congested urban freeways. Variable pricing is the key to these lanes being able to deliver sustainable congestion relief, unlike HOV lanes. The key is to use variable pricing to keep the lanes operating at the optimal combination of speed and vehicle throughput to make the highest-value use of these lanes' capacity. Typically this is a speed in the vicinity of 55 mph and a throughput of about 1700-1800 vehicles per lane per hour. This 'sweet spot' on the speed/flow graph is shown in Figure 2. Variable pricing is the only proven way of maintaining lane performance of this kind.

Should North Carolina's urban areas address traffic congestion with priced express lanes? This is certainly an option that should be considered, especially in the more-congested urban areas. If existing HOV lanes are under-utilized, it is not very costly to add the equipment needed for AET and convert those lanes to HOT lanes. And any HOV lanes that become over-used face a mandate from FHWA, required by the MAP-21 legislation, to bring such lanes into compliance with the federal standard of 45 mph or better, at least 90 percent of the time during peak periods.[34] The most reliable way to do this is to increase the occupancy requirement,

[32] Cox, W, "A Summary of 2011 Commuting Data Released Today," www.newgeography.com, September 20, 2012.
[33] McGuckin N and Srinivasan, N, "The Journal to Work in the Context of Daily Travel," presentation at TRB Census Data for Transportation Planning Conference (www.trb.org/conferences/censusdata/Resource-Journey-to-Work.pdf).
[34] Poole, RW Jr., "A Gift from Congress for HOV and HOT Lanes," *Surface Transportation Innovations*, Issue No. 110, December 2012.

which would usually be from two persons to three. We know from experience that when such a shift is made, the number of three-person carpools will be far lower than the total number using the lane when the requirement was only two. And that creates the opportunity to convert the lane to a HOT lane, to make use of the newly available excess capacity.

Figure 2: Expressway Lane Speed/Flow Curve



Source: Highway Capacity Manual, 2000.

When it comes to adding new managed lanes to a congested freeway, the potential exists to finance a large fraction of the construction cost using the toll revenue that will be generated (assuming that there is enough congestion in the regular lanes to make it worth people's while to pay to bypass it). In such cases, the difference between a 2-person HOV requirement and a 3-person requirement is huge when it comes to revenue. An express toll lane that limits free passage to vehicles with three or more persons, but also charges solo-drivers for use, can generate more than 10 times as much revenue as one that essentially gives away a majority of its capacity to two-person carpools (as is the case for a number of HOT lanes that retain a 2-person requirement).[35] The much larger toll revenue can support debt service payments on toll revenue bonds and federal TIFIA loans, which may be able to pay for the majority of the cost of building the new lane. In several recent projects of this type, in Texas

[35] Poole, RW Jr., "Managed Lanes: Networks vs. Individual Facilities," Table 1, Paper No. 10-0770, presented at Transportation Research Board 2010 Annual Meeting, January 2010

and Virginia, the state ended up paying only 20 to 30 percent of the project cost, with the rest being covered by toll-based financing.

One of the priced managed lanes projects, in Austin, will charge all automobiles to use the lane, without any special breaks for carpools; that is also true of the managed lanes under construction on I-95 in Baltimore. Those projects will still support higher-occupancy vehicles such as vanpools and express buses. An eight-person van provides as much person throughput as four HOV-2 vehicles, and a 50-person express bus provides as much person throughput as 25 HOV-2 vehicles. Express toll lanes planned in cooperation with transit and ride-sharing agencies can still aim for high person throughput, with minimal loss of toll revenue.

Another reason to think carefully about whether to allow carpools free use of costly express toll lanes is enforcement of the occupancy requirements. To the extent that HOV lane occupancy is enforced, it is only on a random basis, by highway patrol officers visually observing how many people are in cars using the lane. Because this is very costly, these lanes are never monitored on a full-time basis. Various kinds of technologies have been proposed, and some of them tested, for automated occupancy detection, but so far none have proved workable. On several of the newest HOT lanes projects (in Los Angeles and in northern Virginia), the technology selected is a switchable transponder, on which the driver selects one, two, or three occupants and the device sends that information when it passes beneath the toll-collection antenna. In principle, information about which vehicles have declared themselves as eligible carpools can be transmitted to patrol cars, which are supposed to watch for those cars, by license plate number, and visually check on how many occupants are inside. No data are yet available on how well this will work.

An option yet to be tried is off-line enforcement, based on granting free passage only to "registered" carpools sponsored by an employer and registered with the local ride-sharing agency. The transponder account for such vehicles would be recognized by the tolling software as eligible for free (or discounted) passage during peak periods, but drivers of those vehicles would pay the regular toll if they use the lanes at other times. The ride-sharing agency would be responsible for regular audits of participating firms, to ensure that the registered carpools were still in operation and hence entitled to free passage during peak periods.[36] Several recent HOT lane projects (in Atlanta, Los Angeles, and Miami) have required carpools to register in order to get free passage, but none have yet implemented off-line occupancy enforcement.

State DOTs have designed managed lanes in a variety of ways. Two key questions are the method of separation from regular lanes and where vehicles can enter and leave the express lanes. Some HOV lanes offer continuous access across a dashed pavement stripe. One drawback to this approach is that when traffic in the regular lanes slows down, drivers in the HOV lane typically slow down as well, since they know vehicles in the regular lanes may dart into the HOV lanes. By contrast, most priced managed lanes are separated more definitively from the regular lanes—either by a painted double-line buffer, a set of plastic pylons, or a concrete barrier. Any of these forms of separation limit managed-lane entry and exit to a relatively small number of access points. With pylons or concrete barriers, vehicles in the managed lanes generally do not slow down when the regular lanes do, since drivers don't have to worry about regular-lane drivers darting into the managed lanes.

There is not necessarily one best way to separate managed and GP lanes, and the choice must be tailored to the specifics of each project. In general, continuous access is not a good

[36] Poole, RW Jr., "Automating Managed Lanes Enforcement," Paper #09-0385, presented at Transportation Research Board 2009 Annual Meeting, January 2009

idea for managed lanes, due to their need to operate reliably at significantly faster speeds than the GP lanes. In addition, the number of ingress and egress points needs to be limited, for operational reasons. This has led some state DOTs (e.g., Florida DOT) to rename the GP lanes as "local" lanes, as distinguished from the priced "express" lanes, to educate drivers that the express lanes are intended for longer-distance travel. Some new managed lanes (e.g., those added to the I-495 Capital Beltway outside Washington, DC) make extensive use of direct access ramps (from bridges over the expressway) to get vehicles into and out of the express lanes. While more costly than ingress/egress via "slip ramp" from adjacent regular lanes, direct access ramps reduce the extent of conflict between slow-moving vehicles in GP lanes and faster vehicles in the managed lanes. These design considerations, as well as many policy aspects regarding whether and when to implement priced lanes, are addressed in some detail in a new guidebook from the Federal Highway Administration.[37]

Summing up, NCDOT should analyze the potential for priced managed lanes in the four urban areas with the greatest extent of traffic congestion (per Table 1). Existing HOV lanes may well be candidates for conversion to HOT lanes, and in some cases (e.g., Charlotte and possibly Raleigh), there may be corridors congested enough to warrant the addition of new lanes as priced managed lanes.

Interstate Widening

A modernized highway network that can adequately move traffic from point A to point B is vital for North Carolina. The state's Interstates and freeways are the top priority since they carry a disproportional share of all North Carolina traffic, about 20 percent. Interstates and freeways are limited access highways without traffic lights such as I-85 and I-95 that move large numbers of vehicles longer distances at relatively high speeds.

. There are three major reasons to improve the Interstate highway network. First, a better highway network will make commuting quicker and less stressful. Auto commuters make more than 90 percent of all commuter trips in the state. While urban congestion is moderate in parts of the state, it is a significant issue in Charlotte, Raleigh, and other large regions. Second, an improved highway network makes logistics and shipping quicker and more dependable, which is crucial to the North Carolina economy and particularly companies that rely on just-in-time shipping. Third, an enhanced highway network will help tourism. North Carolina is one of the top tourism destinations in the southeast. Charlotte, Raleigh-Durham, the mountains, and the beaches contribute billions of dollars annually to the state economy. Many tourists drive to the state and other rent cars when touring state attractions.

How dependent is North Carolina on a quality highway network? Approximately 92 percent of residents commute to work by car.[38] Eighty-one percent drive alone and 11 percent carpool. Only 1 percent use transit; while this number is higher in Charlotte and Raleigh it is significantly lower throughout the rest of the state. While 1.8 percent walk, only 0.2 percent use a bicycle.

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[37] Federal Highway Administration. *Guide for Priced Managed Lanes Development*, March 2013.

[38] US Census Bureau, American FactFinder, at: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_11_5YR_S0801&prodType=table (accessed March 19, 2013).

Calculating whether or not it is appropriate to widen a highway and how many lanes to add is a challenging issue. Modern 4-lane freeways with ideal geometrics and traffic conditions can carry upwards of 24,000-25,000 vehicles per lane per day, or about 100,000 ADT (at LOS E, 'maximum flow')[39]. At traffic volumes above this, peak hours lengthen and traffic regularly stalls. But older freeways with tighter geometrics, higher percentages of trucks, or in hilly terrain often have lower maximum capacities, closer to 80000-90000 ADT.

Further, most agencies design for better circumstances than LOS E. NCDOT generally uses a Level-of-Service D ('moderately congested") standard for capacity[40]. From a strict 'traffic' viewpoint, widening is considered a priority if the projected traffic is higher than the LOS D standard. For general planning purposes (*not* detailed location-specific design) Table 15 below shows, for example, the maximum daily traffic volumes that would be permitted for LOS D 'coastal plain' freeways. That means, for example, that for a rural 4-lane freeway on the 'coastal plain' with 10 percent 'peak hour trucks (such as I-95), the maximum allowable volume for LOS D would be 66,200. So, if the projected 20-year traffic volume for this road is above 66,200, then 6 lanes would be needed to carry the traffic at LOS D or better. Similar tables are available for other regions of the state and for other circumstances. Additionally, land costs, benefit-cost analysis, likely traffic growth, the role of transit and community preferences are all important factors.

Table 15: NCDOT LOS D Threshold Volumes, 'Coastal' Area Freeways

	Four Lanes			Six lanes			Eight Lanes		
Pct Trucks	**Urban**	**Suburban**	**Rural**	**Urban**	**Suburban**	**Rural**	**Urban**	**Suburban**	**Rural**
0-5%	67400	66900	67900	102000	101300	101800	137300	136200	135700
6-10%	65700	65400	66200	99600	98900	99400	134000	133000	132500
11-15%	64200	63800	64700	97300	96600	97100	130900	129900	129400
16-20%	62800	62400	63200	95100	94400	94900	127900	126900	126500
21-25%	61400	61000	61800	93000	92300	92700	125100	124100	123700
26-30%	60000	59700	60500	90900	90300	90700	122400	121400	121000
31-35%	58800	58400	59200	89000	88400	88800	119800	118800	118400

Of course, the critical assumption, that LOS D is the appropriate design standard, is also open to question. In practice, 4-lane freeways around the US would probably not be widened at volumes much less than 100,000 ADT (near or over LOS E levels) since the money to do this is simply not available. Even in North Carolina, there are numerous sections of 4-lane freeway that are already above 75,000 ADT, and several are near 100,000 ADT:

Table 16: North Carolina Interstate 4-lane Sections with ADT > 75,000

Route	Region	From	To	Lanes	2011 ADT
I-26	Asheville	Exit 31	Exit 40	4	75000
I-440	Raleigh	I-40	Exit 1D	4	77000
I-440	Raleigh	Exit 1D	Exit 3	4	83000
I-485	Charlotte	Exit 59	Exit 64	4	88000
I-77	Charlotte	Exit 23	Exit 31	4	92000

[39] National Research Council. *HCM 2010: Highway Capacity Manual*. Washington, D.C: Transportation Research Board, 2010.

[40] North Carolina Department of Transportation, Transportation Planning Branch, LOS D Traffic Volume Standards for Systems Planning, Raleigh NC, October 14, 2011.

One could make a similar argument for roads with presently 6 lanes: many are already over 100,000 ADT but few are near 150,000 ADT and probably would not be widened at 100,000 ADT.

With the understanding that the issue is complex, the following are examples of some sections of NC Interstates that have traffic volumes close to or exceeding design capacity, and thus might be candidates for widening:

- I -26, in and around Asheville,
- I-40, near Hickory,
- I-40, in and around Winston-Salem
- I-40, in and around Greensboro
- I-40, in and near Durham and Raleigh
- I-440, around Raleigh,
- I-77, between Exit 4 and Exit 31, through Charlotte
- I-85, in and around Gastonia
- I-85, between Kannapolis and China Grove,
- I-485, between Ballantyne and I-77 south of Charlotte.

In addition to these Interstate sections, other sections of other freeways, and some sections of urban arterials may also be approaching design capacities and warrant consideration for widening.

Performance-Based Highway Maintenance Contracting

Many transportation agencies in the United States and around the world have contracted some maintenance of their roads and highways as a way to lower maintenance costs (relative to in-house, government provision) and deliver better value for taxpayers. However, outside of some limited contracting of highway landscaping services, the North Carolina Department of Transportation has thus far made modest use of highway maintenance contracting.

The traditional approach to road and highway maintenance contracting used by state transportation agencies involves piecemeal contracting for certain aspects of road maintenance—e.g., pavement, signage, guardrails, landscaping, snowplowing, etc.—and are unit- or work-order oriented. Contracting companies are paid for the amount of work they complete, as opposed to the quality of work that they provide. These contracts are usually limited to one year with potential additional option years. While traditional road maintenance contracting can offer significant cost savings over in-house government provision, there is little to no flexibility in determining work methods, as the contracting agency typically defines the work processes. In effect the private contractor mimics the agency's processes, which by definition, severely restrict innovation and limit the potential cost benefits.

Yet, highway maintenance contracting has been evolving in recent decades toward a more performance-based approach. Current best practices in highway maintenance contracting rely on longer-term, multi-year performance-based road maintenance contracts. The public agency defines an end outcome goal, and the contractor decides how best to achieve the desired outcome. The contract creates clearly defined performance measures, outcomes and timetables, and it allows for new and innovative delivery methods, opportunities for value engineering, and improved efficiencies.

One form of performance-based contracts in road and highway maintenance is total asset management, also known as "fence-to-fence" maintenance contracts. These contracts cover maintenance services for every part of the road or highway (i.e., everything from "fence-to-fence," including repairs, signage, guardrails, landscaping, and the like[41]), and they specify minimum performance standards and desired end outcomes. Contractor payments are similarly performance-based, and they tend to include bonus payments for high or exceptional performance and penalties for poor performance with fines, aligning the incentives between the public and private sectors.

