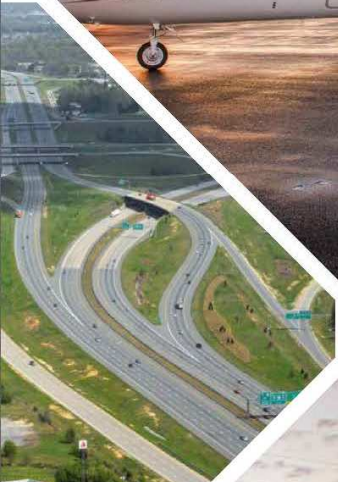
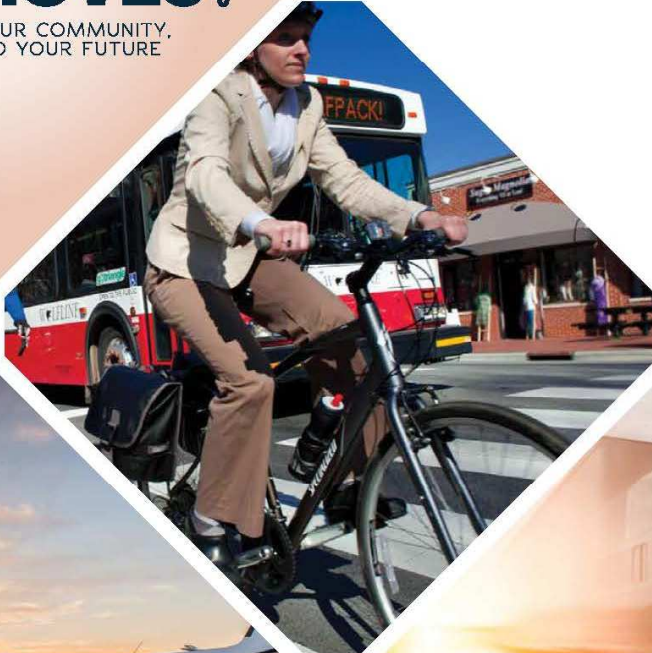




NC MOVES 2050

CONNECTING YOUR COMMUNITY,
YOUR VOICE AND YOUR FUTURE



NC MOVES 2050 FUTURE NEEDS ASSESSMENT

Technical Memo 1
November 2020

TABLE OF CONTENTS

- 1. INTRODUCTION..... 3**
 - 1.1 ANALYTICAL APPROACH 3
 - 1.2 TREND 2030 BASELINE 3
 - 1.3 DEVELOPING 2050 TREND 4
 - 1.4 ADAPTABILITY AND COVID-19 4
- 2. NEEDS BY ALTERNATIVE FUTURE 5**
 - 2.1 2050 TREND NEEDS 7
 - 2.2 GLOBALLY CONNECTED NEEDS..... 7
 - 2.3 RENEWED NEEDS 9
 - 2.4 INNOVATIVE NEEDS.....10
 - 2.5 UNSTABLE NEEDS.....11
- 3. MODEL METHODOLOGY12**
 - 3.1 STATEWIDE MODEL (NCSTM)12
 - 3.2 OFF-MODEL ADJUSTMENTS13
 - 3.3 LOCAL EXPERT REVIEW AND INPUT13
- 4. MODEL RESULTS.....14**
 - 4.1 MOBILITY AND MODERNIZATION RESULTS BY MODE14
 - 4.2 RESULTS BY ALTERNATIVE FUTURE.....14
 - 4.2.1 *2050 Trend*14
 - 4.2.2 *Innovative*14
 - 4.2.3 *Renewed*14
 - 4.2.4 *Globally Connected*.....15
 - 4.2.5 *Unstable*15
- 5. NEEDS BY CATEGORY16**
 - 5.1 MOBILITY AND MODERNIZATION NEEDS BY MODE16
 - 5.1.1 *Aviation*.....18
 - 5.1.2 *Active Transportation*19
 - 5.1.3 *Ferries*20
 - 5.1.4 *Rail*21
 - 5.1.5 *Transit*.....21
 - 5.1.6 *Highway*.....22
 - 5.2 ASSET NEEDS22
 - 5.2.1 *Bridges and Pavement*.....23
 - 5.3 OTHER NEEDS.....25
- 6. PERFORMANCE SUMMARY27**
- 7. CONCLUSION.....28**
 - 7.1 FLEXIBILITY.....28
- APPENDIX A – NC FIRST COMMISSION 2032 GAP ANALYSIS.....29**

LIST OF FIGURES

Figure 1: Four Alternative Futures	5
Figure 2: Trend 2050 Multimodal Needs	6
Figure 3: 2050 Funding Needs – Trend and Futures	6
Figure 4: Needs Estimate in 2050 Trend	7
Figure 5: Needs Estimate in the Globally Connected Alternative Future	8
Figure 6: Needs Estimate in the Renewed Alternative Future	9
Figure 7: Needs Estimate in the Innovative Alternative Future	10
Figure 8: Needs Estimate in the Unstable Alternative Future	11
Figure 9: Model Analysis Process	12
Figure 10: Multimodal Needs Development	16
Figure 11: Multimodal Needs Development By Mode	17
Figure 12: Estimates for Mobility and Modernization, Asset, and Other Needs	17
Figure 14: Estimate of Highway Asset and Other Needs	24
Figure 15: Alternative Futures Performance Summary	27

1. INTRODUCTION

NC Moves 2050 crafted a new approach to understand the degree of North Carolina’s future transportation needs to guide future investment, resources, and focus. Employing a comprehensive methodology required multiple tools and sources to address needs specific to short- and long- term horizons. Identifying individual needs by timeframe addressed shared statewide multimodal transportation interests across North Carolina Department of Transportation (NCDOT) and partner needs like transit systems. This methodology also incorporated needs from regional stakeholders such as metropolitan planning organizations (MPOs), rural planning organizations (RPOs), partner state agencies, interest groups, and elected officials. The full analytical approach, including use of alternative futures to construct a range of estimates to 2050 is described in this memo.

1.1 ANALYTICAL APPROACH

Understanding expected conditions under four alternative futures (**2. NEEDS BY ALTERNATIVE FUTURE**) built a foundation to develop and organize needs under condition and timeframe. This approach distinguished short-term needs expected by 2030 from long-term needs oriented under a range of 2050 conditions. A tailored model (**3. MODEL METHODOLOGY**) was a key tool to strengthen and understand needs according to alternative future by modal categories. Model results (**4. MODEL RESULTS**) were analyzed together with input from subject matter experts to thoroughly understand outputs by mode and by alternative future. The needs were further organized into three categories (“Mobility and Modernization”, “Assets”, “Other”) and described by “mode” (**5. NEEDS BY CATEGORY**). Performance implications (**6. PERFORMANCE SUMMARY**) explain what these estimates could mean for North Carolina’s entire transportation system. The analysis concludes (**7. CONCLUSION**) with a contextual understanding of how NC Moves 2050 can be adapted as the actual future unfolds.

1.2 TREND 2030 BASELINE

Assessing North Carolina’s multimodal transportation needs required speculating how needs are being met through 2030 and what would be necessary to identify and meet multimodal needs through 2050. Trend 2030 identified needs informed through North Carolina’s State Transportation Improvement Program (STIP), Strategic Transportation Prioritization (SPOT) Database, Transportation Asset Management Plan (TAMP), Highway Safety Improvement Program (HSIP), and other statewide programs. The 2030 Trend needs represent highway and non-highway capital priorities not committed in the STIP, investment levels to meet 10-year pavement/bridge performance targets and to fully fund statewide program priorities (such as Spot Safety). Costs were split between those borne by NCDOT versus total implementation costs as well as by capital versus operating costs based on 2018 dollars. Estimates excluded non-infrastructure support programs and needs beyond the SPOT database like privately owned rail assets and commercial airports, and yet-to-emerge needs absent from sources.

A needs and revenue forecast for 2032 was constructed in September 2020 for the NC FIRST Commission to review, and this forecast became a subset of NC Moves 2050. Using feedback from the NC FIRST Commission helped tailor and communicate the influence of some of the same alternative future assumptions possible over

the next 12 years. The 2032 forecast and assessment is documented through a presentation available on the Commission's [website](#).

1.3 DEVELOPING 2050 TREND

Extrapolating data from the SPOT Database, utilizing current Metropolitan Transportation Plans (MTP) and the NC Statewide Travel Demand Model (NCSTM) formed the basis of 2050 Trend needs. This approach represents transportation demand translated into planning-level estimates expected over this timeframe. 2050 Trend is a baseline comparable to similar planning-level estimates created by conditions within each of the four alternative futures by mode, system, and region.

1.4 ADAPTABILITY AND COVID-19

Although NC Moves 2050 was not designed to foresee the level of change due to a global pandemic, the scenario planning process introduced in the Plan is even more relevant and important as a result of COVID-19. The unpredictable disruption associated with the pandemic and other drivers of change are altering the way people value mobility and make transportation choices, forcing transportation agencies to adapt operations, management and investment in the transportation system.

2. NEEDS BY ALTERNATIVE FUTURE

The four alternative futures for NC Moves 2050 encompass NCDOT and partner systems to provide a comprehensive picture of statewide multimodal transportation needs (**Figure 1**). These influencing assumptions are translated into quantitative and qualitative factors tested across a variety of tools and inputs to represent plausible future performance outcomes across four possible scenarios:



FIGURE 1: FOUR ALTERNATIVE FUTURES

Forecasting beyond the next 10 years is at best an order of magnitude exercise. Quantifying multimodal transportation needs to 2050 is a challenging task due to an increasing level of uncertainty and unpredictable events. The transportation industry is experiencing rapid change which may alter demand from the best forecast of current tools and models. The use of alternative futures provides a more comprehensive view accounting for “what if” possibilities from NC specific research, trends and forces of change. **Figure 2** illustrates key sources, analytical modeling and subject matter input utilized to establish the 2050 Trend and create estimates under each of the alternative futures. These sources were organized within three categories of needs, **Mobility and Modernization**, **Assets** and **Other**, to easily communicate results and to represent statewide transportation infrastructure and resources to advance NCDOT’s vision, goals and performance.

To address NC Moves 2050 goals, total statewide transportation needs are estimated to range between \$113 billion and \$125 billion through 2050 (2050 Trend), or approximately \$5.65 billion to \$6.25 billion annually (**Figure 3**). Estimates are highest statewide in the Globally Connected alternative future (\$123 billion to \$166 billion), followed closely by the Renewed alternative future (\$123 billion to \$166 billion). Estimates are lowest in the Innovative alternative future (\$104 billion to \$111 billion) because of efficient technology and economies of scale.

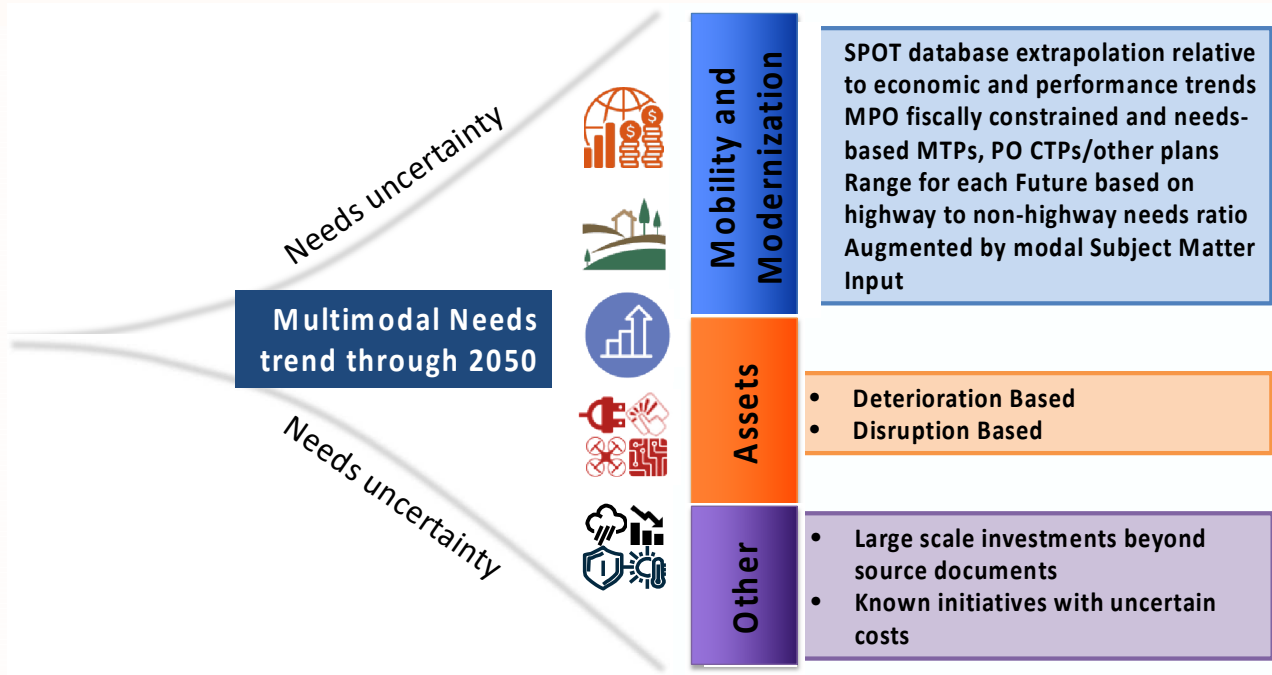


FIGURE 2: TREND 2050 MULTIMODAL NEEDS

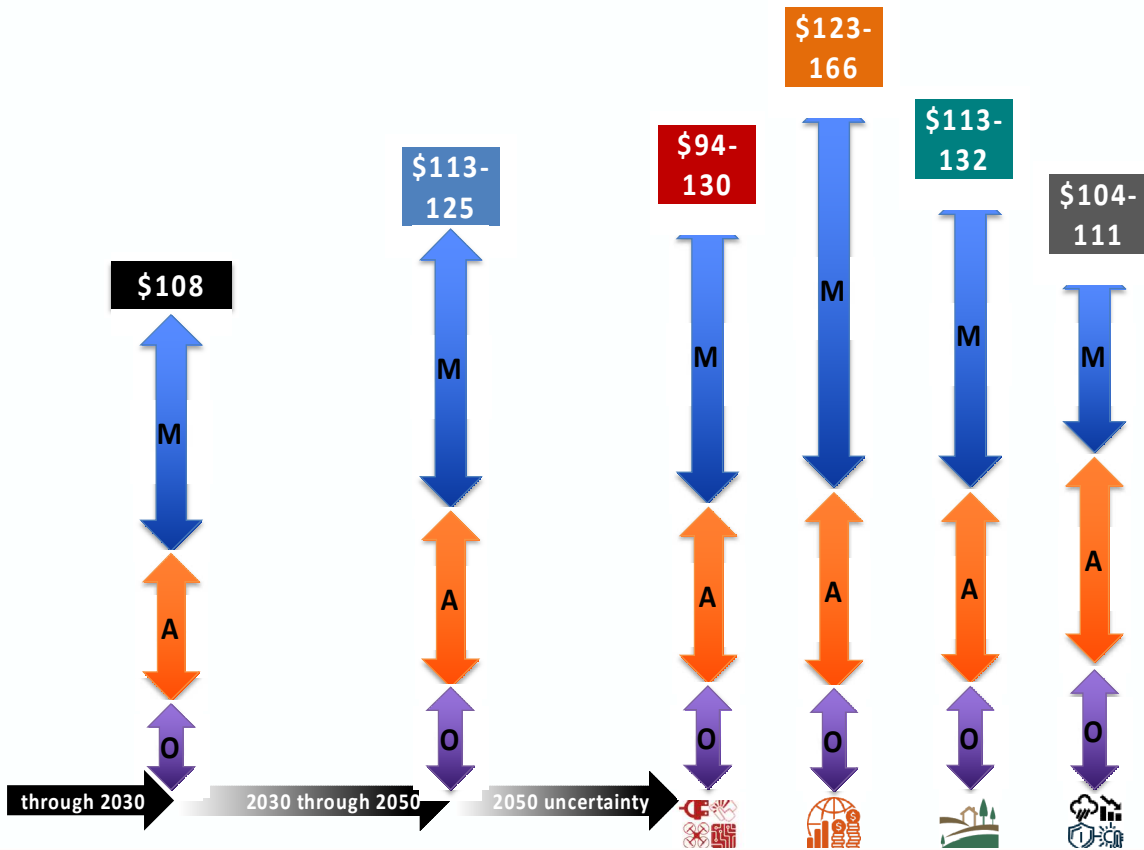


FIGURE 3: 2050 FUNDING NEEDS – TREND AND FUTURES

2.1 2050 TREND NEEDS



The 2050 Trend estimates fall between the Renewed and Unstable alternative futures (**Figure 4**), and double-headed arrows indicate the range of increase in estimated needs from 2030 Trend. Some of the same technology benefits from Innovation drive needs down, but economic and population growth continue and keep pressure on existing infrastructure and increase demand for new multimodal connections. Total needs from 2030 to 2050 in 2050 Trend alternative future increase relative to total needs through 2030 due to incremental change in technology, continued economic growth, and travel demand which in turn increase pressure on performance but the high-end estimate reflects more multimodal investments.

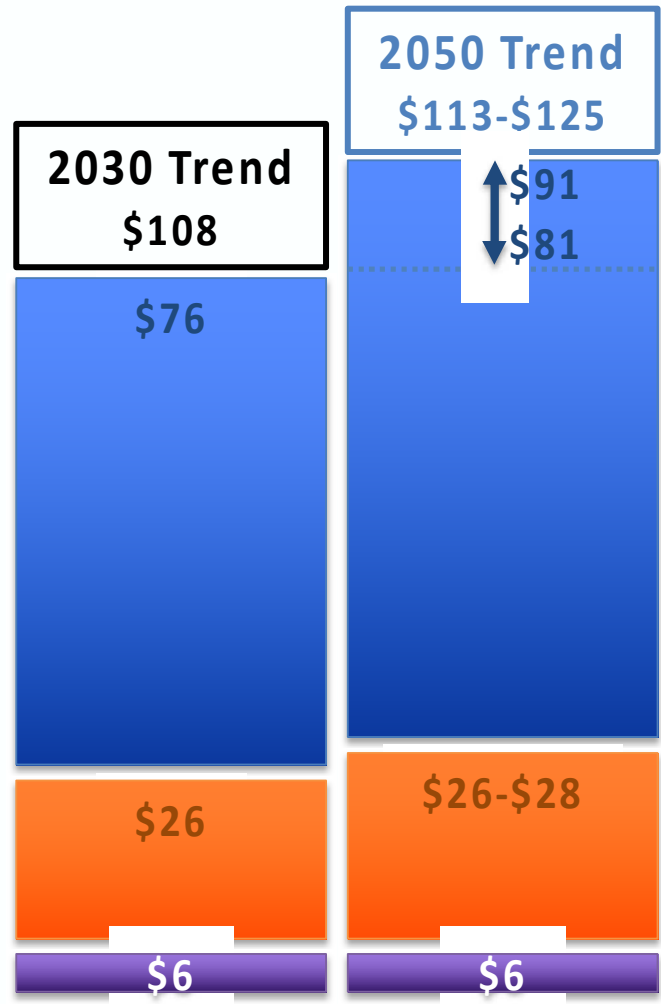


FIGURE 4: NEEDS ESTIMATE IN 2050 TREND

2.2 GLOBALLY CONNECTED NEEDS

The Globally Connected alternative future generates economic growth in manufacturing, technology, automation, and services to position North Carolina as a leading market for a skilled workforce



connected through international gateways and an efficient freight system. Vehicle Miles Traveled (VMT) substantially increases, and economic growth spurs more travel demand across all modes, particularly freight. Advanced technology and more locally produced products offset some VMT growth and asset management needs, but all results bring much higher needs compared to 2050 Trend for Mobility and Modernization as well as assets (Figure 5).