Performance-based total asset management contracts are typically fixed-cost in nature and of a longer duration than traditional contracts—typically five or more years with extension options at the end—which sets the stage for budget predictability in the maintenance budget (through fixed-cost pricing, where maximum payments are known in advance). Further, these contracts transfer significant risks from the agency to their private sector partners. Performance-based road maintenance and management contracts could cover individual facilities, facilities in a common category, facilities within individual districts, facilities in bundles of districts, and even facilities agency-wide.

According to a comprehensive report on the international implementation of performance-based maintenance contracting released by the Transportation Research Board (TRB) in 2009, "[t]here is evidence that PBMC results in better outcomes at lower cost with less risk and more financial predictability for highway agencies."[42] Among the motivations behind the adoption of performance-based maintenance contracting cited in the TRB report are:

- Potential to reduce agency costs;
- Potential to increase level of service;
- Changing from focus on inputs and outputs to a focus on delivering performance-based, customer oriented outcomes;
- Ability to achieve budget stability, given the fixed-cost nature of contractor payments;
- Shifting risks from public agency to private contractors, or sharing risks;
- Ability for the contractor to potentially minimize life-cycle costs; and
- Allowing contractors to innovate with flexibility in how to achieve performance targets, as opposed to requiring adherence to strict method specifications.[43]

This performance-based asset management approach was pioneered in Australia, Canada, and New Zealand and has since spread around the world. In the early 1990's, Australia entered a 10-year, $130 million performance-based contract including all maintenance activities for 450 km of urban roads. A 1999 World Bank report estimated that the condition of the roads had improved by an estimated 15 percent at a cost savings of 35 percent. Similarly, over the last two decades, nearly all road and highway works have been contracted

[41] This "fence-to-fence" approach is different than the traditional division of maintenance into "light" (off-pavement maintenance activities to include, grass mowing, litter removal, tree trimming, rest areas, sign/ guiderail repair, painting and runoff monitoring) and "heavy" (on-pavement maintenance activities, to include asphalt and ALL on-road maintenance at the risk of the contractor).

[42] Hyman, W, *Performance-Based Contracting for Maintenance*, National Cooperative Highway Research Program Synthesis 389, (Washington D.C.: Transportation Research Board, 2009), p. 2, http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_389.pdf (accessed March 18, 2013).

[43] Ibid, p. 9.

out in New Zealand, and countries including Norway, Sweden, Holland, the United Kingdom and various Canadian provincial governments have used a similar approach.

The 2009 TRB report on performance-based maintenance contracting found that by 2005, 35 countries had performance-based maintenance contracts and an additional 15 countries were exploring adoption. Table 17 shows estimated cost savings through performance-based maintenance contracting relative to traditional contracting approaches in several jurisdictions, ranging from roughly 10 to 40 percent.

Table 17. Performance-Based Maintenance Contract Cost Savings, Selected Countries

Country/Jurisdiction	Cost Savings Relative to Conventional Maintenance Contracting
Norway	About 20-40%
Sweden	About 30%
Finland	About 30-35%
Holland	About 30-40%
Estonia	20-40%
England	10% minimum
Australia	10-40%
New Zealand	About 20-30%
United States	10-15%
Ontario, Canada	About 10%
Alberta, Canada	About 20%
British Columbia, Canada	Some, but might be on the order of 10%

Source: Pakkala, P cited in World Bank Transport Note No. TN-27, September 2005, cited in William Hyman, *Performance-Based Contracting for Maintenance*, National Cooperative Highway Research Program Synthesis 389, (Washington D.C.: Transportation Research Board, 2009), p. 11.

The Virginia Department of Transportation became the first to adopt this approach in the U.S in 1996, outsourcing over 250 miles of Interstate maintenance to one contractor in a 5.5-year, $130 million fixed-cost contract that covered all maintenance—including routine repairs, preventive treatments, rehabilitative and restorative maintenance, labor, materials, and equipment—necessary to meet the contractual performance standards.[44]

Though comparing the costs of service provision between public and private entities can be a complicated endeavor, several studies tried to quantify the cost savings attributed to Virginia's maintenance approach, with savings estimated to be between 6 and 20 percent. Given the success of the program, Virginia legislators passed a law in 2006 expanding this performance-based contracting approach to cover the maintenance of all of the state's Interstate highways.

The Florida Department of Transportation (FDOT) has taken the performance-based highway maintenance contracting model even further since it began using the approach in 2000. As of the end of 2012, Florida had a total of 33 total asset management contracts in place, covering all manner of road typologies and geographies—i.e., specific Interstate segments, entire stretches of Interstate, entire FDOT districts, bundles of highway segments,

[44] Ybarra, S, "Virginia Saving Money With Fixed-Price Interstate Maintenance Deal," May 8, 2008, http://reason.org/news/show/virginia-saving-money-with-fix (accessed March 18, 2013).

toll roads, etc.—and the agency plans to pursue 12 additional contracts in the coming years.[45] FDOT officials estimate that approximately 80 percent all state highway maintenance is now contracted out, with plans to increase that share to 90 percent in the coming years, with 50 percent being completed under total asset management contracts and 40 percent completed under traditional work order contracts (the remaining 10 percent of FDOT maintenance is performed by in-house crews).[46] The agency has also noted a significant improvement in the overall level of service, as the state's highway maintenance rating program scores have consistently improved over the last decade.[47]

Though current savings estimates are not available, a 2005 FDOT report found that, at that time, the state estimated a total savings of $105 million (or 17 percent) through the use of total asset management contracts, and agency officials have also noted a significant reduction in the amount of administrative resources needed to manage the program (relative to traditional, piecemeal contracting approaches), including reductions in the number of contracts to manage (from hundreds down to dozens), vendor payments processed, and more.[48]

Florida Department of Transportation Secretary Ananth Prasad commented on the benefits of performance-based maintenance contracting in a November 2012 Reason Foundation interview:

> *We gain efficiencies in operations. We see efficiencies of scale in bundling the maintenance to make the responsibility cover "fence-line-to-fence-line," from milepost to milepost. We don't have to go and procure a contractor for fence work, procure a contractor to mow, procure a contractor for potholes and guardrail, etc. Now what we're doing is bundling all of that to gain efficiencies there, and the firms can gain some efficiencies there too. The risks can be spread across all the elements.*
>
> *And in return, we get a better price and we save money. And there are significant cost savings from a contract administration standpoint and significant cost savings from a contract procurement standpoint. But in the large scheme of things, it gives us cost efficiencies by bundling all of these into one contract—a long-term contract that's a lump-sum contract—so not only do we get all of the benefits I've mentioned, but it also gives us a price stability. It's a long-term, stable cost, doing routine maintenance with very low administration costs. Instead of managing 20 contracts, for example, now we're managing four or five.*
>
> *Our contracts are seven-year contracts, so we basically get a price upfront for seven years, and know what's it's going to cost. I don't have to take bids, and if the costs go up, that's a risk that the private sector is taking. In an era when we don't know what*

[45] Florida Department of Transportation, Asset Maintenance homepage, http://www.dot.state.fl.us/statemaintenanceoffice/asset.shtm (accessed March 18, 2013).
[46] Gilroy, L, Phone interview with Tim Lattner and Michael Sprayberry of the Florida Department of Transportation's Maintenance Division, October 29, 2012.
[47] Ibid.
[48] Florida Department of Transportation, *Asset Management Program Summary*, April 2005.

the future revenues are going to be or what's going on at the federal level with their program, having price stability is huge.[49]

In addition, the Texas Department of Transportation announced in August 2012 that it had saved $10 million (30 percent) over traditional delivery methods in a Houston-area pilot project on performance-based maintenance contracting, and it plans to extend a similar contracting model to Interstates and state highways in the Houston, Dallas, and San Antonio metropolitan areas.[50] The agency estimates that expanding performance-based maintenance contracting to these areas would save the state approximately $120 million over a five-year period, which would be invested in other highway maintenance work across the state.[51]

Obviously, performance-based maintenance contracting has to consider the impacts on agency staffing, stakeholder concerns, and public perceptions. But given the experiences and successes seen in Florida, Virginia and Texas, a similar use of performance-based road maintenance contracting could help North Carolina transportation officials lower the costs of highway maintenance, hold their maintenance budgets flat, and ensure that core maintenance priorities are covered. NCDOT should consider the expanded use of performance-based highway maintenance contracting on state highways and other transportation facilities.

[49] Gilroy, L, "Delivering Florida's 21st Century Transportation System Through Tolling, Managed Lanes and Public-Private Partnerships," November 21, 2012, http://reason.org/news/show/1013145.html (accessed March 18, 2013).

[50] Texas Department of Transportation, "TxDOT Looking to Private Sector for Routine Maintenance Help to Create Value and Generate Cost Savings of $120 Million," August 27, 2012, http://www.txdot.gov/news/038-2012.htm (accessed March 18, 2013).

[51] Ibid.

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projects including the successful 91 Express Lanes in Orange County. More than 20 other states and the federal government have since enacted similar public-private partnership legislation. In 1993, Poole oversaw a study that coined the term HOT (high-occupancy toll) Lanes, a term which has become widely accepted since. California Gov. Pete Wilson appointed Poole to the California's Commission on Transportation Investment and he also served on the Caltrans Privatization Advisory Steering Committee, where he helped oversee the implementation of AB 680. From 2003 to 2005, he was a member of the Transportation Research Board's special committee on the long-term viability of the fuel tax for highway finance. In 2008 he served as a member of the Texas Study Committee on Private Participation in Toll Roads, appointed by Gov. Rick Perry. In 2009, he was a member of an Expert Review Panel for Washington State DOT, advising on a $1.5 billion toll mega-project. In 2010, he was a member of the transportation transition team for Florida's Governor-elect Rick Scott. He is a member of two TRB standing committees: Congestion Pricing and Managed Lanes. In this report, Mr. Poole prepared detailed sections for private-public-partnerships, tolling and pricing, and provided additional materials for other sections and recommendations.

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Appendix: Detailed Descriptions of Suggestions and Recommendations

Administration		
ID	**Short Description**	**Description**
ADM-01	Ensure that 'modal advocacy' is NOT a goal of any office of the DOT.	NCDOT should focus on providing high-quality cost-effective *access* for NC citizens, to the destinations they want to go and via the mode they want to use. *Mobility* (the *use* of transportation facilities) on the other hand, is the responsibility of individuals. Championing one mode over another (for example, by separating projects by mode in project evaluation, or by providing modal services in advance of demonstrated need) results in low cost-effective projects and wasted public dollars. NCDOT offices should specifically NOT advocate one modal use over others, but evaluate their appropriateness head-to-head in each circumstance.
ADM-02[52]	Focus performance measures on service delivery	New federal legislation (MAP-21[53]) creates performance measures for conditions on the National Highway System, safety, freight, congestion mitigation, and air quality. Of the six NCDOT Executive Performance Measures listed for SFY 2013 that address the goal of "efficiency", two deal with changes in customer behavior (increase transit ridership levels, and increase port cargo movements). Revise these to address the quality of service delivery (e.g., percentage of buses running on time, and speed of movement of container and break-bulk cargo). Ensure that NC measures for MAP-21 are in compliance.
ADM-03[54]	Add an 'effectiveness' goal	The transportation system is in place to provide adequate cost-effective access to the places people want to go. Does it do this? Some measures of 'access' are needed; e.g., percentage of population within 10 miles of a 4-lane hwy, percentage of population/employment within 1/4 mile of a transit stop, percentage of population with access to demand responsive transportation, average commute times, percentage of transit riders without cars, etc.
ADM-04[55]	Add a 'planning success' goal	Current performance measures in the 'works well' goal focus on schedule and budget concerns; no planning concerns are reviewed. A key mission of planning is to estimate the facility usage (traffic counts, transit ridership, bike path use, etc.) for proposed projects. A performance measure might be: "percentage of major projects that reached the level of use that planners predicted and that was used to justify the project: 85 percent or greater". Over-estimates of traffic should also be tracked.

[52] North Carolina Department of Transportation, Metrics for State Fiscal Year 2013, at: http://www.ncdot.gov/download/performance/executivemeasures.pdf (accessed March 19, 2013).
[53] MAP-21 (Public Law 112-141, 216Stat.405), July 6, 2012.
[54] North Carolina Department of Transportation, Organizational Performance, at: https://apps.dot.state.nc.us/dot/dashboard/ (accessed March 19, 2013).
[55] Ibid.

ADM-05[56]	Add nearby state comparative metrics to DOT dashboard	The 'dashboard' currently shows NC data by state and by county, and in some cases as compared to the US average. Add the performance of nearby states so that citizens can see how we compare to SC, VA, TN, and GA.
ADM-06	Evaluate the e-procurement system	Evaluate the e-procurement system for return on investment. The 1.75 percent charged on purchases of materials such as aggregates should be exempt. Also, reconciling e-procurement invoices is complex and time consuming.
ADM-07	Expand the suggestion reward program	Institute a program that offer rewards for suggestions that lead to improvement in procedures that further mission accomplishment. Suggestions should be evaluated by a panel outside of the chain-of-command, in such a way that rewards do not depend on implementation.
ADM-08[57]	Realign Divisions/Expand Division functions	The present alignment of the 14 DOT Divisions dates from the 30's, and bears little resemblance to the functional economic regions of the state. But realignment is complex and would affect many functions. Realign the 14 divisions to better match the state's Economic Development Regions. Realign the Regional Mobility Development Specialists (who currently coordinate transit funding in 10 Districts) to match the Economic Development Regions as well. Concurrently or separately, expand Division responsibilities for some planning activities, project data and selection, and some categories of funding. Raise the amount for Division-lead highway projects to $ 3 million, to better use existing staff.
ADM-09	Reduce the Board Membership	Only about ½ of the states have a Transportation Board, and those that do generally have smaller policy-oriented boards. Only one state (PA) has a larger Board (23 members) compared to NC's 19 members. Recent administrative changes have reduced the responsibilities of the Board to select projects. Therefore, specific location-based selection of projects by Board members is less important than in the past. Reduce membership to the Board of Transportation from its current 19 members (largely location-based) to a smaller Board of 5-7 at-large members (but geographically balanced) with transportation expertise representing specific policy issues.
ADM-10[58]	Ensure equal road quality everywhere.	The current situation, in which large regions of North Carolina have substandard lane widths, shoulder widths, and road conditions, is intolerable and would not be permitted for other services such as health or education. Adopt as state policy a goal to have an equal-quality road system in all regions of the state.

[56] Ibid.
[57] Solicited suggestion.
[58] Hartgen, DT, Cost-*Effectiveness of North Carolina's Major Road Projects*, a Report for the John Locke Foundation, 2004.