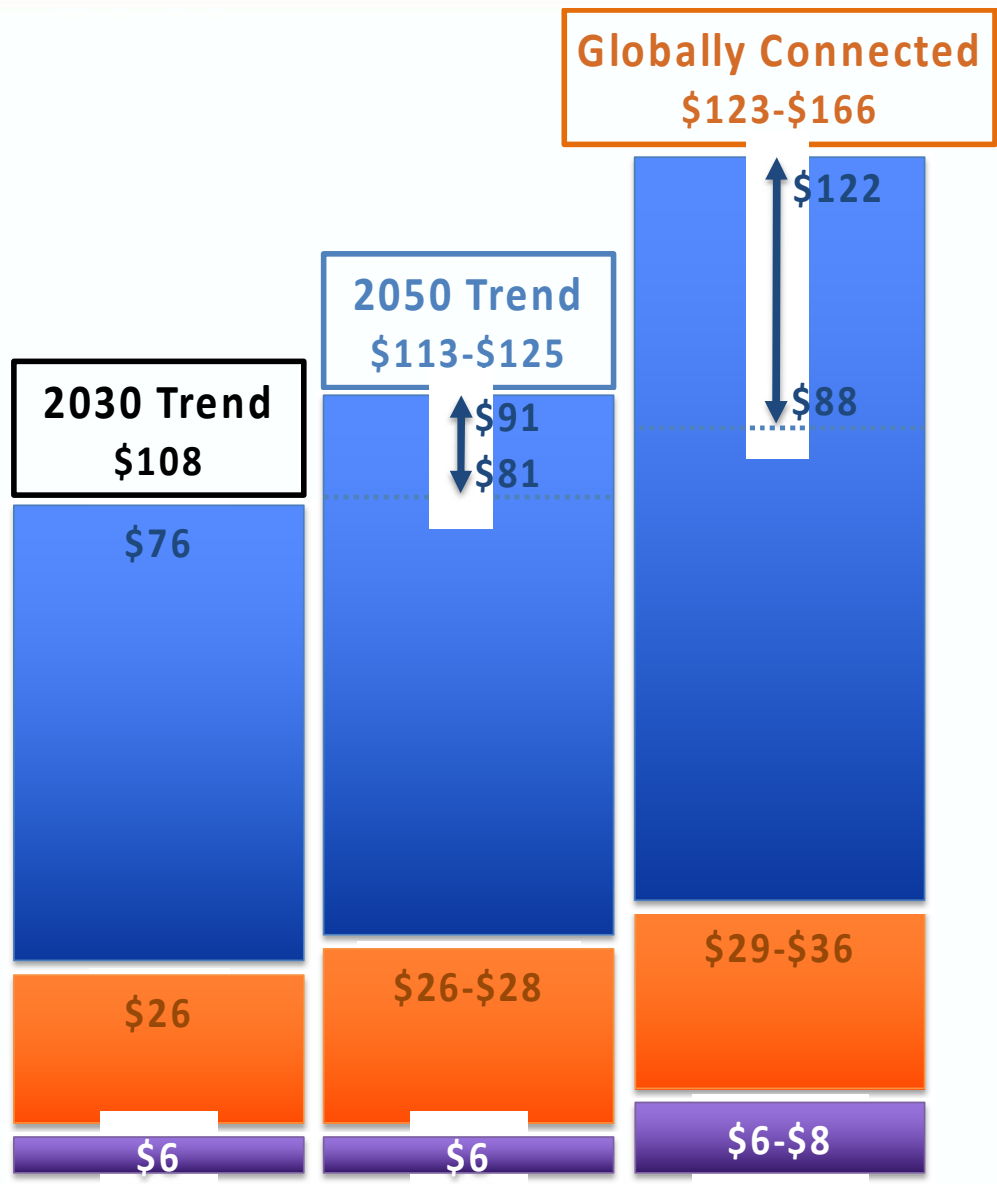


FIGURE 5: NEEDS ESTIMATE IN THE GLOBALLY CONNECTED ALTERNATIVE FUTURE

The economy continues to grow and diversify at an accelerated pace because of a substantial focus on manufacturing and international trade, resulting in more freight movement, growth in large urban regions, and demand for diverse transportation options within and between regions, while non-urban regions remain stagnant. Additional vehicular travel of goods and people across the state puts more pressure on roads and bridges, and new roads as well as multimodal connections are needed to accommodate economic growth.

2.3 RENEWED NEEDS



The Renewed alternative future brings small towns and rural communities closer together to become more connected to each other and to urban centers through transportation. Growth in rural communities and small cities increases travel demand and crucial support of longer-distance travel, but growth and aging population require more multimodal options, which makes estimates comparable to 2050 Trend, with higher top-end to support growing rural economies (Figure 6).

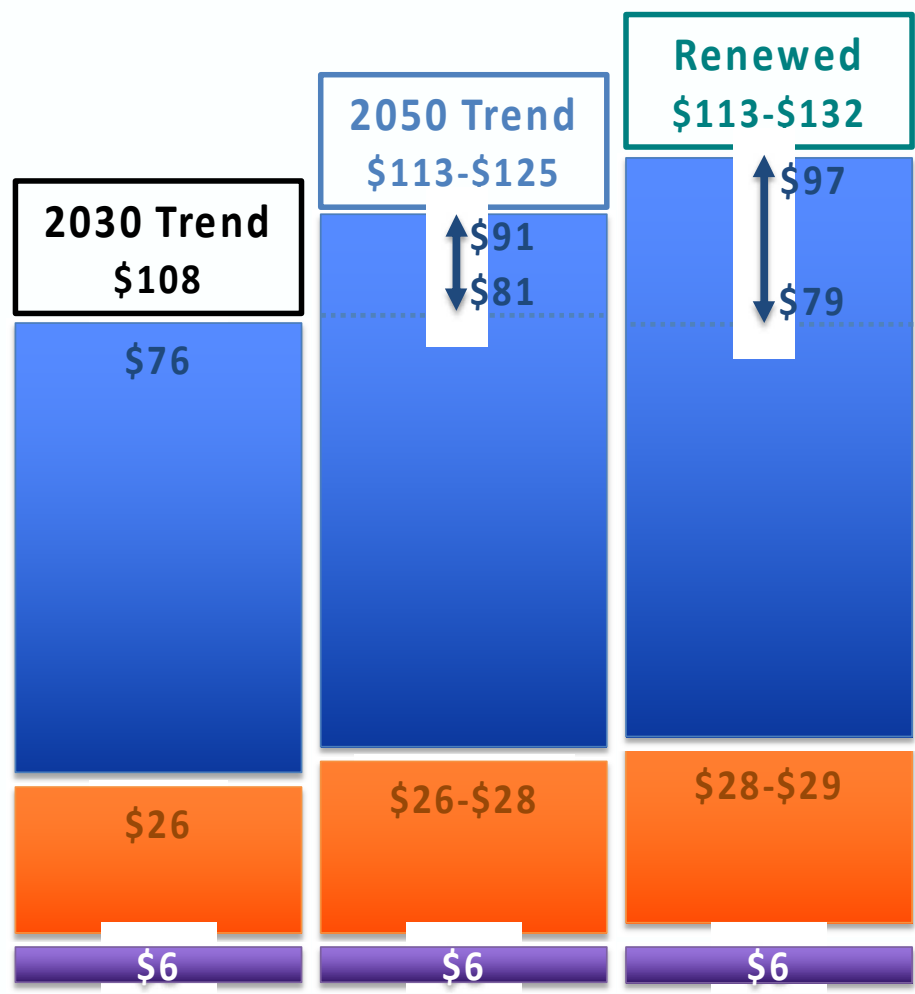


FIGURE 6: NEEDS ESTIMATE IN THE RENEWED ALTERNATIVE FUTURE

Town and community growth are matched with a moderate shift toward connected and autonomous vehicles (CAVs), increased rural transit service, additional intercity and regional transit and rail service, and more locally produced goods. Urban regions continue to grow, but towns and communities grow faster. Community growth in transportation requires ample local investment targeted at specific demand-based trip origins and destinations, and studying duplicities opens up opportunity for more efficiency.

2.4 INNOVATIVE NEEDS

Statewide estimates are lowest in the Innovative alternative future because advanced technology as well as new mobility options increase transportation's throughput, drive new development patterns, and feed economic growth. VMT decreases following multimodal system expansion, new technology replaces travel demand, and new modes reduce highway capacity needs. Technology costs to deploy a fully connected and automated system increases overall estimates which increases needs above 2050 Trend (**Figure 7**).

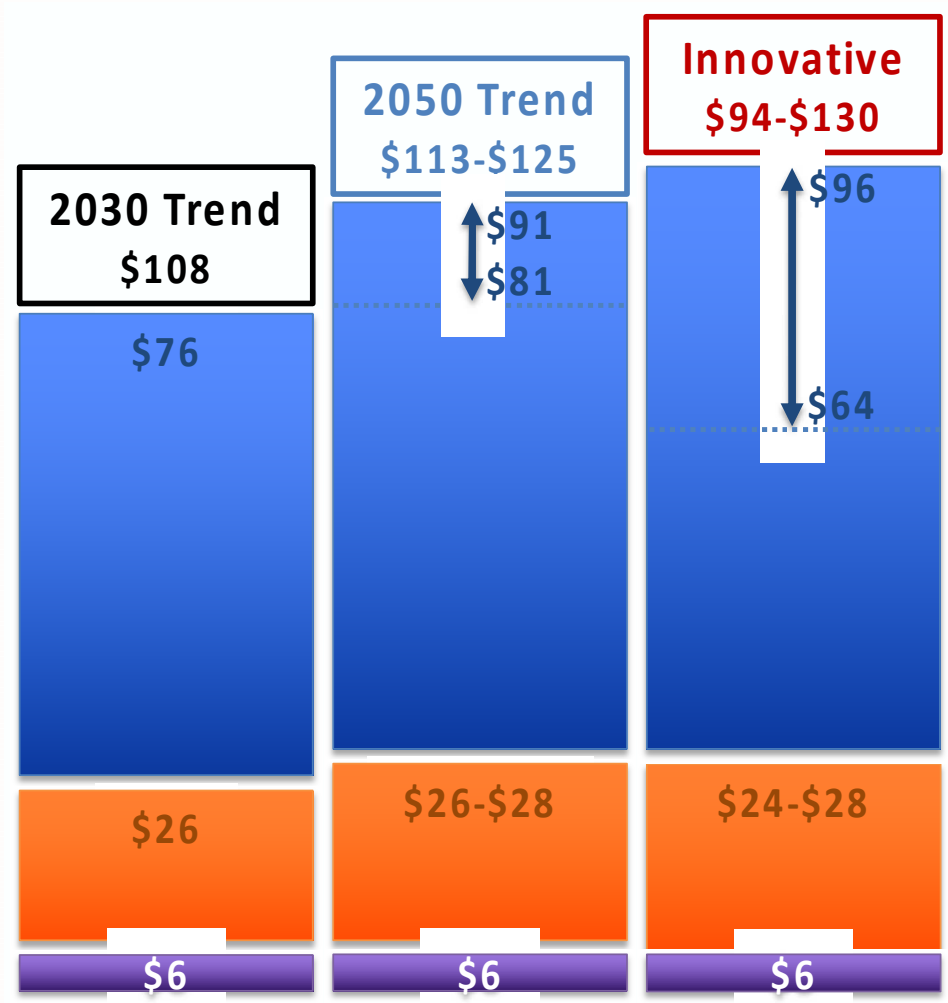


FIGURE 7: NEEDS ESTIMATE IN THE INNOVATIVE ALTERNATIVE FUTURE

Advances in technologies also support safer, more reliable travel with less emissions, lower costs, and a more accessible multimodal system. Greater availability of Mobility as a Service (MaaS) means users subscribe, hail or access options to move from point to point without owning a vehicle. Connected and autonomous vehicles (CAV) share corridors, mainstream electric vehicles combined with modern shared and micromobility reduce emissions, robust technology maximizes telecommuting and the 24x7 workforce, and imported goods as well as on-demand deliveries surge. Implementing new technology also can increase costs for NCDOT and partners, especially in transit operations.

2.5 UNSTABLE NEEDS



Estimates are higher in the Unstable alternative future than in the Innovative alternative future because of funding instability, political and social events, environmental threats, and energy uncertainty. Less economic growth and travel demand relative to 2050 Trend result in lower Mobility and Modernization needs, but asset management needs could significantly increase to address frequency and severity of weather events as well as other system disruptions. Transportation management incrementally increases efficiencies which improve system movement (**Figure 8**).

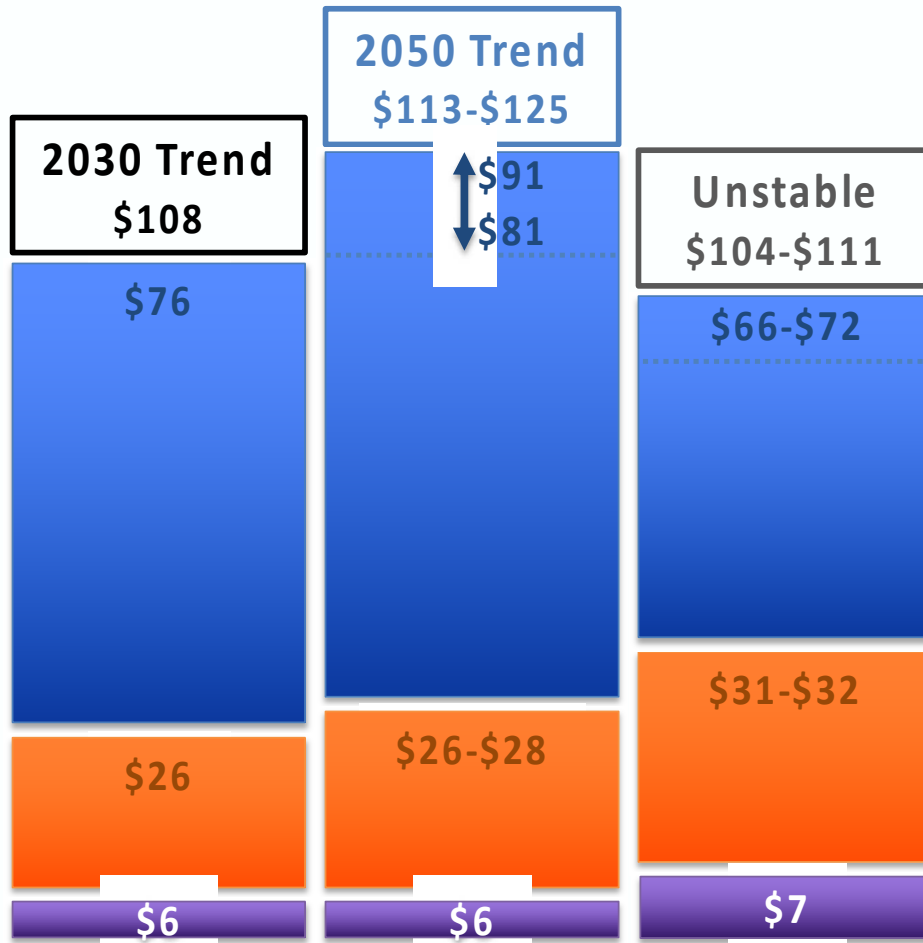


FIGURE 8: NEEDS ESTIMATE IN THE UNSTABLE ALTERNATIVE FUTURE

Outcomes could stall tourism and stagnate the economy which creates a transportation system with high travel costs and unreliable mobility. Resources shift to maintain assets which support resilient, safer infrastructure and ensure access to more communities in vulnerable areas. The state economy grows but less than the trend because of energy uncertainty, severe weather and/or environmental events, as well as other economic challenges which impact the state's population, vehicle ownership, and statewide VMT.

3. MODEL METHODOLOGY

Building a tailored model was one of many tools used to create the picture of performance by moving needs according to alternative futures into modal categories across three steps (Figure 9). The model was first run to establish a baseline for analysis, then adjustments were made based on best practices from local reports, and finally input was incorporated from regional MPOs Metropolitan Transportation Plans (MTPs) as well as other modeling experts to improve accuracy, enhance relevance, and further understand future needs.



FIGURE 9: MODEL ANALYSIS PROCESS

3.1 STATEWIDE MODEL (NCSTM)

For the 2050 Trend and each alternative future, the NCDOT statewide model (NCSTM) was run to assess highway network travel demand as well as other core Mobility and Modernization measures by extrapolating population as well as employment projections and then testing high/low points for each alternative future.

- **Extrapolation** – 2050 Trend extrapolated population projections from the North Carolina Office of State Budget and Management (NC OSBM) through 2050 and combined these with current NCSTM and MPO population and employment projections. The highway network includes all existing and committed projects consistent with programmed projects in Prioritization 5.0 (P5.0), but not MPO MTP projects.
- **High/Low Tests** – Testing high and low points for each alternative future required adjusting population, employment location (land use), and network capacity levers within the model to reflect potential CAV impacts such as using a 1.5x multiplier for interstate capacity in a high CAV case.

The NCSTM was built on current travel cost and value of time estimates which bind the model's capabilities to these core assumptions. Assumptions were not modified in any alternative future, and the model's network only encompasses statewide and regional tier facilities. The model also only focused on highway passenger and freight trips, lacking a mode choice estimation or transit assignment.

3.2 OFF-MODEL ADJUSTMENTS

Due to the model's known limitations, several adjustments to NCSTM results were made to further tailor model results based on best practice factors from local and regional research as well as reports. Off-model adjustment factors included:

- **Travel cost changes (VMT increase or decrease)** – Based on assumptions within the U.S. Department of Energy, Annual Energy Outlook (AEO) scenarios for fuel cost elasticity and total travel cost elasticity.
- **Telecommuting share (Commute VMT, Peak period delay)** – Based on current eligible employment (finance, information, and services sector), and a high and moderate factor for number of days per week telecommuting
- **Land use/development change (VMT per capita decrease)** – Based on average VMT per capita within 14 Northeast and Mid-Atlantic states across four different community types. Population shares within four region types in NC (large urban, medium urban, small urban, and non-urban) are adjusted across the community types to test how adjustments to denser and mixed-use communities impacts VMT per capita.
- **Transit and active transportation mode share (Commute VMT, Peak period delay)** – Commute mode share trends from the American Communities Survey is compared to the NCSTM which predicted commute trips in 2050 by region to determine a 2050 trend mode share. Insight from NCDOT subject matter experts on transit and active transportation mode share by region type for each alternative future are used to assess impacts to commute VMT.
- **Mobility as a Service (MaaS) usage (VMT decrease)** – Based on recent national and international studies, estimates of potential decreases in auto ownership and population share of regular Mobility as a Service (MaaS) users and frequency of use are tested for each alternative future and each region type.
- **Electric Vehicle market share (fuel consumption decrease)** – The latest forecasts from the AEO indicates a combined plug-in electric (PEV) and plug-in hybrid electric (PHEV) share from 19 – 26% of the fleet by 2050. The International Energy Agency projects a 40% fleet share by 2050 in the most optimistic scenario.
- **Non-Work travel demand (VMT decrease)** – This adjustment, primarily within the Innovative and Globally Connected futures), addresses the potential for reduction in shopping trips (approximately 20 percent of all travel per National Household Travel Survey data) resulting from more online and on-demand shopping and delivery.
- **Freight activity (Truck VMT increase)** – Based on insights from the Statewide Multimodal Freight Plan, the NCSTM predicted truck VMT to increase in each region (highest increase in large urban) in the Globally Connected future.

3.3 LOCAL EXPERT REVIEW AND INPUT

Model results were reviewed and adjusted from comparing performance outcomes documented in recent or ongoing 2040/2045 long-range plans with consistent assumptions from each MPO and MTP as well as according to direct input from NCDOT experts. For non-urban areas, a combination of resources was scanned including representative CTPs and the P5.0 database.

4. MODEL RESULTS

4.1 MOBILITY AND MODERNIZATION RESULTS BY MODE

The model analyzed Mobility and Modernization by surface and non-surface modes. Surface modes included highway, transit, active transportation (bike/ped), and rail systems, and non-surface modes encompassed ports, aviation, and ferry transportation systems.

For surface modes, all supporting data, assumptions, sources, calculations, and outcomes were included in a single spreadsheet tool. The tool focuses on a short-list of ten Mobility and Modernization measures along with population and employment. Results are segmented geographically (statewide, large urban, medium urban, small urban, non-urban) and by system (statewide tier, regional tier). For non-surface modes, projections of future demand, utilization, and capacity were based on input from NCDOT modal experts across the Alternative Futures as well as project information from the P5.0 database.

4.2 RESULTS BY ALTERNATIVE FUTURE

After the surface and non-surface mode analyses were completed, each Alternative Future was then compared to 2050 Trend to develop a range of plausible performance outcomes through 2050.

4.2.1 2050 TREND

Population growth of 4 million and employment growth of 2.5 million significantly increases total travel demand. Annual VMT (including passenger vehicles and trucks) increases by 36 percent statewide (or 40 billion more miles traveled). This translates to a 58 percent increase in vehicle hours traveled (VHT), which is a product of growth in peak period congestion.



4.2.2 INNOVATIVE

VMT decreases slightly as the potential increase in VMT from high deployment of CAVs in addition to shared Mobility and Modernization are offset by growth in traditional and emerging transit technologies, and a reduction in travel demand due to telecommuting and more on-demand deliveries.



CAVs and other technologies help increase speeds and reduce delay throughout the system, enabling more travel to occur in uncongested and reliable conditions. Truck VMT decreases slightly as a result of drone deliveries and consolidation.

4.2.3 RENEWED

VMT increases as a result of more non-urban travel and more long-distance travel between growing rural communities and urban centers. Moderate deployment of CAVs and growth in transit use, particularly in smaller urban regions and growing rural communities, and intercity passenger rail expansion, helps offset some of this new travel demand. VHT slightly decreases as a result of a more even growth pattern (i.e. less focus in large urban areas). Truck VMT increases as a result of growth in rural economies.



4.2.4 GLOBALLY CONNECTED

VMT increases as total travel activity increases across all trip types as a result of an expanded and more diverse economy, including a 30 percent increase in truck VMT. This increase in VMT is accommodated by the network, resulting in a VHT decrease, through moderate CAV deployment, consolidation and optimization of some freight activity, and increased drone and other autonomous vehicle deliveries.



4.2.5 UNSTABLE

Total population and employment growth decreases around 20 percent, with sustained economic decline in rural, at risk areas. This results in decreases in VMT and VHT, and less transit demand, although comparatively, transit does well due to anticipated higher vehicle travel costs from energy uncertainty. Little to no CAV in this future results in more congestion and anticipated lower system reliability (not quantified).



5. NEEDS BY CATEGORY

5.1 MOBILITY AND MODERNIZATION NEEDS BY MODE

Analyzing needs across modes explains how the size of user base (population), infrastructure system, spatial requirements, and funding sources specifically affects future needs. Multimodal needs were developed using a quantitative and qualitative approach (Figure 10).