ADM-11[59]	Set targets for level of road condition and time to achieve it.	North Carolina's road system has evolved over a long period of time, from at least the 1920s, and its current status reflects the difficulties of providing uniform pavement and bridge condition, lane width, shoulder width, and capacity in widely varying terrains. The state's road funding formulas are not presently based on performance targets. Therefore, the targets for more uniform conditions should provide goals (e.g., percentage of rural secondary roads rated <50) and target dates (e.g. 10 years) both the necessary time and the requisite funding to make reasonable progress without unduly hampering needs in other dimensions. In addition, the measures and targets should conform to federal MAP-21 requirements.
ADM-12[60]	Ensure that performance measures guide management	NCDOT's Performance Dashboard provides a snapshot of how NCDOT is performing in several metrics. However, it is not clear that the information is actually used to guide decision-making, or that the annual performance report includes adequate context for the Board, Secretary, or staff to make decisions. All measures should be tracked over time, and used to guide funding decisions. Project delivery time, pavement condition, and accident data should be tracked over time to determine trends. The performance report also does not include metrics related to congestion and accessibility. These important measures should be added.
ADM-13[61]	Develop objective project delivery data	Project delivery rates are a basic metric for most state DOTs, but NCDOT's actual project delivery rate remains unknown. The STIP contains projects from the 1990's, and some projects first included in the 1980s or earlier. Some projects have been through the NEPA process once, twice, or even three times. Some of these projects are strategic and still needed, others are less needed. All projects that have been in the STIP for more than ten years should be evaluated for continued viability. Projects that solve 'yesterday's problems' should be eliminated. The Annual Performance Report should include the number of projects in development and the number of projects that have completed NEPA and permitting during the previous year. A related problem is the delay of projects in the 1-5 year work plan. NCDOT needs to do a 'root cause' analysis of why projects in year 1-5 of the work plan are delayed. DOT's delivery rate for these projects hovers around 60 percent. The first year of the STIP appears to be over-programmed by around 30 percent.
ADM-14[62]	Improve training for DOT staff	NCDOT's staff is critical to its ultimate success. DOT needs to significantly improve employee skills and engagement. This means identifying employee skills and preferences and matching them with jobs. Getting the right people into middle management is also a critical issue. Employee recruitment, skills and management capabilities should continuously be addressed. The state's community colleges and universities can assist in this effort.

[59] Ibid.
[60] Solicited suggestion.
[61] Solicited suggestion.
[62] Solicited suggestion.

ADM-15	Expand the use of GIS tools	Virtually everything that DOT manages (road sections, bridges, signs, trucks, maintenance sheds, etc) is location-based. So-called 'geographic information systems' are now available that use 'location' as the building block of transportation management. NC reports using 9 applications of GIS, but the NC applications are for peripheral services (library, public interface) as opposed to core functions. The potential use of GIS in other activities include: roadway inventory, maintenance management, project planning, project management, project data display interface, accident data management, transit inventory, transit operational management, bike-ped project planning and management, mapping, and public interface.
ADM-16[63]	Re-evaluate management of Turnpike Division	North Carolina set up its Turnpike Authority to fast-track various toll road projects. Recently the Authority was fully integrated into the DOT, and very recently the Legislature moved several Authority-listed projects back to the Mobility Fund. Given that tolls are a mechanism for funding, not project justification, and that apparently only one listed project remains under the purview of the Authority, North Carolina needs to study other states to create the most effective, efficient organization for tolling entities.
ADM-17[64]	Examine state aircraft leasing	Many states lease aircraft on an 'as needed' basis instead of owning them. There are several national companies that now specialize in aircraft rentals and/or timeshare. Many state DOTs lack economies of scale and aircraft maintenance skills. Leasing aircraft offers the same benefits to the state at a much lower cost for taxpayers.
ADM-18	Examine functional privatization	Some states and provinces (e.g., Virginia, Alberta) and even nations (New Zealand, Finland) have experimented with extensive privatization of DOT functions such as maintenance, planning and others. NCDOT should examine other states and countries such as Virginia, Alberta and New Zealand that have privatized large portions of their DOT functions. Would this model work in a U.S. state? How much savings could this generate?
ADM-19[65]	Develop a comprehensive recruitment and training program	As the workforce changes DOT needs to take steps to recruit new staff and train all employees in changing procedures.. Develop a comprehensive program that identifies skill gaps, and ensures that the workforce is trained to effectively and efficiently deliver transportation services to North Carolina. The services of the state's universities and community colleges might be able to assist in recruiting and providing continued education and professional development to NCDOT staff and other transportation professionals.
ADM-20[66]	Improve DMV and DOT customer training	The public's interaction with DOT and DMV is often on a 'service' basis, similar to retail establishments. Therefore staff personnel in those functions are often at the 'front line' of contact with the public. Training programs can be an effective and efficient way to address some training

[63] Solicited suggestion.
[64] Solicited suggestion.
[65] Solicited suggestion.
[66] Solicited suggestion.

		needs. If properly designed and developed, the training programs can also be cost-effective For instance modules for DMV License examiners have recently been developed for on-line use. Expanding this effort can improve the 'customer service' provided by NCDMV and in other parts of NCDOT. The state's universities and community colleges might be able to assist in providing this training.
ADM-21	Sell unneeded right-of-way	When some parcels are purchased in entirety for road right-of-way some unused portions of parcels form a jagged 'saw-tooth' edge. These portions could be re-sold to adjacent land-owners and the proceeds used for mapping equipment. NCDOT should review its right-of-way holdings using modern GIs software, and then sell unneeded parcel portions.

Aviation		
ID	**Short Description**	**Description**
AV-01[67]	Re-evaluate FAA Block Grant participation	FAA's Block Grant program provides funds to states, rather than directly to general aviation airports. The program worked well until recently, when NCDOT administrative issues, grant application problems, communications problems and funding reductions led to less communication and less trust. Given the importance of General Aviation (GA) facilities to economic growth of many smaller counties, North Carolina's participation should be re-evaluated.
AV-02[68,69]	Re-establish the NC Aeronautics Council	For many years, NCDOT benefited from advice from the Aeronautics Council. The Council was recently dissolved. However, this council (with membership from academia, industry leaders and military, among others) provided general oversight on projects, grant allocations and spending in the state aviation industry in general. Consulting with such a body would offer insights on all of the areas of interest to include infrastructure, economic growth, funding and organizational efficiency. Also, the body could oversee the most important areas in aviation, maintaining a safe and secure operational environment. Further, each airport in the state has oversight by one or more groups, and the Division of Aviation should be no exception. Re–establish the Council, with specific charges and mandated responsibilities.
AV-03[70]	Implement merit-based project evaluation	North Carolina has recently begun to implement merit-based project evaluation for highways, public transit, and pedestrian-bicycle projects (the "SPOT" process) and should do the same for general aviation projects cooperatively with stakeholders. Some airports are building new terminals, asking for longer runways, etc. when the need is not necessarily there. Prioritizing projects based on limited funds is needed. Criteria should

[67] Solicited suggestion.
[68] Solicited suggestion.
[69] Solicited suggestion.
[70] Solicited suggestion.

		include potential user (flyer) benefits and costs, facility condition, direct economic impact, safety, geographic location, functional services, etc. The process should be data-driven and transparent.
AV-04[71]	Evaluate international services for GA airports	The Monroe Co. Airport has recently announced a plan to offer international service for freight, with US Customs Service participation. The cost would be about $ 250,000/annually, for a total of 30 flights annually, or about $ 8,000/flight. User fees have not been set, but are likely to require additional local or state taxpayer support and possible future facility upgrade. Given the likely low demand, this may not be cost-effective. Therefore, services such as this should be evaluated and criteria developed before state funds are committed.
AV-05	Develop criteria for passenger airport organization	Recently the Asheville area airport has been transferred from local control to a state-created Authority, and a similar move is proposed for the Charlotte-Douglas International Airport. Both moves were initiated independently of local governments. Given the importance of passenger airports to economic viability, stable airport organization and management must be ensured. North Carolina needs to have objective and transparent criteria for determining how its passenger airports should be organized, so that issues regarding state or local control can be addressed objectively.
AV-06[72]	Balance GA airport improvement with demand	North Carolina's GA airports vary widely in demand, use, and service levels. Some are intensely used, and may need expansions, while others are less utilized, have the necessary capacity for the future. However, maintaining smaller general aviation airports is more difficult do with limited resources. The NCDOT GA maintenance program has helped many smaller airports. It is important to protect programs such as this that benefit general aviation airports.
AV-07[73]	Re-organize the Division of Aviation	Aviation is heavily regulated by the Federal Aviation Administration and the National Transportation Safety Board. However, many airports are controlled at the local level by city and county governments and boards. These arrangements make it difficult for the leadership of these facilities to function and perhaps maintain compliance with all of the other necessary federal level organizations. This results the subordinate position of aviation in many states. The Division of Aviation should be re-organized as a separate entity with in the state, since it appears to be subordinate to state level organizations while driven primarily by federal level influences. This arrangement at times appears to cause a bureaucratic stall in the way of policy development and influence.
AV-08[74]	Include aviation in long range planning	Ensure that aviation is a part of local and state planning. Understand the role of aviation in economic development. Ensure that airports meet community needs.

[71] Bell. A, "Monroe Goes International," *Charlotte Observer*, Feb 15, 2013.
[72] Solicited suggestion.
[73] Solicited suggestion.
[74] Solicited suggestion.

AV-09[75]	Develop airport facility management plans	Airport management plans should include pavement surveys to assess conditions and set priorities, and surveys of facilities such as buildings, utilities and equipment.

Commerce and Trade		
ID	**Short Description**	**Description**
Com-01[76]	Review Foreign Trade Zone adequacy	North Carolina's Foreign Trade Zones (FTZs) allow local manufacturers and shippers 'direct' access to overseas trade services through locally-sited facilities. However, two NC trade regions (Northeast and Advantage West) are not currently covered under the state's FTZ existing program. Because of the benefits that could be derived from this program, further examination into the creation of new zones or expanding existing zones is encouraged. The cost-effectiveness of the other zones should also be reviewed; this might be done cooperatively with neighboring states.
Com-02	Expand 'just in case' distribution	"Just in time' logistics system rely on partial use of vehicles as warehouses, delivering materials 'just in time' for use. "Just in case' distribution is a supporting system of distribution centers intended to mitigate the effects of disruptions in 'just in time' supply chains caused by weather, strikes, etc. North Carolina is ideally suited, geographically and economically, for such sites. Although expanding 'just in case' delivery is not generally a government function, the state has a significant distribution industry already and its role in 'just in case' distribution might also be substantial. Government can assist in this effort.
Com-03[77]	Plan for the Panama Canal widening	The widening of the Panama Canal, scheduled for completion in 2014, is likely to create major shifts in US freight distribution, moving some east-bound cargo to the east coast, shifting mode use, and increasing truck traffic. Although North Carolina's ports are presently not suitable for large-capacity container ships, the state is likely to see more truck traffic, distribution sites, and other supporting services. North Carolina needs to make strategic decisions regarding its response to the Canal widening, particularly if it is to compete for 'big-boat' traffic and/or serve other markets and distribution opportunities.
Com-04	Re-evaluate the need for the Global TransPark	The Global TransPark in Kinston has struggled from the start to attract business clients. The initial business model (manufactured goods sent by separate air service) may not be workable. The Legislature's Program

[75] Solicited suggestion.
[76] Solicited suggestion.
[77] Solicited suggestion.

		Evaluation Division has already proposed divestment of the TransPark, but the issue of the Escheats fund would need to be dealt with[78]. The TransPark's status, and the state's support of it, should be objectively reviewed on its merits.
Com-05[79]	Implement criteria for transportation investment in 'economic development'	The McCrory initiative and the recent NCDOT effort to include 'economic development' in project evaluation is a step in the right direction. In addition, current economic incentive contracts should be reviewed to determine projects which include state responsibility and obligations to upgrade a certain road or bridge. Consideration should be given to finalize those projects that are yet to be completed and are needed for support and growth. Presently, criteria used to evaluate projects are jobs-based, specifically jobs created versus project cost. However, since most transportation projects serve both 'new jobs' and existing 'jobs' traffic, "economic development' impacts should discount impacts on existing jobs. Since most 'benefits' from transportation projects flow to project users, additional benefits for 'economic development' should be carefully evaluated to be sure there is no double-counting. Projects should be evaluated head-to-head statewide, and the system should be transparent and data-driven.
Com-06	Evaluate projects in the Logistics Report	The Report of the Logistics Task Force, completed in 2012, identifies numerous issues and opportunities for expanding logistics in North Carolina, but does not discuss the potential demand for actions, nor benefits versus costs. There is no substantive treatment of demand for services, market locations, the cost of production, competition from other states and nations, pricing for goods, what NC makes and where is it needed. These factors are far more important than road or rail/marine capacity in determining freight needs. Particularly, the benefits and costs of major projects such as seaport expansion, the 7 portals, and the Global TransPark should be evaluated. The Logistics Report should be re-visited and expanded, and its proposals subjected to merit-based evaluation.
Com-07[80]	Coordinate logistics improvements with other states	Logistics improvements in other states can have a significant effect on North Carolina's economy. For instance, the Panama Canal widening will affect distribution along the eastern US. Railroad upgrades in other states, particularly the Midwest, will also ease shipping costs and convenience to NC destinations. Removal of major highway bottlenecks in nearby states will benefit North Carolina. These actions should be coordinated with actions in NC.

[78] North Carolina General Assembly, Program Evaluation Division (PED) Report No. 2011-02, *North Carolina Should Weigh Continued Investment in the Global TransPark Authority and Consider How to Repay the Escheat Fund Loan,* April 2011.
[79] North Carolina Chamber of Commerce, *Bridge to a Stronger Future: Powering North Carolina's Economy, Transportation Paves the Way*, 2012.
[80] Solicited suggestion.