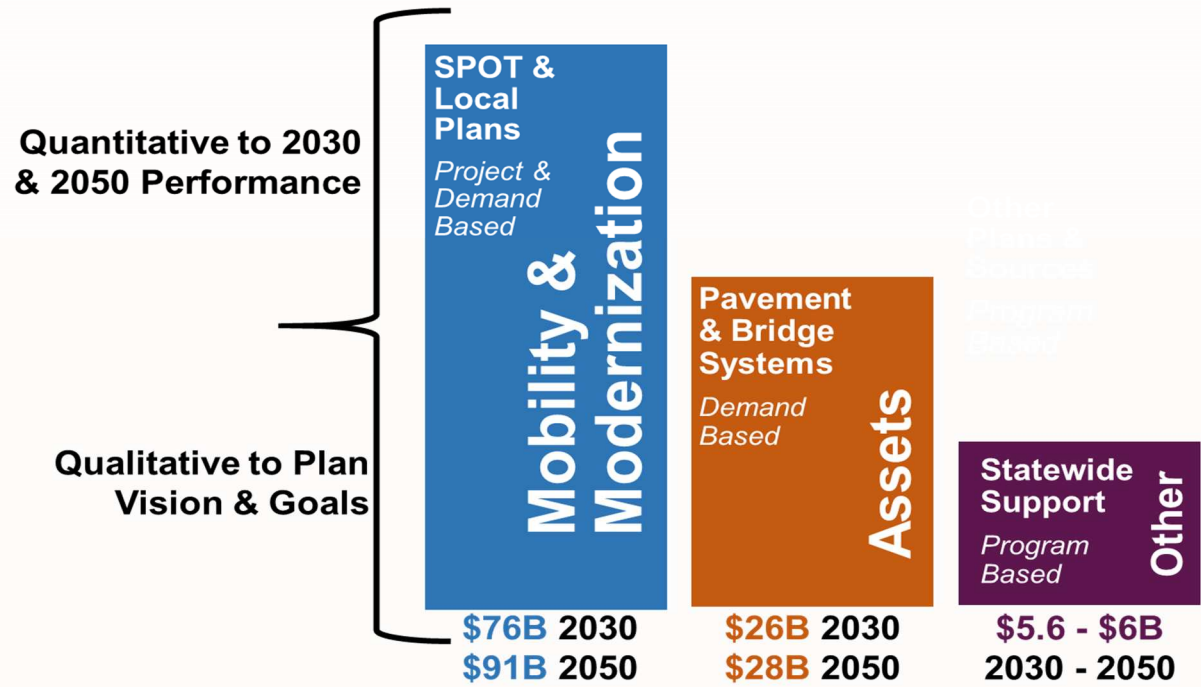


FIGURE 10: MULTIMODAL NEEDS DEVELOPMENT

Mobility and Modernization needs by mode were quantitatively determined from extrapolating data from the SPOT database relative to economic and performance trends. Reviewing plans from local MPOs including MTPs and CTPs that documented fiscally constrained and needs-based projects helped shape needs from a qualitative perspective. Goals for each mode guided by performance measures and improvement opportunities were used to translate into financial estimates necessary to meet stated goals (Figure 11). Needs were also given ranges based on a ratio of highway to non-highway needs, and all figures were then augmented and adjusted following input from modal subject matter experts.

Goal	Category	Measure	Trend & Service Opportunities Across Futures	Translation into Systems-Level Needs (\$)
Infrastructure Health (Assets)	Highways	Pavement/Bridge Deterioration	Truck volumes tracked to VMT	Compare to: Reported Standards, Studies, or SPOT Database
			Increased truck platooning	
			Increased frequency of local deliveries	
Mobility		Congestion & Reliability	Strategic Capacity Expansion	
			Vehicle & system technologies	
Mobility	Active Transportation	Mode Share Increase	Expansion of regional trails	
			Uptick in local commute trips	
Infrastructure Health (Assets)	Aviation	General Aviation Pavement Condition	Urban Air Mobility; local/regional travel	
			Increased activity of underutilized assets	
Mobility		Commercial Service Enplanements	Airport Operator Interview	
Mobility	Ferry	Ridership/Utilization	TBD	
Mobility	Passenger Rail	Annual Passenger Miles & NC DOT Amtrak Operating Support	Passenger service extensions from Carolinian & Piedmont	
			Commuter rail service	
Mobility	Transit	Increase in Mode Share &/or Passenger Miles Traveled	Higher micro-mobility in urban areas	
			Increase in multimodal (BRT/LRT) transit infrastructure	
			More rural need for demand-response	

FIGURE 11: MULTIMODAL NEEDS DEVELOPMENT BY MODE

Goals for Mobility and Modernization needs focused around improving infrastructure health and individual mobility. They were broken down by modal categories to be evaluated against modal-specific performance measures. Further trends and service opportunities were identified across futures and then compared to reported standards, published studies, and data in the SPOT database to translate each goal into an individual system-level specific need by mode (Figure 12). Mobility and Modernization analyses provided this foundation to determine, quantify, and estimate main Asset needs like bridges and pavement as well as Other needs to support small construction and traffic management after conducting analyses for the non-highway modes detailed below. Interviews with key non-highway NCDOT staff were conducted to build off of results from the SPOT database and provide additional insight into trends and forces influencing future needs. A summary of those takeaways starts with Section 5.1.1.

		2030 Trend Need Estimate	2050 Trend Need Estimate
Mobility & Modernization	Highway Capital	\$56B	\$65B
	Non-Highway Capital	\$20B	\$26B
	TOTAL	\$76B	\$91B
Assets (Infrastructure Health)	Bridge	\$7B	\$8B
	Pavement	\$8B	\$9B
	Routine Maintenance	\$11B	\$11B
	TOTAL	\$26B	\$28B
Other	State Non-Highway Support	\$5B	\$5B
	Small Construction	\$0.4B	\$0.4B
	ITS Infrastructure/Traffic Management	\$0.2B	\$0.2B
	TOTAL	\$5.6 - \$6B	\$5.6 - \$6B

FIGURE 12: ESTIMATES FOR MOBILITY AND MODERNIZATION, ASSET, AND OTHER NEEDS

5.1.1 AVIATION

NCDOT's role focuses on advising, policymaking, innovation, and grant allocation as NCDOT only owns and operates military airports and one industrial airport, Global TransPark. Commercial service airports, air cargo services, general aviation facilities, and emerging modes of transportation (e.g. drones and air taxis) were considered separately. Automation, machine learning, and artificial intelligence may enable self-driven aerial vehicles as well as expedite air taxi fleet deployment, urban air traffic management, and increased small aircraft ownership, but significant technical and regulatory obstacles will need to be overcome first.

Statewide economic and population growth is expected to increase passenger demand for air travel and stronger connections to and from airports which is discussed further under Highways. Business aviation is also expected to grow and provide direct, longer distance service to corporate passengers alongside sustained economic growth of North Carolina. General aviation reliever airports, strategically located in the same metropolitan areas as commercial service airports, are also expected to play a vital role in accommodating part of this business traffic and specialize aviation facilities to optimize capacity.

A new generation of airplanes for general aviation may modernize mobility with less expensive individual short-haul flights (e.g. RDU to downtown Raleigh) from electrical vertical takeoff and landing (eVTOL) vehicles which could also facilitate repurposing underutilized aviation assets to accommodate statewide operations. These electric propulsion aircraft (e-aircraft) technologies are expected to be less noisy and more environmental-friendly, reviving general aviation by decreasing costs and addressing environmental issues. Small electric aircraft are already available in the European General Aviation market and prototypes are being tested in the United States. By 2050, a significant proportion of small private planes (2-4 seaters) and air taxis are expected to use electric propulsion and require charging equipment.

Average freight demand has been increasing, but activity is volatile because air cargo is very sensitive to external factors (e.g. fuel cost, geopolitical events), and air freight cargo in North Carolina has followed the national trend of minimal growth from influence of morose European exports and the latest U.S. tariffs. Drone delivery could impact long-term trends in air freight. FedEx has discussed possibly decentralizing distribution from massive regional centers to smaller, more local facilities to dispatch parcels and small cargo using Unmanned Aerial Systems (UAS).

While UAS facilities might have a disruptive impact on air cargo movements and package deliveries, they have been excluded from this analysis because federal and state funding is limited to improving public airport facilities supporting aircraft activities. The Federal Aviation Administration (FAA) is conducting a pilot program in North Carolina to deliver small cargo of express parcels and medical materials by small UAS which might become mainstream in 5 to 10 years. While promising, uncertainty still exists about the safety and reliability of urban air mobility until safe and efficient operations are demonstrated in urban environments and adequate standards on what is permitted to fly and flight operations are thoroughly defined.

Aviation is estimated to encompass about 3% of total needs to repair airport pavement, build taxiways and runways, update terminals, and other airfield development projects. At the 2030 horizon, 85% of airports in North Carolina should have adequate runway length. All of them should have adequate runway width and bearing strength. From 2030-2050, investments should focus on maintaining aviation assets to achieve a PCI11 (Pavement Condition Index) of 75 or higher statewide through regular pavement maintenance to capture the full lifespan of the runway. Damage from extreme weather caused by climate change could increase maintenance

and require adjusting pavement management systems for shorter lifespans. Coastal airports as well as airports near rivers should also explore resiliency measures to protect their assets.

If quieter eVTOL expand to supplement current urban air mobility services from helicopters, more helipad-like facilities (vertiports) for takeoff/landing as well as support facilities for charging at helipads and regional O&M (operations and maintenance) centers at airports in existing networks would also be needed to provide these connections and modernize mobility from airports to urban centers, between urban centers, and within larger metropolitan areas.

5.1.2 ACTIVE TRANSPORTATION

Like NCDOT's role for aviation in North Carolina, NCDOT is in a similar position for modernizing bicycle and pedestrian transportation mobility which focuses on policymaking, education, and encouragement programs. NCDOT supports local jurisdictions by offering bicycle and pedestrian planning grants, overseeing and managing funding through STIP, and assisting in project development. NCDOT does maintain a network of more than 3,000 miles of state and regional bicycle routes but local jurisdictions maintain bicycle and pedestrian facilities. NCDOT does require costs to be shared between the state and local jurisdictions to incorporate bicycle/pedestrian facilities as incidental features of highway improvement projects.

North Carolina's active transportation needs are increasing and will continue to do so over the next decade because of population growth, urbanization, aging cohorts, low-income individuals, as well as younger generations replacing driving with other modes. The current 6.3% of households without access to a vehicle is expected to increase as urbanization continues, seniors stop driving, modern shared mobility supports low-income households, and new working professionals forgo car ownership. With a renewed focus on transportation equity, walking and bicycling infrastructure are core to North Carolina residents' abilities to have equitable access to opportunity. Converting single-vehicle occupancy trips to public transit, walking, and bicycling trips also plays a vital role in slowing the effects of climate change, but robust communication and education programs both with and without technology will be needed to inform residents about active transportation choices to create these new segments of users.

Modern micromobility choices have exploded statewide with bike share and scooter-share appearing in more and more North Carolina cities each season. Smartphones and technology have made modern micromobility options possible, but non-technological options must also be made available for statewide access to continue to encourage all North Carolina residents, especially those in urban areas, to move without an automobile. Mobility-as-a-service (one transaction transportation) will become more common with private and public transit, autonomous vehicles, and using walking and biking for trip-chaining (linking work and non-work trips). Citizens will need to be educated on safe transit, walking/biking, and modern micromobility use as well as interaction with other modes. Together, multiple modern shared mobility options especially in urban areas will continue to make it more obvious to forgo owning a personal vehicle.

Active transportation ("Bike/Ped") projects represent around 1% of all needs and include infrastructure to strengthen and enhance the safety of pedestrian and bicycle facilities like adding and/or refinishing bike lanes, trails, and sidewalks. Pedestrian and bicycle infrastructure assets are currently fragmented in North Carolina and cultural challenges between roadway users still exist as North Carolina is one of the least safe states in the United States for walking and bicycling. Improving and increasing active transportation infrastructure assets

especially in denser urban areas will meet demands of a changing North Carolina to support residents in their travel.

Safe, well-marked, and well-lit connections to comfortably access transit in any form will be required like making physical improvements to transit stations and bus stops with the focus on a new type of Complete Street that prioritizes all modes and encourages transit use over driving. Complete Streets are streets designed for pedestrians, bicyclists, and any other users in addition to motor vehicles to encourage full use of outdoor public space. Physical and visual elements are used to separate modes like clear pavement markings and crossings, concrete barriers and curbing, as well as landscaping ensure safe and comfortable travel for all users.

North Carolinians are becoming dependent upon supportive infrastructure, local land use decisions, and education/safety-focused programs and initiatives because residents expect their public officials to care for and invest in public space. Committed funding is needed to construct and maintain these assets even if that means reducing some funding for other modes like highways because making one improvement without system connectivity sways users away from active transportation options. Local land use policies create greater density of residential, commercial, and employment centers to support transit and transportation investments. Technical assistance will provide further guidance on how communities can implement solutions, including addressing modern micro-mobility trends.

Active transportation assets depend on seamless first-to-last mile connectivity, modal integration, system efficiency, widespread accessibility, and simple convenience which largely depend on local land use decisions and policies. Public/private partnerships can help construct and maintain assets like dock-less public bikeshare and scooter-share systems around housing and urban centers built upon Complete Streets principals. Connecting transit and commuter rail services to regional and greenway trails will further support active transportation choices.

5.1.3 FERRIES

NCDOT owns and maintains ferry services in North Carolina, but only two terminals statewide have shown increased ridership. North Carolinian's are moving away from rural areas which has hampered ferry growth and ridership as local rural economies change. Strong marketing and advertising should help to increase ridership alongside creating more partnerships to leverage local resources. Working with the North Carolina Ports Authority and coordinating with MPOs as well as RPOs will help to strengthen North Carolina's ferry services through collaborative efforts. Capturing opportunities to enhance multimodal connectivity will increase ridership by linking trips to destinations such as connecting the passenger ferry to the tram system to take individuals around Ocracoke, North Carolina.

Maritime ("Ferry") services are slightly over 0.1% of all needs to fund port and waterway improvement projects like dredging and building as well as repairing seepage barriers, locks, dams, and service bridges. Ferry asset needs also include increased funding to finance capital improvement projects to maintain as well as modernize stationary (docks) and mobile (boats) assets, standardizing hybrid maritime operations, and procuring more vessels with higher propulsion technologies. However, the rising sea level caused by climate change posts the biggest threat to North Carolina's ferry services as nearly all ferry assets are below sea level. Capital funds to improve the ferry channel and terminal are needed to re-shift the channel inlet, un-comprise the terminal, and soften the shoreline.

5.1.4 RAIL

North Carolina's freight rail system Mobility and Modernization needs were built off of cross-referencing local studies from MPOs in addition to MTPs, results from the SPOT database, and the NCDOT Statewide Multimodal Freight Plan completed in 2017. Addressing redundancy gaps in combination with overall system needs should modernize freight mobility. The freight rail service model might need to be adapted to match changes in operating risks and environmental policies. Continuing to leverage benefits from existing agreements like the North Carolina and Virginia Compact as well as the Southeast Rail Commission will help deliver ongoing value on top of further development of rail safety programs such as the Sealed Corridor and Crossing Hazard Elimination programs. Collectively, these measures will help modernize freight rail mobility.

Freight railroads ("Rail") capture just under 6% of total needs which are mostly funded by the private sector. Freight railroad operators build track (including intermodal terminals) as well as construct and maintain right-of-way corridors, rail yards, maintenance and operations facilities, railroad crossings, rail bridges, and rail signals. North Carolina's freight railroad needs include, but are not limited to, maintaining and modernizing track and signal assets, crossings and bridges, as well as these ancillary facilities. Some freight assets will justify being converted to transit assets for passenger rail use if demand shifts surpass transit capacities.

5.1.5 TRANSIT

Health and safety shape North Carolina's passenger rail mobility needs. Corridor-by-corridor analyses illuminated multiple service opportunities especially from the Raleigh-Charlotte corridor while statewide ridership was analyzed using population and travel shed market density analyses. Together, these methodologies showed overall transit mobility needs as some corridors gaining riders while ridership declined along other corridors. Service enhancements along the Raleigh-to-Selma, Wake Forest, and Richmond corridors will enhance transit mobility as fewer drivers' licenses and vehicle ownership pointed to more rail riders along these routes, highlighting locations for line extensions as well as new stations for 2050. Other commuter rail opportunities between Charlotte and Kings Mountain, Mooresville, and Gastonia in addition to between Raleigh and Durham as well as Fayetteville should also be explored. Some corridors dropped passengers due to competition from Transportation Network Companies (TNC's), and utilizing these changes in travel demand should help realign resources to modernize transit mobility.

While the long-term competition and impact from TNC's and autonomous vehicles are still unknown, affordably priced and accessible transit will remain incredibly attractive to many income brackets as long as transit stops are maintained, and systems remain efficient. Passenger rail will remain especially attractive as highway congestion encourages more ridership. Robust communication and education programs both with and without technology informing residents about transit choices will also help create new segments of users.

Transit represents around 15% of total needs which includes all public transit services in North Carolina. Buses, passenger rail, and on-demand or scheduled services operate daily service as well as maintain capital assets like rolling stock (buses and train cars), stations, track, rail signals and switches, and facilities including maintenance garages and ancillary buildings. Additional assets will be needed as service extensions are implemented while ongoing capital projects will help maintain these capital assets to ensure no asset remains in use past their recommended useful life.

Aging residents in rural parts of the state will require more on-demand transportation services which will require more assets like vans and buses equipped with physical attributes like ramps to ease travel for seniors and/or riders with physical disabilities in accordance with the American Disabilities Act (ADA) as well as specially trained operators to deliver these specialized transit mobility services. At the same time, car-free younger residents coming of age will want independence and freedom gained from traveling solo, and bus as well as transit enhancements with newer state-of-the-art vehicles equipped with WiFi will deliver Mobility and Modernization to these North Carolinian's.

Mixed transit fleets will increase in the short term (2030) and require access to both electric charging facilities as well as alternative and traditional fuels. It is also likely these mixed infrastructure (bus rapid transit, commuter rail, light rail) needs will continue to increase through long term (2050). Also in the long term, some freight-owned assets could be converted for passenger rail use aligned with ridership demand as targeted commuter rail service is further developed. The full implementation of Passenger Train Control (PTC) will be a significant long-term asset investment that has a huge impact on passenger, operator, and system safety.

5.1.6 HIGHWAY

Modernizing mobility along state highways as well as local roadways is the biggest current and future mobility need because roadways are the largest transportation infrastructure system in the state and most North Carolinian's rely on these roadways for daily mobility. Modernizing highway mobility needs are guided by improving congestion levels which increases reliability along individual corridors. Continuing to track truck volumes alongside VMT will illustrate whether the increased frequency of local deliveries continues to justify room for strategic capacity expansion throughout North Carolina's highway network.

Utilizing and implementing vehicle as well as system technologies will also help modernize highway mobility. Implementing traffic management policies as well as infrastructure for intelligent transportation systems (ITS) including traffic signals increase throughput. State resources ensure adequate snow and ice removal both to enhance safety and maintain traffic flows. Local roadway operators are responsible for maintaining and modernizing local roadways, but maintaining state-owned roadways continues to be the first step towards modern roadway mobility through targeting these high-level travel corridors.

Some roadways need alternatives due to capacity constraints to improve reliability, but like transit, robust communication and education programs with modern driver training and vehicular technology will inform residents about other roadway users as well as different roadway choices. Drivers aware of bicycles and transit vehicles as other roadway users will reduce the chance of collisions. Using technology to divert VMT away from over-saturated roadways and into congestion-free corridors will also improve mobility. Above all, enforcing safety laws and educating drivers enhances human safety and modernizes highway mobility.

5.2 ASSET NEEDS

Aviation, Active Transportation ("Bike/Ped"), and Maritime ("Ferry") asset needs collectively are estimated to have the smallest funding requirements. Freight Railroads ("Rail") and Transit are expected to require a medium level of funding, while Roadways ("Highway") will demand the most funding from North Carolina's transportation budget (**Figure 13**).

NCDOT's asset needs focus on highways, bridges, and pavement, which cover the largest share of needs of all modes at just under 75% of the total. State and local roads, bridges, and accompanying assets including sidewalks, striping, lighting and guardrails all need to be maintained as part of the largest transportation infrastructure system in the state. Interchange improvements and new facilities can also help congestion levels as roadways overall are preserved to ensure vehicles (and passengers) move safely combined with engineering improvements at high crash locations to enhance human safety. Asset needs for bridges and pavement are explained further below across multiple NCDOT highway maintenance-related infrastructure programs.

5.2.1 BRIDGES AND PAVEMENT

NCDOT recently transitioned Highway Maintenance and Asset Management Programs from a reactionary, condition driven approach to a more proactive asset and lifecycle-based approach implemented through three maintenance improvement programs (MIPs). Mirrored after NCDOT's State Transportation Improvement Program (STIP) that defines a 10-year capital investment program, the MIPs represent 5-year maintenance investment programs for pavements, bridges, and other roadway assets (**Figure 14**). MIPs closely align with current funding programs from the state legislature that identify and publish monetary levels needed to sufficiently reach MIP goals and targets.

NCDOT Program		Funding Source	Focus	Plan Horizon	Annual Estimate	Detail	2030 Need Estimate	2050 Need Estimate
Assets	Bridge Maintenance Improvement Program BMIP	Bridge and Bridge Preservation Programs	Non-Interstate Roadway Bridge Maintenance	5-year	\$375M	Bridge	\$7B	\$8B
	Highway Maintenance Improvement Program HMIP	Contract Resurfacing & Pavement Preservation Programs	Highway Pavement Resurfacing & Rehabilitation	5-year	\$600M	Pavement	\$8B	\$9B
	Routine Maintenance Improvement Program RMIP	General Maintenance Reserve (GMR) & Roadside Environmental programs	Other Highway Assets (shoulders, signs, drainage pipes etc.)	5-year	\$475M	Routine Maintenance	\$11B	\$11B
	TOTAL							\$26B
Other	Other Assets	State General Funds	Repairing Potholes / Removing Roadway Debris	3-year	\$390M	State Non-Highway Support	\$5B	\$5B
	Other Repairs	State General Funds	Addressing Storm Damage	Seasonal	\$200M	Small Construction	\$0.4B	\$0.4B
	Other Repairs	State General Funds	Technology	Annual	\$20M	ITS Infrastructure/Traffic Management	\$0.2B	\$0.2B
	TOTAL							\$5.6-\$6B

FIGURE 13: ESTIMATE OF HIGHWAY ASSET AND OTHER NEEDS

The Highway Maintenance Improvement Program (HMIP) outlines a 5-year investment plan for NCDOT’s largest asset (pavement) funded through Contract Resurfacing and Pavement Preservation programs. Addressing pavement resurfacing and rehabilitation activities throughout primary and secondary roadways cost about \$600M per year. The Interstate Maintenance Program funded with approximately \$110M of federal aid from the National Highway Performance Program (NHPP) takes care of maintaining pavement along interstate highways (**Figure 14**).