Com-08	Facilitate the circumstances for information technology	North Carolina should be cautious in favoring various forms of information technology. For instance, the state's recent focus on fiber-optic and 'information highway' extensions to rural areas using state right-of-ways may be eclipsed by 'cloud computing' and better wireless service. Rather than promote specific information technologies, NC should facilitate the circumstances for many options, including 'server farms'.
Com-09[81]	Ensure/improve highway connectivity	North Carolina is part of the "Piedmont-Atlantic "mega-region" (Northeast-DC-Atlanta-Florida) in the United States. Protection, expansion and maintenance of the key highway corridors connecting those regions are necessary in order to effectively move goods and commerce in and out of the state. Funding on these important corridors deserves higher priority.
Com-10[82]	Evaluate longer-combination vehicles in NC/connect to eastern turnpikes	US law generally prohibits the use of longer-combination trucks (double-large trailer vehicles) in the eastern US except on selected turnpikes and toll roads. This limitation inhibits commerce and increases costs for east-coast goods movement. Although there are significant issues of safety, operation and terminal sites that need addressing, many of North Carolina's Interstates are similar in design and traffic volume to those of eastern toll roads and western-state Interstates where these vehicles are now permitted. North Carolina should evaluate the impacts of longer-combination vehicles, and work with other states to encourage Congress should return authority to individual state Departments of Transportation to determine and authorize longer combination vehicles to operate in appropriate road systems, regulations, restrictions and requirements appropriate for those individual states.
Com-11[83]	Remove highway bottlenecks	Like most states, North Carolina's transportation system contains 'chokepoints' or bottlenecks that slow travel. These typically occur on Interstate interchanges, lane-drops, or key river crossings. A recent national study[84] identified 5 major Interstate bottlenecks in NC, not counting numerous arterial bottlenecks. At such locations traffic is slowed by an average of 20 percent. Federal legislation (MAP-21, National Freight Program) requires bottleneck identification and a National Freight Plan. North Carolina should identify and remove bottlenecks in the highway system that affect both freight and commuter traffic. These locations should be given higher priority in project selection.
Com-12[85]	Detailed survey of	National freight-flow data are often limited to large 'BEA' regions, not

[81] North Carolina Chamber of Commerce, *Bridge to a Stronger Future: Powering North Carolina's Economy, Transportation Paves the Way*, 2012.
[82] Ibid.
[83] Solicited suggestion.
[84] American Trucking Research Association, *Freight Performance Measures at 250 Freight-Significant Highway Locations*, September 2011.
[85] Solicited suggestion.

	freight flows	urban areas. Therefore, North Carolina has a limited understanding of the flow of freight at a regional or county level. Although this is very detailed data, in order for transportation planners and economic developers to better assist NC's economic development efforts we must develop freight flow information with a narrower geographic scope than has been accomplished in past.
Com-13[86]	Pre-assess accessibility for industrial sites	Economic development efforts often move quickly and a location in NC may be disqualified by a prospective company before the location is even aware of the disqualification. As such it is important that proposed industrial sites are "pre-qualified" for access. Having a better understanding of the sites' accessibility features and needed improvements in advance of a prospective clients search would assist in NC having consistent opportunities to secure a client visit. While some of this information is available at the DOCM's website (www.accessnc.commerce.state.nc.us), a more refined database permitting selection by accessibility data would be useful. A full team should include representatives from DOT, DOCM and local economic development offices.

Division of Motor Vehicles		
ID	**Short Description**	**Description**
DMV-01[87]	"Outsource registration and titling services provided currently at two state offices"	"Contractors are a cost-efficient way for the State to provide vehicle registration and titling services. As of January 2012, there were 118 license plate agency (LPA) contractors (101 private businesses and 17 local public entities) and two state DMV offices providing registration and titling services. Customer fees for registration and titling services go to the State, and the State in turn compensates LPA contractors on a per-transaction basis. The Program Evaluation Division determined the State pays less for each transaction performed by private contractors ($2.12) and local public entity contractors ($2.07) than for transactions performed by state offices ($6.13)."
DMV-02[88]	"Implement a standardized, performance-based contract for LPAs"	"Lack of a standardized, performance-based contract for all contractors limits accountability and oversight. As a result of changes in the LPA program, two-thirds of LPAs operate under indefinite contracts, differing from the other third of LPAs that operate under term-limited contracts. The major differences between the two contracts are that indefinite contracts do not have a duration term and do not require LPAs to pay the State to lease computer equipment, have a public restroom, or report

[86] Solicited suggestion.
[87] North Carolina General Assembly, Program Evaluation Division (PED) Report No. 2012-07, *Contract Agency Vehicle Registration and Titling Services Are Cost Efficient, but Contracts Need Performance Terms*, April 2012, p.1.
[88] Ibid.

		notary fee collection. Neither type of contract has performance measures, such as customer satisfaction, customer complaints, and transaction error rates."
DMV-03[89]	"Improve oversight and communications in the LPA program"	"Lack of coordination and poor communication hinders DMV's oversight of contractors. The Program Evaluation Division found DMV relied on processes that react to problems rather than working with LPAs to improve overall performance. Interviews and surveys also revealed a lack of coordination among oversight mechanisms, creating a disjointed oversight structure."
DMV-04[90]	Pass legislation to allow pay-as-you-drive (PAYD) auto insurance.	North Carolina currently requires that annual insurance premiums be stated upfront. Pay-as-you-drive (PAYD) insurance is a mileage-based system, where the premium may increase or decrease depending on miles driven. This requirement can limit PAYD's attractiveness to drivers if there is no provision for granting a credit if he drives less than his predicted mileage. A Brookings Institute report[91] calculated that PAYD insurance implemented in all 50 states could reduce vehicle miles traveled (VMT) by eight percent and save $50-$60 billion a year by decreasing the number of crashes and other driving-related externalities. With PAYD insurance, nearly two-thirds of households would save an average of $270 per car per year. In turn, insurance would become more affordable and the number of uninsured drivers would decrease. PAYD insurance has the same impact on managing travel demand as a $1-per-gallon gas tax increase. Decreased congestion through VMT reductions would also result in decreased pressure for highway capacity expansions.

Environment and Community Involvement		
ID	**Short Description**	**Description**
ENV-01[92]	Improve environmental agency and stakeholder coordination	Public engagement is essential to creating consensus on the best transportation solution for a community at the outset of a process, stimulating new innovative solutions and identifying conflicts early so that they may be resolved. Integrating environmental planning into the transportation planning process will greatly improve efficiency and speed up the delivery process. Early coordination would encourage decisions about natural resources upfront and would prevent unrealistic expectations by local governments about projects that appear to be "set in stone" when included in the state's transportation plan. This should also include careful

[89] Ibid.
[90] Smart Growth America and the State Smart Transportation Initiative., *The Innovative DOT: A handbook of policy and practice*, 2012, p.72.
[91] Bordoff, JE and Noel, PJ. "Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity." Brookings Institute, at: http://www.brookings.edu/research/papers/2008/07/payd-bordoffnoel (accessed March 19, 2013).
[92] Solicited suggestion.

		examination of the purpose and need behind each proposed project. Similarly, early coordination ensures that potential obstacles are indentified and tackled at the outset. This helps avoid the delays that can result from unresolved conflicts that otherwise might ultimately end in permit denials or even, in rare cases, litigation. NCDOT should involve stakeholder groups and state and federal resource agencies early in both the transportation planning stage and during the project development stage.
ENV-02	Increase projects solutions within current right-of-way	New federal legislation (MAP-21, July 6, 2012) allows for expedited environmental review for projects *within* existing operational right-of-way (they are treated as 'categorical exclusions' not requiring detailed environmental assessment). Draft rules implementing this law have recently been released[93]. This change will significantly alter the evaluation of 'within operational right-of-way' alternatives. North Carolina should review all major projects to reduce their impacts by limiting the improvement to within current right-of-way, wherever possible.
ENV-03[94,95]	Eliminate the annual vehicle safety inspection; keep the emissions inspection	North Carolina's Program Evaluation Division studied both safety and emissions inspections in 2008 and emissions inspections again in 2012. They found in 2008 that "no evidence exists showing the safety inspection program is effective" and in 2012 found that "eliminating the vehicle emissions program altogether would result in a pollutants increase of more than 80,000 tons per year." Eliminating the safety inspection would save NC drivers about $87 million each year, but eliminating the emissions inspection would require other more costly actions to meet federal air quality standards. The state has already taken action to exempt 1-3 year-old vehicles from annual inspections (to become effective Jan 1, 2014), which is expected to save NC motorists $9.6 million annually, while not affecting the State's adherence to federal air quality standards, and possibly jeopardizing NC's federal highway funds. Consideration should be given to eliminating the 'safety' inspection completely.
ENV-04[96]	Reduce CO_2 emissions with cost-effective measures	Recent national studies indicate that policies to improve overall vehicle fuel efficiency will have the largest impact on transportation-related CO_2 emissions, and will have the greatest relative and most cost-effective impact. Overall, technological improvements to vehicles resulting in higher fuel efficiency, along with traffic signal timing and speed harmonization, hold out the most hope for significant reductions in future CO_2 emissions. Next in line are policies aimed at improving the efficiency of the transportation system, particularly signal timing and coordination,

[93] US Department of Transportation, Federal Highway Administration, Environmental Impact and Related Procedures (Notice of proposed rulemaking (NPRM)), *Federal Register* 78:40, 13609-13614, February 28, 2013.
[94] North Carolina General Assembly, Program Evaluation Division (PED) Report No. 2008-12-06, *Doubtful Return on the Public's $141 Million Investment in Poorly Managed Vehicle Inspection Programs*, December 2008.
[95] North Carolina General Assembly, Program Evaluation Division (PED) Report No. 2012-05, *A Three-Year Emissions Inspection Exemption Would Save North Carolina Motorists $9.6 Million*, March 2012.
[96] Hartgen DT, Fields, MG, Scott, M, San Jose, E., *Impacts of Transportation Policies on Greenhouse Gas Emissions in U.S. Regions*, Reason Foundation Policy Study 387, November 2011.

		and speed harmonization. Next in cost-effectiveness are policies aimed at changing commuting behavior, particularly policies that encourage tele-work. Likely to be less effective, both absolutely and relatively, are major capacity increases, more HOV or stand alone HOT lanes, transit shift policies and carpooling, although in some regions they can provide modest savings. North Carolina should encourage cost-effective reductions in CO_2 emissions, but not impose CO_2 regulations that are stricter than federal requirements.
ENV-05[97]	Reduce stormwater impacts of sprawl	Major transportation projects that increase sprawl have the biggest impact on water quality, both from the direct stormwater runoff from roads, but also the related parking lots associated with suburban communities. Stormwater is often the #1 one cause of pollution in urban areas. Although land use planning and is a local function in NC, the state should be cognizant of potential impacts of major new roads on land use.
ENV-06[98]	Control erosion during construction	When road projects are being constructed, NCDOT and contractors should do a better job of controlling sedimentation and erosion. Sometimes DOT projects do not do as good a job of controlling sedimentation as private projects that are regulated by local officials or DENR. Improve oversight and use 'best practices' to control erosion during construction.
ENV-07[99]	Improve communications with stakeholders	It sometimes appears that NCDOT has difficulty communicating effectively with stakeholders, and is 'going through the motions' of public involvement. Dissenting opinions in stakeholder committees can go unaddressed. Staff members can sometimes appear dismissive of the public, consultants, elected officials and other agencies. Documents seem to be written to communicate between internal stakeholders, or other participants in interagency processes, whereas elected officials and residents need simpler and clearer communications. NCDOT needs to review, and modify if needed, its communications strategies. Training programs organized through universities and community colleges might be one way to deal with this issue.
ENV-08[100]	Streamline environmental regulations	For environmental regulations that the state controls, it should consider elimination of those that are duplicative of federal regulations, antiquated and unnecessary for the completion of a project. Regulations add cost, time and requirements which will slow down project delivery and increase final cost to the taxpayers. The goal should be to decrease review times and/or have tools in place to reduce the amount of time a project is being studied, while ensuring compliance. This can be done so that environmental stewardship and economic growth balance. This is not to suggest that environmental reviews of projects should be abrogated, only that these should be streamlined.

[97] Solicited suggestion.
[98] Ibid.
[99] Solicited suggestion
[100] North Carolina Chamber of Commerce, *Bridge to a Stronger Future: Powering North Carolina's Economy, Transportation Paves the Way*, 2012.

ENV-09	NC regulations should conform to federal rules.	North Carolina's transportation related environmental regulations (e.g., guidelines for air quality planning, vehicle inspection, congestion management, etc) should be no more stringent than corresponding federal regulations.
ENV-10[101]	Incremental I-85 widening via lane mgt within ROW, fund by tolls.	The single most important traditional road project in Gaston County would be to widen 1-85 from the Catawba River west through Gastonia. A comparatively recent Fast Lanes study estimated such a project would cost about $850 million, but would be substantially cheaper than the proposed Garden Parkway (~ $ 2billion). Roughly half of Belmont's public safety calls are for responding to traffic accidents where westbound I-85 narrows from four lanes to three at Belmont Abbey College (Exit 26). The new lanes could be partially funded by the use of demand management tolling. Rather than forcing tolling on existing lanes as is proposed for I-95, or building new toll facilities as was proposed for the Garden Parkway, variable tolling that manages demand and helps fund new lanes on existing facilities should be encouraged. This is essentially a fix-it-first project, and fix-it-first should be the guiding principle to repair important traditional transportation infrastructure such as roads and bridges. Using variable demand tolling as a way to manage future demand on these facilities will require special legislation. The project might also fit within the current right-of-way, possibly permitting a 'Categorical Exclusion' designation under MAP-21 draft rules.

Funding and Financing		
ID	**Short Description**	**Description**
F-01	Add congestion and other measures of need to STIP Funding Formula	North Carolina's formula for funding major roads and bridges allocates funds to 7 distribution regions based on population, miles to complete the intrastate system, and 1/3 divided 1/7th each. Critics say the formula biases funding toward rural regions, shortchanging urban areas that have major congestion-related needs. Proponents say that regions have different needs and that adding congestion or other criteria would hamper rural development. Change the 'equity formula' to put more emphasis on congestion mitigation and economic development. This would increase funding to urban areas but reduce the need to spread a 'little money everywhere'. It would also help fund major projects that move the economic engines of the state forward.
F-02	Select projects by distribution region or division rather than county	Historically NCDOT applied the STIP formula to the County level, even though the legislation allocates funds only to the Distribution Region. This method allocated funds in such small amounts that some small counties don't get allocations for major projects. If projects were prioritized within Division or Distribution Region, larger projects could be funded. However, smaller projects within counties might be delayed or deleted. DOT has already taken steps in this

[101] Solicited suggestion.

		direction, by reducing Board responsibility for project selection and by beginning the SPOT program. This should be formalized by directive.
F-03[102]	Expand Mobility Fund/Fund major projects separately/Reduce STIP $	Currently NC funds some projects in separate categories (Loop funds, Mobility Fund, Turnpike Authority), diverting funds from the STIP. The intent of this is to move major projects forward. However, as more projects are added to the separate categories, very large projects such as I-95 repairs and major bridge work are difficult to fund. A consolidated funding category for very large projects could fund major projects which would be evaluated and prioritized head-to-head statewide. However funding for smaller projects might suffer unless new funds are found. Consideration should be given to financially expand the Mobility Fund and funding it separately, to more quickly address projects of statewide significance. The funds for this can be obtained from reducing the STIP through project prioritization.
F-04[103]	Actively review and evaluate alternative funding sources	NC has traditionally been a 'user pay as you go' state, relying largely on fuel taxes and registration fees for highway funding. The state recently raised its gas tax 8 cents, making it now one of the highest in the US and the south. But due to more efficient vehicles and inflation, needs may continue to exceed traditional sources. A variety of 'innovative' financing methods are being used in other states. These include TIFIA funds, state infrastructure banks, private activity bonds, GARVEE bonds, public-private partnerships, etc. Federal legislation (MAP-21) significantly expands TIFIA funds and establishes a 'rolling application' process. While these are financing, not funding methods they generally provide ways to expedite projects by accessing future revenue streams. However, in one of the most aggressive recent moves, Virginia eliminated its 17.5 cents/gallon fuel tax entirely, replacing it with a 3.5 percent *wholesale* sales tax on fuel and a 0.3 percent increase in non-food general sales taxes, both dedicated to transportation. The move received praise from bonding firms, but less support from transportation economists concerned about weakening the 'user pay' principle. North Carolina has been prudent in its use of these methods, letting other states 'try them out'. Fitch's recent downgrade of NC GARVEE bonds is an early warning of possible problems. When used properly – not as a panacea but in limited situations – they can be useful, but they cannot replace traditional funding methods. NC has recently experimented with TIFIA, GARVEE, tolls/pricing, and design-build arrangements, and is considering PPP arrangements. NC needs to have an in-place mechanism for tracking alternative funding and evaluating various options, against objective criteria for where they should be applied.
F-05[104]	Increase	Recent federal legislation (MAP-21) reduced federal funding