The Bridge Maintenance Improvement Program (BMIP) gives a 5-year investment plan for NCDOT’s second largest asset (bridges) which includes replacing as well as rehabbing non-interstate bridges using funds from the state’s Bridge and Bridge Preservation Programs. At approximately \$375M per year throughout primary and secondary roadways, this still excludes the additional \$15M needed to upkeep bridges along interstates which is included in funding from the NHPP (**Figure 14**).

The Routine Maintenance Improvement Program (RMIP) shows the 5-year investment plan for other highway assets like roadway shoulders and ditches, pavement markings, signs, pipes, and tree line clearances which all receive about \$475M per year from the General Maintenance Reserve (GMR) and Roadside Environmental

programs (**Figure 14**). NCDOT developed an expected lifecycle figure for each of these assets to analyze with existing asset quantities to guide statewide investment strategies, annual work need goals, and keep the system in a good-state-of-repair safe for users. Using roadway signs as an example, these signs have a life of about 20 years, which means NCDOT established a goal to replace 1/20th of all signs per year which ensures no signs are in use past 20 years. Additionally, reducing critical failures lowers repair and/or replacement costs for assets like drainage pipes.

Other asset-related roadway work statewide requires addressing but lack clearly established goals due to the nature of the work like repairing potholes which cannot be planned for despite requiring significant resources. Similarly, removing roadway hazards like debris, installing pipes along residential driveways, and administration costs for processing driveway permits, encroachments, and subdivision plan reviews all cannot be predicted in advance. Therefore, NCDOT used a historical 3-year average of annual expenses to establish a baseline for these types of activities which is approximately \$390M per year (**Figure 14**). As NCDOT's new production-based asset management programs and practices mature, planned maintenance abilities will also increase, which will lower annual costs for these activities outside the RMIP. However, as annual inflation will increase the cost of performing these activities that could cancel out any realized savings, costs for non-RMIP maintenance efforts are held constant over the analysis period.

As an ocean state, North Carolina is faced with a variety of natural disasters and other storm events that cause significant damage to roadway assets and require numerous financial resources to address. On average, costs statewide in response to these disasters is approximately \$166M per year which have increased significantly over the past few years due to major hurricanes like Hurricane Matthew and Hurricane Florence. Additionally, responses to other disasters like mud slides, flooding events, and snow and ice events are increasing which is expected to continue. As such, future repair costs are estimated at \$200M per year (**Figure 14**).

Clearly, NCDOT's maintenance programs are extensive given the breadth of work activities and system responsibilities, and huge financial resources are needed to support these programs. Current annual funding needs exceeds \$978M to perform all necessary activities within GMR and Roadside Environmental programs as well as programs supporting RMIP, disaster response, and other critical maintenance activities which is expected to surpass \$1.04B by 2030.

5.3 OTHER NEEDS

Outside of Mobility and Modernization as well as asset needs, Other Needs exist that also require NCDOT's support and equate approximately \$75M statewide per year funded from the North Carolina General Assembly. NCDOT delivers a variety of smaller scale construction and spot improvement projects across the state each year to improve safety and mobility, enhance economic development alongside helping to improve the overall roadway condition. Other Needs in 2050 Trend branch from 2030 Trend with the largest being NCDOT's support towards non-highway modes including constructing secondary roadways.

NCDOT's continued backing of statewide programs further assists local needs like the Spot Mobility and Safety Programs to develop smaller projects improving safety and/or operational issues as well as the State Street-Aid Powell Bill Program to give state aid to municipalities which began in July 2020. State funds are also needed for

high impact/low cost projects like installing and upkeeping sidewalks for pedestrian safety and modernized mobility; aiding small construction projects geared towards economic, industrial, and/or public access development projects to improve rights-of-way; and implementing Intelligent Transportation Systems (ITS) to advance traffic management.

2050 Trend's Other Needs encompass large scale investments beyond source documents as well as known initiatives with uncertain future costs. All Other Needs are crucial to Mobility and Modernization and must be accounted for to move forward from 2030 Trend to 2050 Trend. However, in most cases, funds are allocated equally across Divisions, which limits project size and scope and restricts what actually can be repaired and/or improved. Additionally, even though these programs can provide much needed localized system improvements, funding levels for these programs are not expected to significantly increase as competition for limited funding continues statewide.

6. PERFORMANCE SUMMARY

Needs across modes were analyzed by VMT according to population demand and alternative future (Figure 15). Traveling more miles on any system puts more wear-and-tear on that transportation's infrastructure and requires more investment to maintain safe and operable service. Looking at subtotals, needs are lowest across all modes in the Unstable alternative future, but once highway assets are added, needs are actually lowest under the Innovative alternative future because of scaled savings experienced from improved technologies.

Base/Horizon Years/ Alternative Futures		Annual VMT (billions)	Annual Truck VMT (billions)	Weekday VHT	Transit/AT Commute Mode Share	Factors
2015 Baseline vs. 2030 and 2050 Trend	2015	111.87	7.90	4,968,000	3.1%	NC STM (statewide model) base year
	2030 Trend	128.51	9.03	6,066,000	3.6%	1.8 million more people and 1.2 million more jobs combined with an increase in network capacity consistent with the current STIP, travel costs remain the same as today.
	2050 Trend	151.87	10.53	7,827,000	4.4%	4 million more people and 2.5 million more jobs combined with an increase in network capacity consistent with the current STIP, travel costs remain the same as today.
Alternative Futures vs. 2050 Trend	Innovation	149.75	10.23	7,271,000	↑	More urban migration and high-tech employment with increase in density and mixed-use development; high CAV development and modern shared-mobility buildout, along with high telecommute and on-demand economy.
	Globally Connected	160.08	13.68	7,674,000	↑	More manufacturing jobs and shipping of goods (both international and domestic); increase demand for all modes of freight; increased demand on highway/ inter-city network supply.
	Renewed	154.26	10.72	7,622,000	↑	More telecommuting and high-tech employment in mid/small urban and rural areas; increased modern shared mobility in all markets.
	Unstable	136.53	9.67	6,581,000	↑	Population growth below projections with relocation from coastal and other at-risk areas; decreased auto ownership and higher travel costs; highly unreliable system.

Base/Horizon Years/ Alternative Futures		Annual VMT (billions)	Annual Truck VMT (billions)	Weekday VHT	Transit/AT Commute Mode Share
Performance Metric Indicators	2050 Trend	151.87	10.53	7,827,000	4.4%
	Innovation	↓	↓	↓	↑
	Globally Connected	↑	↑	↓	↑
	Renewed	↑	↑	↓	↑
	Unstable	↓	↓	↓	↑

Legend: Comparison to 2050 Trend

- ↑ Increase > 5%
- ↗ Increase 1% to 5%
- No Change 1% to -1%
- ↘ Decrease -1% to -5%
- ↓ Decrease > -5%

FIGURE 14: ALTERNATIVE FUTURES PERFORMANCE SUMMARY

7. CONCLUSION

7.1 FLEXIBILITY

Meeting transportation needs is an ongoing shared challenge across North Carolina to help residents and goods move safely and efficiently throughout the state. To address NC Moves 2050 goals, continuing to recognize where and how investments are needed will help maintain and build a strong multimodal transportation network. Highlighting projected system demand and key assumptions built upon model results as well as subject matter input supports statewide and local/regional perspectives to tailor efforts towards specific needs that achieve stated outcomes. Results can be updated alongside new findings and research as travel patterns are realized and needs are met.

The Alternative Futures influence system-level multimodal short (2030) and long term (2030-2050) needs bounded by a range of possibilities to guide future investment, resources, and energies. Separating components alongside the big picture provides overall as well as individualized estimates on future transportation needs according to different plausible scenarios that helps plan the outcome if that reality is realized. It is unrealistic to expect one of the Alternative Futures to exactly match North Carolina's future, but it is highly likely that North Carolina will experience a combination of these effects because hypothesizing an extensive range of possibilities prepares for the unexpected and provides bearings for further analyses.