[102] North Carolina Chamber of Commerce, *Bridge to a Stronger Future: Powering North Carolina's Economy, Transportation Paves the Way*, 2012.
[103] Solicited suggestion.

	flexibility/consolidate road funds	categories and increased flexibility. In North Carolina, money that sometimes gets "stuck" in some programs could be used more effectively in others. NC should reduce or eliminate smaller 'pots' of money that can't be shifted around, and develop fund categories that largely correspond to federal categories for major pots.
F-06[105]	Cautiously increase use of debt	With interest rates at historic lows, there is no better time to leverage debt, either through enhanced use of P3s or bonding capacity. A recent report shows NC has some additional debt capacity. Buy when rates are at historic lows like what other states are doing. A number of studies show net gain from infrastructure investment. However, it is vital not to exceed prudent use of debt, since NC is a fiscally conservative state.
F-07[106]	Lift the cap on the North Carolina's fuel tax	Lift the cap on the state gas tax. If that is not palatable then find an alternative sustainable funding source, for instance VA as example of thinking out of the box and funding roads partially by sales taxes instead.
F-08[107]	Permit 'local transportation taxes' to be used for all modes, not just transit	Presently localities are permitted to raise local sales taxes ½ cent (large counties) or ¼ cent (other counties) for "public transportation". But there are needs for highways and other modes too. Let localities enact local sales taxes increases for "all modes of transportation", not just transit. This would likely allow some localities that want to put some 'local skin in the game' to advance projects. However, it might lead to inequities between localities.
F-09[108]	Prohibit the use of state transportation funds for other purposes	About 25 percent ($ 288 million) of North Carolina's state highway funds are currently diverted to non-pavement uses such as driver education, policing functions, other uses, and some non-highway uses such as transit. Many observers believe that funds from gas taxes and other transportation user fees should be used exclusively for transportation investments, and therefore oppose the current $288 million a year transfer out of the Highway Fund to the General Fund. The time has come to substantially cut back such diversions and use transportation funds for transportation purposes. Adopt a constitutional amendment (like other states have done) to protect transportation funds from being 'raided' for non-transportation uses. This would reduce funding for some current activities, which would have to be funded elsewhere or reduced. The Legislature has already moved to reduce diversions from state transportation funds; this would go further by prohibiting it.
F-10	Investigate revenue from alternative-fueled	With the increasing interest in electric vehicles, and natural gas-powered vehicles, North Carolina needs to review the diversification

[104] Solicited suggestion.
[105] Solicited suggestion.
[106] Solicited suggestion.
[107] Solicited suggestion.
[108] Solicited suggestion.

	vehicles.	of revenues from alternative-fueled vehicles. This ensures that all vehicles that use the roads pay for them.
F-11[109]	Cautiously implement toll road and pricing strategies	North Carolina has been cautious in implementing tolling or road pricing. Its first toll road (Triangle Expressway) has quite low traffic volumes (5000-10000/day for 6 lanes), and several other proposals have been slowed by court action. The state's only HOV lane (I-77 in Charlotte) also carries low volumes, but proposals have been made to convert it to a HOT lane. The state should be investing more in the transportation system through expanded tolling and managed lanes. However given this uncertainty and the errors in forecasting usage, North Carolina should proceed cautiously with valuating toll roads or pricing. The state should study carefully the expansion of managed lanes in appropriate corridors throughout the state. This includes 'managed lanes' ion Charlotte, that include all of I-77, but the state should not act without an objective review of alternatives. Study constructing 'managed lanes' on parts of I-85 and I-485. Evaluate proposed conversion of HOV lanes to HOT lanes. Consider managed lanes for the I-40 expansion in the Raleigh-Durham-RTP corridor.
F-12[110]	Add measures of need to other road funding formulas	North Carolina uses a variety of funding formulas to distribute highway funds. Most of these formulas do not allocate funds on the basis of need or road status, but rather on sized-based measures such as miles, lane-miles, population, or uniformly to each county or Division. Only Contract Resurfacing funds, a relatively small portion of the total, are allocated partially on the basis of pavement needs. As a result, differing system condition levels in different regions of the state are not considered, yet they play a major role in repair costs. North Carolina should review each formula and each funding category, adding measures of need, not just size, to the allocation.
F-13[111]	'Close the loop' between condition and spending.	Several states, notably Montana, have recently adopted policies that require that highway funds allocated to counties on the basis of road condition, then be spent on specific sections of highways that are in various conditions. Such a requirement for North Carolina allocations would ensure that funds are targeted where they are intended.
F-14[112]	Adjust the fuel tax for inflation	Consider a future adjustment of the fuel tax rate for inflation, to allow for revenues to increase modestly over time.

[109] Solicited suggestion.
[110] Hartgen, DT, *Trends in North Carolina's County Road Conditions, 1998-2004*, A Study for the John Locke Foundation, 2004.
[111] Ibid.
[112] Ibid.

F-15[113]	Increase Powell Bill funds	Anecdotal evidence and some data suggest that the state's locally-owned roads are in worse shape than the state-owned road, suggesting that some localities are having trouble maintaining their road condition. Consider raising the share of highway funds for localities (Powell Bill) to 10 percent, from its current 6 percent. This allows municipalities to improve local road conditions, with assistance from the state.
F-16	Establish a State Infrastructure Bank for local road repairs	The Federal Highway Administration has noted that South Carolina's state infrastructure bank provides the best example of a large leveraged SIB that is helping to compress 27 years of road and bridge projects into a seven year acceleration program (known as '27 in 7'). North Carolina should consider establishing a similar program.
F-17[114]	Develop a funding solution for I-95	I-95 is a 40-50 year-old highway with current traffic volumes between 40,000-50,000 AADT. In the future, the highway will need to be re-built and possibly widened where capacity is inadequate. The cost for a full widening has been estimated at over $ 4 billion, far above NC's ability to finance. Yet a solution must be found. Incremental or partial widening may stretch out or reduce costs. Tolling has been suggested but is vehemently opposed locally, and VA and SC are not currently considering tolling. Yet tolling may be part of the answer, as may be partial state funds, PPP arrangements, and other approaches. A large study of the economic impacts of tolling is now underway.
F-18[115]	Expand funding through PPPs, bonding and pass-thru funding	The state should consider alternative ways to finance its transportation improvements that benefit the users of the system: 1. Public-private partnerships. Comprehensive studies have been conducted to help understand the risks and benefits, strengths and weaknesses of PPPs. The state should expand opportunities for design-build, PPPs and other alternative financing methods, recognizing that these alternative financing methods are not a panacea for solving the state's needs, just a supplement. 2. Bonding. The issuance of bonds should be considered as a mechanism. Interest rates are at historic lows, and construction pricing makes this an ideal time to leverage resources and boast short-term employment in the construction fields. The completed projects will lead to long-term economic benefits to the overall economy. However, this can and should be completed in a fiscally responsible manner with ample funds to retire the obligations and with a positive return on investment for the state. 3. Pass-thru financing. Expand tools to allow local communities to determine options for financing with help from the state. South Carolina's Infrastructure Bank for localities is an example.

[113] Ibid.
[114] Solicited suggestion.
[115] North Carolina Chamber of Commerce, *Bridge to a Stronger Future: Powering North Carolina's Economy, Transportation Paves the Way*, 2012.

Highway – Design, Bid, Letting, Construction		
ID	**Short Description**	**Description**
HBC-01[116]	Increase design-build flexibility	Increase design-build (DB) projects and decrease amount of NCDOT 'design' for projects - on some DB projects NCDOT completes up to 70 percent or more of the design, leaving little room for contractors to be innovative and lower costs. NCDOT should pick the alignment/routes for road projects, but leave to potential DB contractors the opportunity to do the rest and leverage innovation. This would likely accelerate project timing from 'concept' to 'bid', lowering costs and also permit NCDOT to 'right size' staff.
HBC-02	Standardize bridge design for small rural bridge replacement	Many small rural bridges are similar in length, height, width, pavement type, and other design features. This is particularly true for spans less than 20 ft on rural low-volume roads. Investigate 'generic' bridge design for faster implementation, basically a 'dial a bridge design' for simple structures. SHRP 2 Project R04 (Innovative Bridge Designs for Rapid Renewal) developed standardized and scalable approaches to designing and constructing complete bridge systems for rapid renewals. The Innovative Bridge Designs for Rapid Renewal: ABC Toolkit (SHRP 2 Report S2-R04-RR-2) includes design standards and design examples for complete prefabricated bridge systems.
HBC-03[117]	'Bundle' bridge repairs into larger contracts.	For bridge maintenance, 'bundling' of bridges can be chosen but it also can be chosen for some higher-level repair work. 'Bundled' bridge repair contracts save design time and administrative costs, and allow contractor economies of scale. Missouri has had good success with this approach. North Carolina is experimenting with this approach.
HBC-04[118]	Set clear measures of road performance	Determine specific measures and goals for road performance that are easily tracked and understood by staff and by the public. How should performance be measured? What condition should roads be in? Should all roads be equal in condition regardless of functional class or location?
HBC-05[119]	Develop additional measures of system performance	Determine how to measure other attributes of road system performance, such as accessibility improvements, job creation and environmental impact. Road system access to jobs, goods and services has been a key element in the Nation's economic progress but it is rarely measured or considered in system performance. Measures that track these features are needed, in addition to measures of condition, congestion and safety.

[116] Solicited suggestion.
[117] McKillip, M., E-mail correspondence with DT Hartgen, RE: Roads/ Waste in DOT, 06-08-2012.
[118] Hartgen DT, Fields, MG, San Jose, E., *Are Highways Crumbling? State and U.S. Highway Performance Trends, 1989–2008,* Reason Foundation, Policy Study 407, February 2013.
[119] McKillip, M., E-mail correspondence with DT Hartgen, RE: Roads/ Waste in DOT, 06-08-2012.

HBC-06[120]	Compare peer state road performance data	Develop annual comparisons of NC road performance data to those of peer states. Over the period 1989-2008, surrounding states improved their highway systems more than did NC. VA and TN improved on all seven measures, SC and GA on six, NC on just four. (In a parallel research effort, develop measures for other modes)
HBC-07[121]	Audit and revise the pavement condition survey.	If NC's biennial pavement condition survey is to be the basis for road fund allocation, it must be accurate and reliable. Audit the survey to determine its accuracy and reliability. Based on the audit, tighten procedures for conducting the survey and increase controls. Survey records should be checked thoroughly by main office reviews and adjacent-county 'double-surveying' at county borders. The need for and basis for the detailed collection of distress data should be reviewed; unless there is a requirement that specific treatments be applied to specific sections, the data may be too detailed for its intended purpose (needs estimation). The survey should also be put into easy-to-access map form using the NDCOT' geographic information systems. The description codes for shoulder width and curb-and-gutter should be clarified for rural versus urban sections. NCDOT's pavement distress survey does not support the condition ratings needed for mechanistic pavement design. Trend data is important in pavement management but lack of resources and data scatter make the current survey difficult to use more effectively. Finally, consideration should be given to a simpler annual survey that would provide data on conditions more rapidly. The recent experiences of Hurricanes Floyd in 1999 and Frances and Ivan in 2004 demonstrate the importance of up-to-date knowledge in preventing road deterioration.
HBC-08[122]	Connect pavement condition data and work records.	The NCDOT should devise a means of recording the location of work completed on the system, both from the STIP and from routine maintenance, thereby 'capturing' changes in the condition of the system as they occur, rather than by later administrative records. This might be done using GIS as the basis for data structures.
HBC-09[123]	Implement rules for when to do projects	The standard economic rule for when to invest in a project is when the amortized user benefits (largely from travel time savings) exceed the amortized agency costs for the needed repair and later maintenance. The NCDOT should research the connection between pavement deterioration, condition, capacity and 'optimum' investment timing,

[120] Hartgen DT, Fields, MG, San Jose, E., *Are Highways Crumbling? State and U.S. Highway Performance Trends, 1989–2008,* Reason Foundation, Policy Study 407, February 2013.
[121] Hartgen, DT, *Trends in North Carolina's County Road Conditions, 1998-2004*, A Study for the John Locke Foundation, 2004, and Solicited suggestion.
[122] Hartgen DT, Fields, MG, San Jose, E., *Are Highways Crumbling? State and U.S. Highway Performance Trends, 1989–2008,* Reason Foundation, Policy Study 407, February 2013.
[123] Ibid.

		and provide a 'schedule' of investment time for each road section. This could be completed as an extension of the HERS-ST[124] modeling system recently developed by the federal government.
HBC-10[125]	Develop ways to fast-forward bridge condition data.	The availability of the state's bridge condition data appears to be substantially slower than the state's pavement condition data. The NCDOT should review ways to make its bridge condition data more easily and more rapidly accessible for use.
HBC-11[126]	Verify road section data	In the past numerous examples of inconsistent data, particularly for lane width and shoulder widths, have been observed in the state's road inventory files. This data is critical to implementing accurate safety and pavement repair policies. The NCDOT should take steps to re-measure this data to ensure its accuracy. At the very least, a distinction should be made between urban curb-and-gutter sections, which are typically narrower with no shoulders, and rural sections.
HBC-12[127]	Conduct research on the rates and causes of deterioration.	Knowledge of pavement deterioration rates is fundamental to predicting highway repair needs in the future. However, the state appears to have developed little if any information about how rapidly North Carolina pavements decay and the causes of this decay. The state's recent Long-range Statewide Transportation Plan used *national* deterioration rates based on data from the 1962 Road Test, and a road deterioration package over 15 years old, even though North Carolina has its own detailed data on road conditions on individual road sections going back 20 years and the federal government had developed modern needs estimation packages specifically for state use. NCDOT should conduct research to evaluate these issues using both its extensive data bases on pavement conditions, the federally-funded Strategic Highway Research Program pavement sites in the state, and the Highway Economic Requirements System.
HBC-13[128]	Implement a comprehensive asset management system	Knowledge of the management, condition and effectiveness of North Carolina's highway and bridge assets (road, bridges, vehicles, equipment, etc.) is paramount to improving system performance. The state should explore the development of a comprehensive asset management system that provides this information in a timely and geographically specific manner. The state's universities may be able to assist in undertaking this effort.
HBC-14[129]	Bid projects on 'lane rent'	"Lane rent' biding includes the cost of the public's delay in highway bids. For instance a project might be bid with higher construction costs

[124] Federal Highway Administration, HERS-ST v 2.0 Software and Documentation, USDOT, Washington DC 20590, 2003.
[125] Hartgen DT, Fields, MG, San Jose, E., *Are Highways Crumbling? State and U.S. Highway Performance Trends, 1989–2008,* Reason Foundation, Policy Study 407, February 2013.
[126] Ibid.
[127] Ibid.
[128] Solicited suggestion.
[129] Solicited suggestion.

	principles	for nighttime construction, but thereby speed construction and reduce commuter delay. So, although construction costs might be higher, the total project cost is lower and the project is delivered faster. Although this method has been used occasionally in NC, its use could be expanded to be applied to all major projects where traffic delays are likely to be significant. Other methods, for instance 'task force' repair, should also be tested.
HBC-15	Evaluate performance-based contracting	Most US road projects are built to a pre-specified design, but in Europe and elsewhere performance-based contracting is more common. In this approach, the bidder offers to design and build the project to meet specific performance specification (e.g. smoothness above a certain level for at least 20 years), and warrants that performance with a bond. Projects built in this manner tend to be more expensive initially but last longer and require less maintenance. NC has some limited experience with performance-based contracting, but should evaluate recent US and European experience with costs and benefits. Because this procedure is different from current 'low bidder' practices, it might require legislation.

Highway – Maintenance, Operation, Safety		
ID	**Short Description**	**Description Details**
MOS-01	Develop a road and bridge condition forecasting model	North Carolina uses national tools for road condition forecasting, but also regularly gathers much more detailed condition data for each road section. This detailed data could be merged (by section, over time) to develop a condition-trend and a future repair schedule model for each road section, and needs estimation by function and forecast year. The project could be developed by consolidating presently allocated pavement research funds into a single major research effort.
MOS-02	Municipal road condition surveys	North Carolina DOT does not collect condition data for municipal streets; instead, the 600+ municipalities use a variety of methods to survey their road conditions, creating inconsistencies and hampering knowledge of true municipal needs. The state should require as part of Powell Bill funding that each municipality periodically (every 2 year) gather and report road condition data using a consistent format. The state's universities might be able to assist in this effort.
MOS-03	Increase performance-baaed contracting out of maintenance	'Light maintenance' (rest stop maintenance, litter, mowing, ditching, sign and guiderail repairs, bridge painting, lighting, light resurfacing, etc) has historically been done by NCDOT's 'force account'. These functions could be contracted out through competitive bidding by route or county, with resulting savings in staffing and costs reassigned. Virginia and Florida have had considerable success with this method. Another option is to increase the use of prison inmates, who presently do some light maintenance now.

MOS-04	'Bundle' contracts for bridge maintenance	In 2009 NC was 40th nationwide in the percent of bridges rated deficient, while SC was rated 23rd.[130] Federal law mandates that bridge funds be spent on deficient bridges, but funds are limited particularly for locally-owned bridges. Rather than 'let' bridge contracts individually, Missouri has had recent success with 'bundling' a groups of bridges (about 500) into large 'mega' bridge contracts to fix lower-rated bridges. This might require permissive legislation.
MOS-05[131]	Implement "fix-it-early" policy for road and bridge maintenance.	It is well known that early maintenance extends road and bridge life more effectively than delayed work. 'Fix-it-early' policies allocate transportation funding in a manner that prioritizes the preservation and repair of the existing highway system over the construction of new projects. Fix-it-early policies stretch limited resources, ensure the safety of a state's citizens, create jobs, and maximize the value of a state's past investments. NCDOT could set as a policy to repair roads and bridges early in their life cycle, for instance at 7-8 on a 10-point scale with light 1"-2" overlays. This stretches out life of pavement and is much cheaper. Two light overlays over a 15-20 year period save huge amounts relative to major construction. Although some continuing system widening and expansion will be needed for new projects or additional lanes, NCDOT's focus should be primarily on its 'stewardship' responsibilities, not new facilities. The Legislature might require that a fixed percent of state road funds be spent on maintenance and repair until specified levels of condition are met. Consider requiring a fiscal note on the 50 year maintenance requirements of a new road should be required, such that the General Assembly would understand the corresponding increase in the maintenance budget. It would be a 'truth in budgeting' type of initiative.
MOS-06	Add 'maintenance needs' to some highway formulas	Several of the DOT programs presently allocate maintenance money by road miles. These programs should be modified to allocate to county by condition (worse gets more) and traffic (higher gets more). This would push maintenance funds toward the counties with the greatest need.
MOS-07	Set maintenance performance goals	Set performance goals and target dates (e.g., X percent of miles with rating >7, by 2015) for each county and district. Have district and county supervisors recommend projects based on traffic and condition, but when allocated funds these supervisors must then spend it on those projects they recommend. Track movement toward better roads over time. This completes the connection between funding and performance. Reward districts/counties for achieving performance. Montana is a good example.

[130] Hartgen DT, Fields, MG, San Jose, E, *20th Annual Report on the Performance of State Highway Systems,*Reason Foundation, Policy Study 406, September 2012.
[131] Solicited suggestion.

MOS-08	Increase public involvement in maintenance reporting	Implement a 'dial a-pothole' reporting (maybe an 'app') so the public can report maintenance needs automatically using cell phones. Issue free or reduced car licensing to encourage. Several of these are already used around the US.
MOS-09	Tie maintenance records to condition reporting	Use geographic information systems to 'capture' maintenance reports of work done by location to resulting condition, thus automatically updating condition data. This closes the loop between field work and expected condition.
MOS-10	Improve rural safety	In 2009, the national fatality rate per 100 million vehicle miles was 2.7 times higher in rural areas than in urban areas (1.96 and 0.73 respectively). North Carolina's fatality rate is 25 percent above the national average, and about ¾ of NC highway fatalities are on rural roads. Improve safety by increasing pavement and shoulder widths on narrow rural curves, providing an extra 'margin of safety' for drivers.
MOS-11[132]	Improve incident removal services	Incidents (accidents, trash, breakdowns, etc) cause both safety and congestion problems. North Carolina's major regions have mobility response services for the Interstates, but many smaller areas do not. Investigate the cost-effectiveness of increasing incident response services to other regions and to rural areas. Improve existing incident management by using shoulders and emergency lanes to speed traffic, by providing the right equipment for incident clean-up, and by responding immediately to non-injury incidents that also delay traffic.
MOS-12[133]	Optimize pavement repair strategies	Use a pavement management system that strives for an optimal maintenance strategy for every year and for each pavement segment. Optimization should include three ideas: total maintenance cost is within budget; generalized maintenance costs (agency costs, user costs due to pavement deterioration, and cost to the environment) are minimized; and, pavement condition is maintained for all segments at high levels of service.
MOS-13	Review the experience of 'superstreet' designs	So-called 'superstreets' are upgraded rural and urban arterials that prohibit cross-movement at key intersections, thus increasing safety, operating speeds, and capacity. They are being increasingly deployed in North Carolina on higher-volume roads where cross-street traffic is a safety issue. However the designs are controversial because they increase travel for cross-street traffic and require more right-of-way than traditional intersection treatments. Before deploying them extensively, North Carolina needs to review its experience, and that of other states, with superstreet treatments.

[132] Solicited suggestion.

[133] From 2012-07 EC163 Maintenance Mgmt 2012 (Panagopoulou, MI and AP Chassiakos, "Optimization Model for Pavement Maintenance Planning and Resource Allocation", pp. 25-38)

Planning and Project Selection		
ID	**Short Description**	**Description**
P-01[134]	Update the State's Long Range Transportation Plan	NCDOT's 2040 Plan (and the studies that preceded it) should be reviewed without the need for more extensive/lengthy study, with appropriate changes. The current Plan assumes that all needs are equally important. Yet there are maintenance and capacity improvements that outpace available resources. The problem only gets worse over time. The revised Plan should balance needs with available resources.
P-02[135]	Increase the focus on economic benefits in project selection	Economic benefits from transportation improvements are of three types: *user benefits* (primarily travel time savings, reduced operating costs, reduced accidents, and improved reliability); improved *economic productivity* from better access to goods and services; and (occasionally*) increased employment* in directly affected industries. A recent national study of eight cities including Charlotte found that significantly reduced congestion would improve regional productivity by 4-10 percent. Construction-related employment is *not* a benefit since it is funded from taxes. Recently, North Carolina has begun to quantify user benefits and some economic impacts, among other criteria, to evaluate projects. The McCrory Administration has called for more focus on economic benefits, which now account for just 10 percent of project rating. More exact measures of all three types of economic benefits are needed, but to ensure consistency, estimates of job impacts should be based on nationally-available methods, not on locally-based assertions that could skew ratings. The program should also be tracked over time to ensure accuracy and accountability.
P-03[136]	Coordinate regional long-range plans and TIPs	In some urban regions of NC, the long range plans propose visions that are at significant variance with the specific project lists of the shorter-range TIPs. While some of this difference is to be expected –for instance as unforeseen projects are added or as approved projects are progressed – MPOs should strive to ensure that shorter-range projects, as identified in the TIP, are generally consistent with the region's long-range vision. This means adjusting both the TIP and the LRP to be more realistic.
P-04[137]	Minimize design variations from community preferences	Occasionally, road plans as progressed by NCDOT are significantly different from designs or projects approved or preferred in local plans. While there are sometimes good reasons for this (e.g., safety, cost, continuity, impacts, etc) and leading agencies are ultimately responsible for project implementation, large variations should be uncommon, and when they do occur, they should be fully justified and described in timely fashion to local communities.

[134] Solicited suggestion.
[135] Solicited suggestion.
[136] Solicited suggestion.
[137] Solicited suggestion.

P-05[138]	Build projects incrementally	Road projects can often be implemented in stages or incrementally, over time or distance. For instance, a commercial road section that may ultimately need widening to 4 lanes (in 20+ years) might initially be widened to a 3-lane commercial section, or a proposed 15-mile 4-lane rural widening might initially be widened to 4 lanes for only a portion of the route. Economic principles (widen a road section when the amortized travel time savings from expanding the highway is larger than the amortized capital cost of the expansion plus maintenance) should be applied to determine when to widen roads.
P-06[139]	Select projects based on merit	All projects should compete for limited dollars in a formula that recognizes user benefits (travel time savings, etc, congestion) as the largest component. We need to move away from 'silo funding' for secondary roads, loops, equity, turnpikes, etc. and instead spend dollars according to the prioritization of rankings. To its credit, the DOT recently began evaluating projects by merit (the SPOT program), for highways, public transportation, and pedestrian-bike projects. The McCrory Administration has identified this as a key goal. Urban areas have supported the State's prioritization model and strongly feel the State needs to maintain its commitment to continuing down that path. Local views currently represent 40 percent of the current prioritization mode. This approach should be continued but be modified to increase the 'weight' of needs-based measures (user benefits versus costs, direct job creation, congestion, condition, etc). This can be accomplished *within* distribution region now, but the next step, head-to-head project evaluation across the state and across modes, probably requires legislation.
P-07[140]	Improve the SPOT project selection process	Although the SPOT process is described as a statewide project ranking system, it is really a statewide ranking *platform,* since project selection is still completed on a Division basis. SPOT also has several weaknesses. Not all projects have all of the pieces of data required by the system. Several project segments in SPOT 2.0 showed '0' for pavement condition ratings (requiring reconstruction) for lengths as long as one or two miles. At least one capacity was listed as 800 vehicles per day which led to a raw score of 500, which was in turn manually adjusted to 100, the actual max of the system. In SPOT 2.0 no single factor may have a score greater than 100 and the final score of all factors is again rounded to 100. The system is complex: a project can fit into one cell of a nine cell matrix. This includes different treatments for statewide, regional, and sub-regional projects. SPOT places considerable weight on 'local' view of projects, even those funded by state funds. The system is also biased towards inexpensive projects at the expense of strategic projects. Major projects, such as in the Mobility Fund or of statewide or inter-regional importance, should be given additional weight.

[138] Solicited suggestion.
[139] Solicited suggestion.
[140] Solicited suggestion.

		SPOT does not appear to be tied to NCDOT's performance measures. As such it is not feasible to see if we have spent our money wisely. The SPOT process should also provide flexibility, for instance as TIPs are amended. Consideration should be given to a 'rolling SPOT" permitting regular updates in a smooth and transparent fashion. SPOT data should be transparent, accessible and easily verifiable.
P-08[141]	Re-assess North Carolina's 'vision' for transportation	The last vision for North Carolina's highway system a 3600-mile intrastate highway system knitting North Carolina together, seven urban loops around our largest cities and paving all of the unpaved roads in the state with traffic volumes over 100 ADT, was developed in the late 1980's. It was a vision crafted in a different time for a different economy. The State was supposed to complete that vision in ten years. Twenty-four years later only one of the three goals (paving secondary roads) is even close to fulfillment. In the meantime North Carolina has changed, and we have added to the list without considering what needs to be reduced or removed. It is unlikely that all of the intrastate system will ever be finished; in fact the completion rate for those projects has fallen to one or two miles a year. North Carolina needs to regularly update its vision for the highway system, tying updates to the US Census. Perhaps the state's universities could assist in organizing this effort.
P-09	Review MPO/RPO structure/ Coordinate regional plans[142]/ Uniform MPO plan formats.	North Carolina's MPO-RPO structure is intended to ensure coordinated planning within federally-indentified MPO areas and surrounding rural regions. These regions sometimes cross Division and occasionally state boundaries, making coordination difficult. Review regional and metropolitan planning organizational structure to ensure better coordination. For those MPOs and RPOs within the same region, coordinate long-range plans. The present process describes a 'turtle shell' world organized largely by county that does not exist in the real world. NC regions should be following a similar format for their plans, with each region presenting the same information in essentially the same way. This will permit straightforward assessment of plan effectiveness, without compromising local prerogatives.
P-10	Evaluate web-based map-oriented transportation services	A variety of web-based services and applications are now being developed. These include traffic volumes, travel times, ride-matching services, map-based trip planning, weather and construction advisories, and social media. Sometimes these services are superior to similar services offered by localities or the state. North Carolina has some of these functions available but not others. The state should review these services, develop ways to provide links to them and/or facilitate their use and prevent duplication with inferior services.

[141] Solicited suggestion.
[142] Solicited suggestion.

P-11[143]	Constrain the STIP to needed and affordable projects.	Several prior reviews of the highway program in recent years have concluded that the State's STIP is too optimistic, is over-programmed, and understates future costs. This leads to inevitable funding delays and disappointed local hopes as construction prices rise and funds tighten. The STIP should be a balanced document that is only slightly over-programmed accounting both for likely increases in project costs and revenue flows but also for project delays.
P-12	Initiate a multi-state planning effort	Virginia, North Carolina, South Carolina, Tennessee and Georgia are adjacent eastern seaboard states that are jointly dependent each other for effective high-quality transportation systems. While some multi-state transportation coordination occurs now (for instance in highway project planning, the I-95 corridor, the I-74 corridor, intercity trucking, rail service and intercity bus service) each state has its own state-oriented planning function. Without diluting its responsibilities each state can benefit from more coordination and perhaps joint planning for various corridor services. North Carolina, in the middle of the corridor, should initiate a multi-state effort to improve cross-state planning for all modal services, for the mutual benefit of all. A Compact for improving I-85 is an example.
P-13[144]	Reassess the need for the 'Loop program'	The 1989 Highway Trust Fund proposed building urban loops for Asheville, Charlotte, Durham, Fayetteville, Gastonia, Greensboro, Greenville, Raleigh, Wilmington, and Winston-Salem. The state's 'urban loop' program was intended to complete loops around major urban regions but additions of loops in smaller regions have diluted its function. Loops should be evaluated head-to-head for cost versus effectiveness. Loops that are planned as current or future Interstate highways should receive higher priority than spurs. Prioritize loops according to higher benefit-cost ratios, e.g. 1.5 or greater. Consider eliminating urban loops that do not meet this criterion.
P-14[145]	Increase priority for widening 4-lane freeways with traffic > 40,000-50,000	Although modern 4-lane freeways can carry upwards of 100,000 vehicles daily, older freeways are often congested at lower volumes. NCDOT informally uses level of service D for evaluating widening needs[146]. Set a formal level-of-service criterion (recommended D or D-E) for 6-laning or modernizing older Interstates/freeways that are 4 lanes with daily traffic 40,000-50,000 or higher. Examples are I-85 west of Gastonia between SC line and U.S. 74 exit 10; I-40 between Exit 259 and 266; and portions of I-95.

[143] Hartgen, DT, Cost-*Effectiveness of North Carolina's Major Road Projects,* a Report for the John Locke Foundation, 2004.
[144] Solicited suggestion.
[145] Solicited suggestion.
[146] North Carolina Department of Transportation, Transportation Planning Branch, LOS D Traffic Volume Standards for Systems Planning, Raleigh NC, October 14, 2011.

P-15[147]	Consider North Carolina's changing demographics in the long range plan.	North Carolina's transportation needs are evolving. The population is aging, becoming increasingly diverse, and concentrating more in the State's urban centers. Meanwhile, the state's youth is favoring a more urban, less automobile dependant lifestyle. As a result, the old focus on highway infrastructure needs re-thinking. NCDOT should create a 25 year transportation plan that better meets the state's needs and provides more transportation choices by advancing all transportation modes and shifting the emphasis away from automobile-focused transportation planning.
P-16[148]	Scale projects to match identified transportation needs	When prioritizing transportation investments, and throughout the design process, NCDOT should ensure that it is pursuing projects at the appropriate scale and size to meet transportation needs. The goal should be to maximize the return on taxpayers' investment while ensuring that projects serve identifiable transportation needs and are sensitive to their surroundings. Urban loops should no longer be given priority over other projects under their own separate prioritization scheme, but should compete with other projects. The Department should reduce its focus on new large-scale highway construction. Instead, NCDOT should adequately analyze, and typically give priority consideration, to smaller scale projects – such as providing increased connectivity for urban and suburban street networks - that are often more cost effective and can obviate the need for expensive highway investments. Priority also should be given to improving existing infrastructure where possible to minimize resource investments. Doing so will have the added benefit of moving projects to construction more quickly, as fewer environmental and other approvals will be needed, and such projects will also strengthen existing communities. And for existing facilities, the concept of "right-sizing" might mean using "road diets" to improve overall system operations and create vibrant communities that will stimulate job growth and local business. Further, when new facilities are needed, context sensitive design should be employed to be sure transportation goals are met without damaging communities. It is important to identify the purpose and need for a project so that the scale of a project matches transportation needs and efficient alternatives will be examined. State planning needs to be improved to more carefully and accurately identify and communicate the purpose and need for projects. In addition, to ensure that the need for a project exists and a benefit will result, transportation modelers should proceed in a manner that avoids the "Monroe Bypass" problem of assuming the project is in both build and no-build estimates of traffic. All future projects should be subject to a prioritization and review process that ensures that the scale of transportation projects matches the transportation purpose and need. Smaller scale improvements and "road diets" should be considered in place of new highway construction, and context sensitive design should be applied.

[147] Solicited suggestion.
[148] Solicited suggestion.

P-17[149]	Repeal the STIP, Vision Map, and Equity Formula. Base project selection on merit.	Given limited transportation resources, it is important to spend transportation dollars wisely, and move away from past priorities that are enshrined in statute as the Highway Trust Fund project list, the Turnpike Authority Project list, and through the antiquated Equity Formula. Many of the projects on these lists have been further set in stone on NCDOT's Strategic Highway Vision Map- which creates unrealistic expectations for communities given current fiscal realities. A new plan should start afresh by abandoning those documents and free NCDOT to focus on choosing the very best, most cost-effective projects to meet the specific identified transportation needs of the State. This will allow the Department to be sensitive to budgetary constraints and to create a long-term transportation vision that supports economic growth and advances other critical goals such as improving safety, increasing accessibility, prompting job growth and facilitating vibrant communities. The Legislature should repeal the Highway Trust Fund List of Projects, the Turnpike Authority List of Projects and the outdated Equity Formula, and that NCDOT withdraw the State Strategic Highway Vision Map.
P-18[150]	Conduct a Strategic Research Initiative for NCDOT Executives	It may be useful to conduct strategic research to advise and guide the future of transportation policy and planning in North Carolina. This effort could focus on developing a new updated vision for the state's transportation system. The state's universities may be able to assist in this effort.
P-19	Resolve the "Monroe Bypass" traffic forecasting issue	The US 4th District Court has ruled (May 3, 2013) that NCDOT should have used different forecasts of land use for the Monroe Bypass's 'build' and 'no-build' alternatives, rather than use the 'build' forecast for the 'no-build' scenario. This procedure (using a single land use forecast for 'build' and 'no-build' scenarios) biases the traffic forecasts toward the 'build' scenario and violates NEPA requirements. NCDOT needs to review all its major road projects forecasts (including some for major at-grade arterials) and come to a resolution regarding how to revise these forecasts that are in conflict with the Court's directive.
P-20[151]	Improve consultant selection process	Improve staff skills and processes for ensuring high-quality planning consultant studies, focusing particularly on selection and fee negotiation.
P-21[152]	Improve intra- and inter-urban access	Regarding inter-city access, a strong infrastructure that moves people and goods efficiently and effectively within and between urban centers is key to a strong State economy. Current levels of congestion will only get worse without a high level of investment in a various modes of transportation. With regard to intra-urban access, Governor McCrory's transportation vision for Charlotte might be a model for other cities as they grow. It is important to jointly plan for future land use planning and various

[149] Solicited suggestion.
[150] Solicited suggestion.
[151] Solicited suggestion.
[152] Solicited suggestion.

		transportation modes, where they are cost-effective.

Pedestrian – Bike		
ID	**Short Description**	**Description**
PBK-01[153]	Clarify state role in pedestrian-bike facilities or lanes.	Improving pedestrian-bike facilities is generally a joint responsibility of local governments, with some assistance from the state. Comparatively small investments (such as sidewalk provisions, bike lane striping, and some trail designations) can have a significant effect not only on walking-bike shares, but also on community health and economic impacts. Evaluate whether and where he state's role in non-motorized transportation – presently limited – should be expanded, for instance for sidewalk maintenance and installation of significant connector links.
PBK-02[154]	Clarify use of state funds for bike trails	Funding for bike trail projects is in question because a recent North Carolina Supreme Court decision has suggested that without specific enabling authority DOT may not have the statutory authority to spend money placing trails on unused rail lines owned by North Carolina. A legislative fix granting DOT appropriate authorization would clarify the use of this money.
PBK-03[155]	Establish criteria for 'road diets'	"Road diets" are projects intended to 'slim down' (reduce capacity) existing roads to fit with lower automotive demand or to incorporate pedestrian-bike needs. A common example occurs when a bypass removes traffic from a state highway through a small town, and the state highway may then be a good candidate for a road diet. Most actions concerning 'road diets' focuses on locally-owned streets. However these actions can sometimes affect traffic volumes on state-owned roads, or occasionally actually include state-owned roads. Road diets also sometimes divert traffic to other streets, a form of 'NIMBY' behavior. The criteria for evaluating how proposed 'road diets' might affect traffic flow and/or state-owned roads need to be clarified. Legislation that encourages DOT to evaluate long term trends for 'road diet' actions, and where appropriate fund reconfiguration of roads to reflect new demands for lifestyle transportation will probably be necessary.

[153] Solicited suggestion.
[154] Ibid.
[155] Ibid.

Ports and Waterways		
ID	**Short Description**	**Description**
PF-01[156]	Review ferry tolls	North Carolina's ferry system, part of the state highway system, provides access to coastal communities for residents and tourists. Ferry service costs are increasing and tolls are not keeping up with costs. At present user fees (tolls) cover only about 6 percent of operating costs, compared with about 45 percent of user fees (gasoline and motor vehicle taxes) for the state highway system. While full coverage of costs is probably not warranted, toll rates should be set so they cover a larger portion of operating costs and are more in line with other typical ferry tolls. But this might result in less access and possibly less tourism and economic activity. DOT should undertake a review of its present toll rates with an eye toward bringing them into line with those of similar operations and the 'user costs' of the state highway system.
PF-02	Evaluate privatization of the ferry system	Privatization of the NC ferry system is likely to be a controversial subject. Although privatization has been briefly considered in the past, current budget constraints suggest that another review is appropriate. DOT should undertake an assessment of the issue, fully exploring potential savings, changes in tolls and services, economic impacts, and other issues. The review should include possible PPP arrangements in which the state and the private sector participate jointly in providing service.
PF-03[157]	Clarify maritime improvements and needs	North Carolina's two major ports, Morehead City and Wilmington, provide access to ocean-based shipping for imports and exports. For inbound shipments, 'first port of call' is critical, since 'in transit' time is a critical element to the supply chain. However the Wilmington port is relatively inaccessible compared to other East Coast ports. North Carolina should coordinate with the Department of Homeland Security to improve port operating hours, which would improve service levels, allow for greater competition and permit increased freight travel at night to improve safety and avoid peak congestion periods. The current maritime tax credit is difficult for companies to earn. The state should consider instead of tying the tax credit to volume increases every year, offering a simple credit for using the ports.
PF-04[158]	Develop 'niche' port services and markets	North Carolina's port competitiveness is likely to worsen with the advent of 'big boats' using the upgraded Panama Canal. The opportunities available to the NC State Ports Authority (NCSPA) are likely to be severely impacted by the industry movement towards use

[156] Solicited suggestion.
[157] North Carolina Chamber of Commerce, *Bridge to a Stronger Future: Powering North Carolina's Economy, Transportation Paves the Way*, 2012.
[158] Moffatt & Nichol, NCSPA *Port Business Case Study Report*, a Report for the North Carolina State Ports Authority, February 2011.

		of larger ships. Doing nothing or maintaining the status quo is not an option since these fleet changes, coupled with improving channel depths at competing ports, could relegate NCSPA into competing to serving only smaller shipping lines. Without a deeper channel depth and better supporting highway connections major volume industries might relocate out of NC to other states to be closer to the supply chain and reduce their costs. This is not a call to compete for the larger container ships, whose size and draft would probably be prohibitively expensive for NC ports to accommodate. Instead it is a call to identify and compete aggressively for 'niche' markets of bulk, break-bulk, roll-on, roll-off (RORO), refrigerated, and smaller container (< 8000 TEU) cargo, and for intra-coastal shipping.

Transit		
ID	**Short Description**	**Description**
PTRAN-01[159]	Consolidate transit funding categories and systems	Many of North Carolina's counties have transit services, sometimes several. Most systems do not have dedicated funding but receive some state funding. The Legislature recently directed NCDOT to study the feasibility and appropriateness of developing regional transit systems, examining both consolidation on the basis of regional travel patterns and the consolidation of single-county transit systems. The study[160] found that regional transit systems could demonstrate significant benefits in terms of addressing regional travel needs, improved regional planning, maximizing funding, and creating administrative and operating efficiencies. North Carolina has 9 separate funding programs for public transportation, ranging from human services transportation, operating assistance, and capital programs. Some of these categories might be consolidated to correspond generally with new federal legislation (MAP-21). NCDOT should examine state transit funding sources and combine or eliminate categories to improve organizational efficiency, and should also proceed with implementing the regionalization study recommendations.
PTRAN-02	Establish criteria for funding LRT, BRT, CR services	Several regions of NC are considering building fixed-guideway transit corridors with light-rail transit, commuter rail, or bus rapid transit. These systems are very expensive and typically have limited demand relative to cost. Given the fiscal pressure that these proposals would place on state government (the state's share is typically 25 percent of capital costs for major projects), North Carolina needs to establish objective criteria, in terms of ridership, costs, and benefits, for when and how much state support for such services should be justified.

[159] Solicited suggestion

[160] NCDOT Public Transportation Division, Statewide Regionalization Study, Final Report, May 1, 2012. At http://www.ncdot.gov/download/transit/nctransit/StatewideRegionalizationStudy.pdf

PTRAN-03	Limit state operating assistance to participation to 10 percent of operating costs	For the largest 15 transit systems in North Carolina, the state's share of operating assistance has averaged 12 percent (2011), but some systems have state participation shares over 20 percent. If state and federal shares are high, localities receive unfair cross subsidies from other taxpayers. Implement rules prohibiting state shares of local transit operating assistance of greater than 10 percent.
PTRAN-04	Ensure that riders pay fair shares of transit operating costs	For the top 15 NC systems, fares from riders average 19 percent of operating costs, but s few systems have rider shares much lower than that. This amounts to an unfair cross-subsidy from state or local taxpayers to some systems. NC systems receiving operating assistance should obtain at least 20 percent of operating costs from riders (for fixed-route systems), and 10 percent from riders for demand-responsive systems.
PTRAN-05[161]	Conduct periodic surveys of transit riders	In order to establish a good baseline for performance-based transit planning, North Carolina needs to regularly conduct detailed transit rider surveys to determine who is riding (not just the unlinked trips and total passenger mile numbers), but trip purposes, household/person characteristics, etc. Surveys need to be completed regularly for all transit systems statewide, using an approach similar to the one currently being undertaken in Charlotte. Repeat such surveys over time, e.g., every five years, so that taxpayers and analysts can see what (if anything) changes, as new investments are put in place.
PTRAN-06[162]	Require independent ridership forecasts	Given the history of inaccuracy of transit forecasts nationwide, and a 'world' bias of over-estimating ridership by 104%, as documented by Prof. Flyvbjerg,[163] North Carolina should require that all forecasts of transit ridership and costs which drive expenditure requests should be made by independent, objective parties.
PTRAN-07[164]	Fund transit from general funds	At present NC highway funds are partially used to support public transit services. This amount is about 2.6 percent ($123 million out of $ 5.2 billion) of the state's transportation budget but is more than twice transit's NC commuting share (1.2 percent). It also represents a diversion of funds intended for highways. Over time, state funds for transit services should come from general funds, not highway funds. Fares and other local transit fees should be the largest fund sources for local transit. General fund support for transit should be kept to a minimum.
PTRAN-08[165]	Set growth limits on operating assistance.	To ensure transit cost containment, North Carolina should establish a maximum statewide operating assistance total for each fiscal year that should grow no faster than inflation plus ridership growth.

[161] Solicited suggestion
[162] Hartgen, DT, *Policy versus Performance: Directions for North Carolina's Largest Transit Systems*, A Study for the John Locke Foundation, 2006.
[163] Flyvbjerg et al., W. *Megaprojects and Risk,* Cambridge University Press, 2003.
[164] Hartgen, DT, *Policy versus Performance: Directions for North Carolina's Largest Transit Systems*, A Study for the John Locke Foundation, 2006.
[165] Ibid.

PTRAN-09[166,167]	Review proposed capital expansions carefully.	Proposed expansions of transit capital costs (e.g., additional vehicles, buildings, etc) may appear to be good deal since the state's share of transit capital actions averages just 6 percent of the total. From the local perspective, money that comes in from outside an agency's region (for an MPO) and outside the state (for the state DOT) looks like 'free' money. So an MPO's financially constrained financial plan is often 'conditional', that is a rail line is approved for inclusion in the local Plan *with the assumption* that 50% of the capital cost comes from the feds and 25% from the state. So while there is a "full cost to the society " of, $ 1 billion for a 1 billion project the actual extra cost to the MPO's region, for the capital purchase, is a more modest $250 million. State decision-makers face the same dilemma: if there is a chance of getting "extra money" brought into the state, some could argue they should be as aggressive as possible because they should be looking out for the interests of the state. But capital expansions translate directly to increased operating costs which must be shouldered by the state and local governments. Since very few systems add riders as fast as service, the added service also increases operating deficits. This spiraling cost situation then repeats itself as the 'capital' is replaced by newer vehicles. The state should set strict rules on when it is willing to pay for additional vehicles, and add them sparsely only as ridership increases justify the fleet expansion.
PTRAN-10[168]	Cost-justify 'new start' and 'small start' submittals.	Given the increasing national demand for federal 'new start' and 'small start' funds along with declining federal resources, it is highly unlikely that rail-based expansions proposed for Mecklenburg, Wake, Durham, Orange and other counties will receive funding in the foreseeable future. The inordinately high costs of these services drain the state's ability to provide equitable and better quality services in other regions and thus unfairly saddle the state's taxpayers with unnecessary cross-subsidies between regions. So-called 'bus rapid-transit' services are much more likely to be viable than rail-based services. To minimize this problem and improve equity across the state, North Carolina should enact legislation prohibiting any North Carolina transit system from requesting federal 'new start' or 'small start' funds without an independent assessment from the state demonstrating that the service being requested is the most cost-effective for the corridor.
PTRAN-11[169]	Expand private-sector transit operations.	Nationwide, the private sector delivers excellent public transit in many cities, and about 20 percent of systems contract out all or portions of operations. Professional transportation providers can deliver high-quality bus and rail service at lower cost, preserving and creating a better transit system. Recent research suggests that private contractors average 25 percent savings over the public sector. In North Carolina, the operation of several large systems (e.g., Charlotte and Raleigh) is contracted out to private companies. North Carolina should offer incentives in the form of additional capital and operating assistance for services that are competitively bid and come in below budgeted amounts. The state should also encourage localities to end one-operator transit

[166] Ibid.
[167] Solicited suggestion.
[168] Ibid.
[169] Paraphrased (with thanks) from Tom Downs, 'The best of both worlds in transit', *Atlanta Journal Constitution*, Nov. 12 2012.

		services and permit competition from other private operators in a variety of forms.
PTRAN-12[170]	Quantify the economic benefits of transit service.	NCDOT should quantify the economic benefits of transit investment in public transportation. The quantification should include agency activities, transit user benefits, access to jobs and services, increased mobility options, and induced private development. Charlotte's Blue Line has had considerable effect on land use development. However the quantifications should also consider lost economic activity from needed government support, and discount development that would have occurred anyhow.
PTRAN-13[171]	Consider the needs of transit dependent citizens	Some segments of North Carolina's population do not have access to an automobile. For example, the elderly and low-income populations often rely on transit for some aspects of their lives including accessing employment, health offices, family and more. As part of the transportation planning process, NCDOT should actively reach out to a range of stakeholders, including groups such as AARP and the NC Justice Center, who represent individuals that have unique transportation needs.
PTRAN-14[172,173]	Implement bus commuter routes before commuter rail service	An alternative strategy for being efficient with public money would be an incremental approach: put in place only what is needed to sufficiently satisfy today's needs (e.g., express bus routes operating in mostly uncongested mixed-flow lanes), and then consider higher-cost services (special bus lanes or rail) only if the existing bus service is shown to be "really slow" because it is mired in traffic congestion. Various suburban communities sometimes subsidize express bus service to nearby large cities. For instance, Belmont and Gastonia currently subsidize express bus to downtown Charlotte. These services can be well-used and helps residents get safely and conveniently to jobs. Just as importantly, this effort removes cars from the road and helps the area come closer to achieving attainment for certain air pollutants. However, such services require supporting services such as parking, which can be expensive to provide. However, the alternatives (fixed-route transit or dedicated bus lanes) are even more expensive. NCDOT should always consider supporting commuter bus service first before committing to more expensive services.
PTRAN-15[174]	Evaluate long-distance intercity bus service	Intercity bus service has grown substantially over the past several decades, with new entrants providing service to smaller communities with limited station facilities. Although some issues regarding safety have arisen, the market for such services in NC is clearly substantial. North Carolina needs to evaluate the potential for these services to substitute for much more expensive intercity rail and/or air service. With proper evaluation and planning they could be a key part of providing public transit access to many smaller communities.

[170] Solicited suggestion.
[171] Solicited suggestion.
[172] Solicited suggestion.
[173] Solicited suggestion.
[174] Solicited suggestion.

PTRAN-16	Develop a statewide (possibly multi-state) transit trip planner.	Many of North Carolina's transit systems have web-based 'trip planner' services that allow users to plan trips and see route schedules. However, these systems are generally not coordinated with inter-city transit service, rail, bus or air or with each other. A statewide 'trip planner' service would allow travelers to plan entire journeys by transit.
PTRAN-17	Evaluate the use of public transit for school transportation	In many large US regions, and some smaller ones, some grade school attendees use public transportation rather than school buses. This reduced the need for school vehicles and increases transit ridership. School bus fleets are 2-5 times larger than transit fleets in many NC cities, suggesting that some economies of scale might be possible. While being cognizant of safety and scheduling issues, North Carolina should undertake a review of the circumstances under which public transportation might transport some students.

Research		
ID	**Short Description**	**Description**
RES-01	Comparative performance data with similar states	North Carolina needs an annual comparison of transportation systems performance (highway, bridge, transit, bike-ped, air service, rail passenger and freight) with similar states to measure how well NC is doing. Similar assessments should include adjacent states (VA, TN, GA, and SC) as well as other states in other US regions that are similar in key parameters (size, population, travel, weather). Comparisons should focus on key performance measures for pavements, bridges, congestion, travel time, road geometrics, safety, expenditures and return on investments. This review should be prepared by an independent organization reporting to the Legislature and Governor.
RES-02	Trends in Accessibility	In a review of European cities, Prud'homme and Lee[175] estimated that a 10 percent increased in accessibility would increase regional productivity by 2.4 percent. A study of 8 US cities, including Charlotte[176] estimated that congestion removal would boost regional productivity by about 4-10 percent. The role of increased access in improving economic performance is not appreciated. NCDOT needs to assess recent trends in accessibility to determine the level of success (or failure) of the mission to provide all citizens access, via the transportation networks, to jobs, goods, services, and opportunities (employment, social, and recreational). The state's universities may be able to assist in this study, using modern GIS tools for various modes, passenger and freight.

[175] Prud'homme R and Lee CW. "Size, sprawl, speed and the efficiency of cities", Urban Studies 36:11, 1949-1858, 1999.

[176] Hartgen DT and Fields MG, *Gridlock and growth: accessibility, traffic congestion and regional economic performance*, a Report for the Reason Foundation, October 2010.

RES-03	Evaluate safety opportunities from the Naturalistic Driving Study	The federally-funded Naturalistic Driving Study is outfitting a large sample of cars in 6 test cities (Raleigh is one) to gather information regarding driver and vehicle performance in advance of vehicle conflicts, incidents, near collisions, crash events and road runoffs. The goal of the study is to determine the factors leading to roadway accidents, so that they can be reduced. Given North Carolina's relatively high accident and fatality rates, the state should immediately investigate the Raleigh test data for findings that may quickly bring down NC accident rates. The state's universities might be able to assist in this research.
RES-04	Implement a 'Research Scan' program	The volume of research and findings from transportation studies is immense and is difficult to track by professionals. Yet many research findings are applicable to NC situations. Establish a small program to track and evaluate research and study findings, and report them to NCDOT administration for consideration. The state's universities may be able to assist in this effort.

Rail Freight and Passenger		
ID	**Short Description**	**Description**
RR-01[177]	Fund NC's AMTRAK service consistent with ridership share	The long-term future of intercity rail passenger service remains clouded. The Obama Administration's vision of a greatly expanded national system remains unfunded. In North Carolina state funds have been used to increase service between Raleigh and Charlotte from 2 to 6 trains per day. However demand increases may not warrant such service expansion and less federal support nationally may result in inordinately superior state service. In the meantime, intercity *bus* service is increasing rapidly as new entrants provide direct point-to-point service for many rural communities as well as larger cities. This raises fundamental questions such as to what extent NC should invest in limited-use rail passenger service or instead encourage better intercity bus service. Review appropriate levels of service and evaluate whether or not funding is commensurate with ridership as a percentage of intercity travel.
RR-02	Require that governments obtain railroad cooperation before proposing track use.	Several recent NC transit plans (Charlotte, Wake county) propose to use existing railroad tracks or right-of-way to operate commuter rail passenger service. Co-mingling freight service and high-frequency commuter service raises fundamental questions of safety, operation, cost, value, and public good versus private ownership. Since railroads generally have unlimited 'first right' of use of their facilities, the state should require cooperation and agreement between railroads and governments regarding co-use of right-of-way, in a manner consistent with both interests, *before* such transit proposals are approved.

[177] Solicited suggestion.

RR-03[178]	Strengthen NCRR reporting requirements	North Carolina has limited oversight of the North Carolina Railroad. As a private corporation, NCRR has less stringent reporting requirements than publicly-traded corporations. NCRR has not fully met reporting requirements since 2007 and lacks a comprehensive strategic plan, and performance measurement system. Changing NCRR's corporate structure could strengthen the State's oversight but requires a lengthy and complicated process. Amending state law to improve the corporation's reporting to the State should be considered.
RR-04[179]	Improve railroad-government coordination	North Carolina's railroad system provides important services for distribution of many products. Increasing inter-modal services between air, truck and rail, and emerging market shifts (such as different freight movements resulting from the Panama Canal widening) imply future changes in demand. North Carolina government should work in partnership with the freight rail industry to maximize opportunities to improve efficiencies of freight movement and add new capacity where warranted.
RR-05[180]	Expand freight railroad use	North Carolina has great potential to use freight rail to support its coastal and inland ports and major metropolitan hubs. For example, freight will play an important role with the planned Charlotte Regional Intermodal Facility at the Charlotte-Douglas International Airport, which is estimated to bring millions of dollars of private investment to the area and hundreds of new jobs. NCDOT should focus on expanding freight service throughout the State, including the extensive North Carolina Railroad system corridor, which could provide a cost effective way to help meet North Carolina's growing transportation challenges.
RR-06[181]	Reduce or eliminate state role in railroads	Some employers see the North Carolina Railroad as a poor partner inhibiting economic growth. The state's role in railroads should be reduced or eliminated, letting market forces provide rail services.

[178] North Carolina General Assembly, Program Evaluation Division (PED) Report No. 2012-10, *North Carolina Should Require NC Railroad Company to Pay an Annual Dividend and Strengthen Reporting,* October 2012, p.1.
[179] North Carolina Chamber of Commerce, *Bridge to a Stronger Future: Powering North Carolina's Economy, Transportation Paves the Way*, 2012.
[180] Solicited suggestion.
[181] Solicited suggestion.

Technology		
ID	**Short Description**	**Description**
TECH-01	Prepare NC response to 'self-driving cars'	In the last decade so-called 'self-driving cars' have moved from pipedream to beta-testing, and some predict considerable use in the next 10-20 years. Several states (CA, FL, NV) have passed legislation regarding self-driving cars. Nevada goes the farthest, with a 22-page rule that permits testing only[182]. Given the potential opportunities for economic growth, and issues such as liability-safety and capacity, North Carolina needs to prepare for the potential of this technology to radically change transportation.
TECH-02	Evaluate public uses for location-based travel data	Location-based travel data such as collected by some cell-phone services also permits public-value services such as congestion delay, and emergency routing and messaging. Significant issues have been raised concerning the privacy of cell-phone based mapping services. Some states are considering legislation to ban the tracking of location without participant knowledge. Given the likelihood of significant availability of such data in the near future, North Carolina needs to review the appropriate uses of such information for public purposes.
TECH-03	Cautiously track EV technology	Although the electric battery was invented more than 200 years ago, progress toward a cost-effective battery that can drive a car for more than 50 miles has proved elusive. Although some researchers see breakthroughs ahead, others are more pessimistic[183]. Given the uncertainty, NC should be cautious about supporting local EV and battery development, but should track progress.

[182] Strumpf, D, "Liability Issues Create Potholes On the Road to Driverless Cars," *Wall Street Journal*, January 28, 2013.
[183] Borenstein, S, "Are batteries slowing technology?" *Charlotte Observer*, February 17, 2013.

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“To prejudge other men’s notions
before we have looked into them
is not to show their darkness
but to put out our own eyes.”

JOHN LOCKE (1632–1704)

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