APPENDIX A – NC FIRST COMMISSION

2032 GAP ANALYSIS

SEPTEMBER 2020

ncmoves.gov

NC Moves 2050

Agenda Outline

1. 2050 to 2032 Analysis

- *Differences in Approach, Inputs; COVID Impact*

2. 2032 Revenue Forecast(s) Across Futures

- *Innovative, Globally Connected, Renewed, Unstable Influences*

3. 2032 Consensus Revenue Forecast

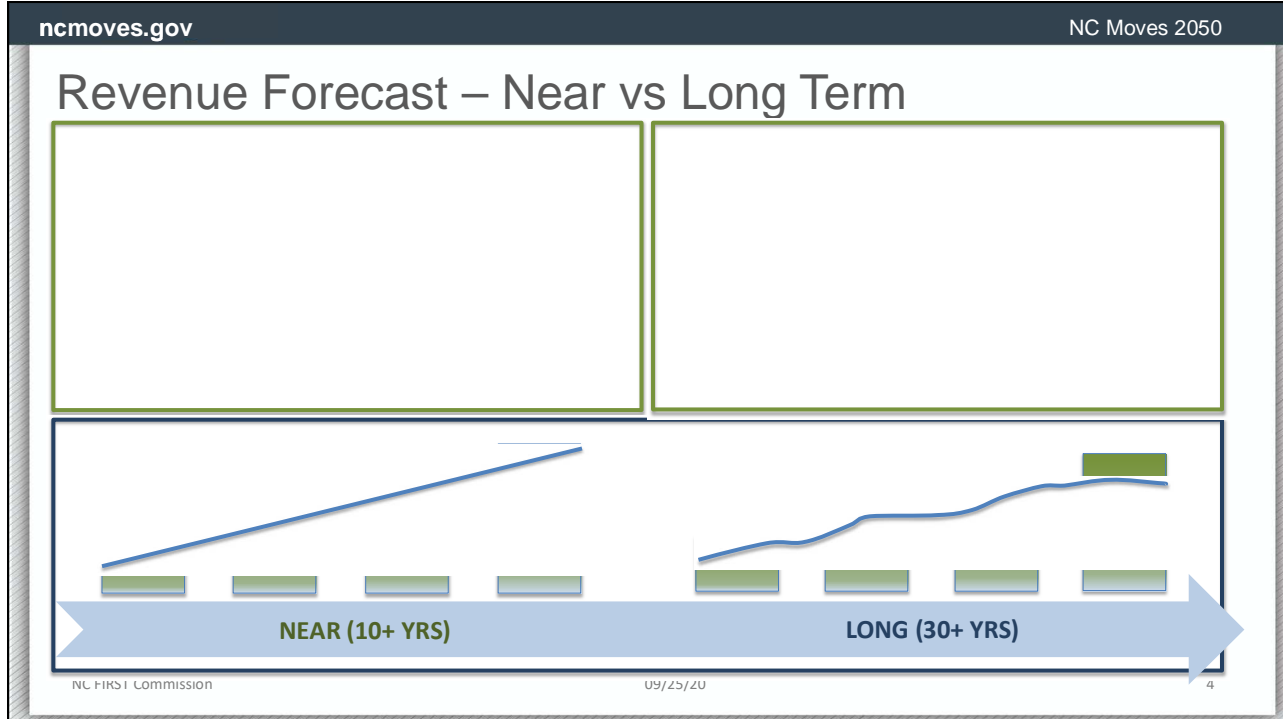
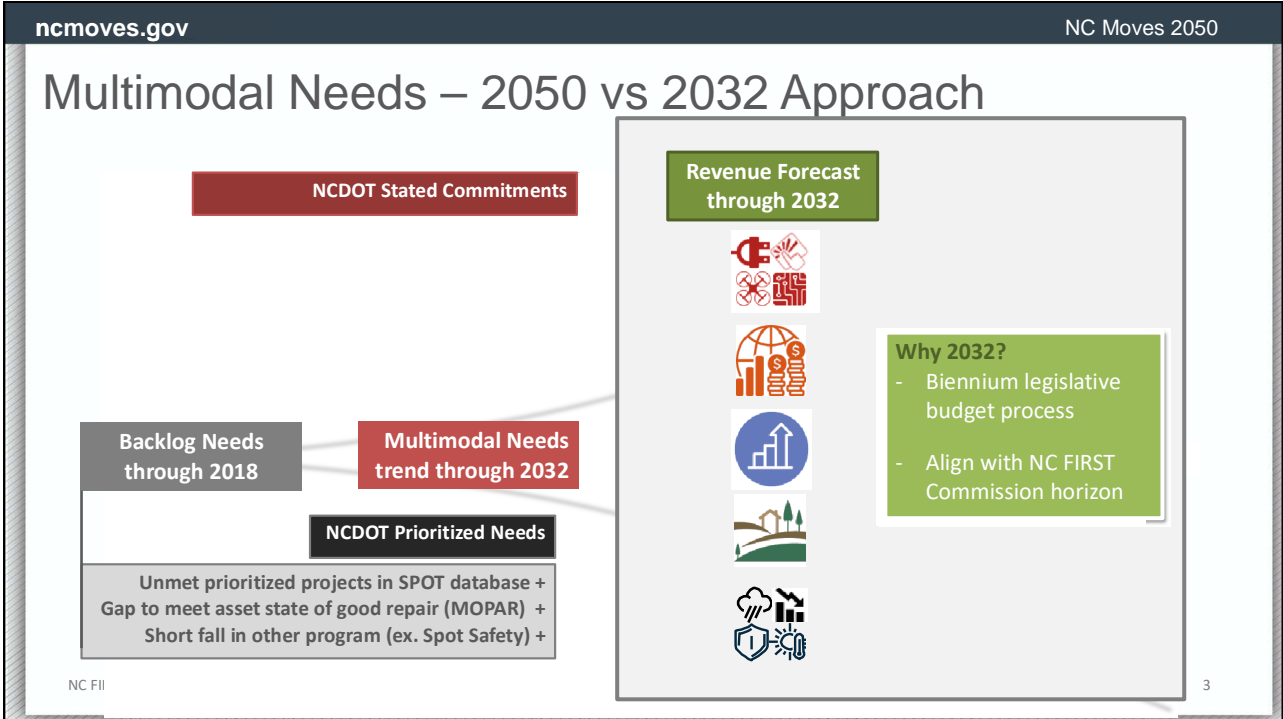
- *Needs to Revenue Gap Implications*

4. Questions

NC FIRST Commission

09/25/20

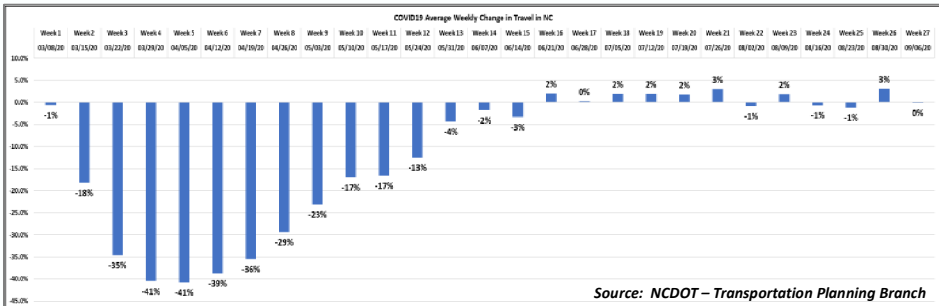
2



2032 COVID Impacts

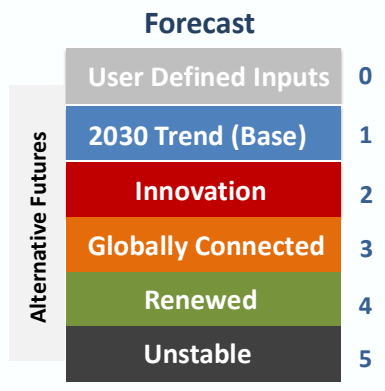
- Limited to FY21/22? Recovery signposts?
 - Statewide VMT back to pre-COVID levels
 - State/federal stimulus discussions
 - Cusp of multi-year federal reauthorization
- Potential for some permanent travel demand changes but also....

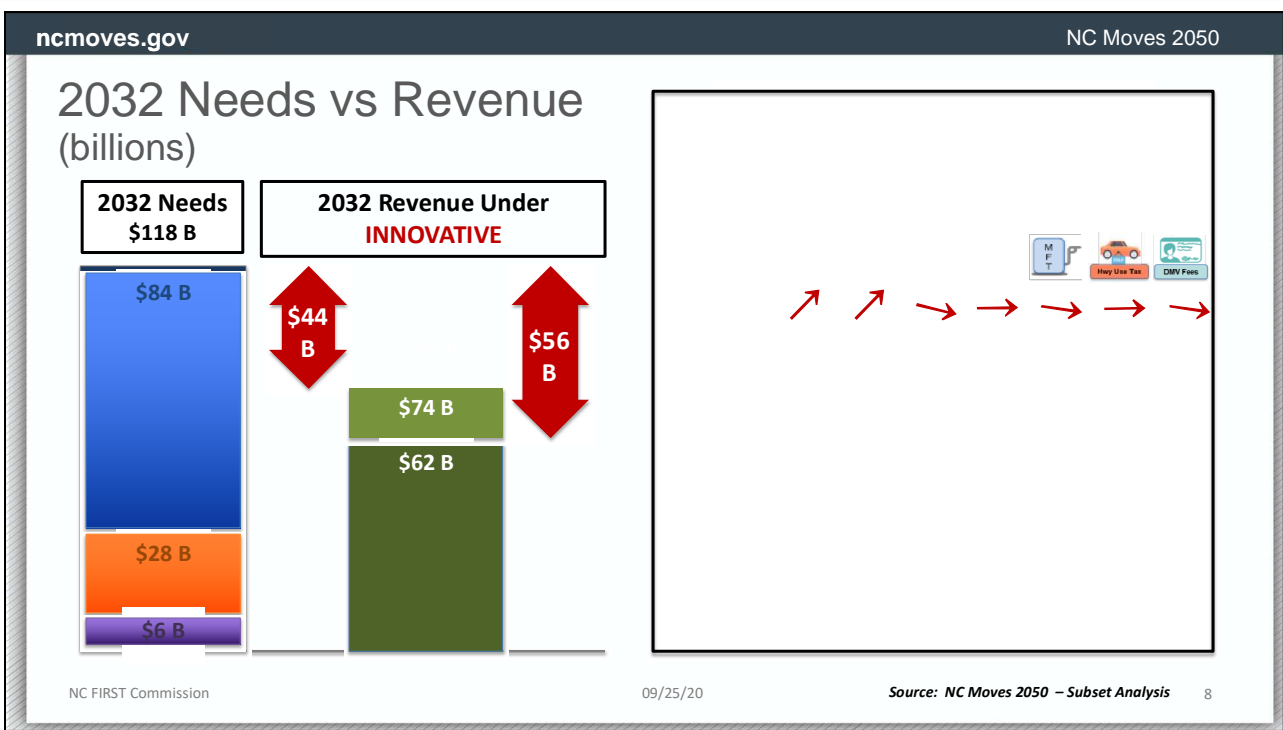
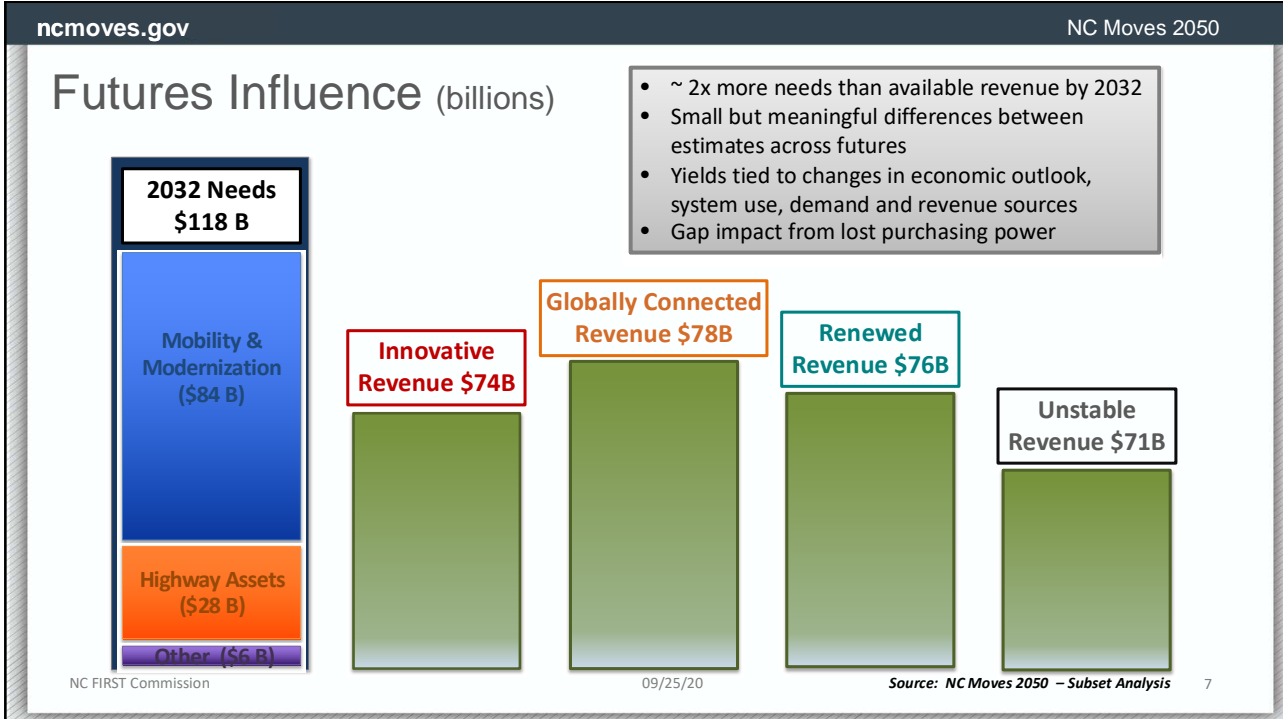
-offsetting trends:
- Work from home, staggered hours leads to less commuters in peak periods, more dispersed travel
 - Robust e-commerce leads to more local truck circulation
 - Less transit use leads to more SOV trips
 - Statewide VMT continues to rise tied to population, economic stability, more recreational travel

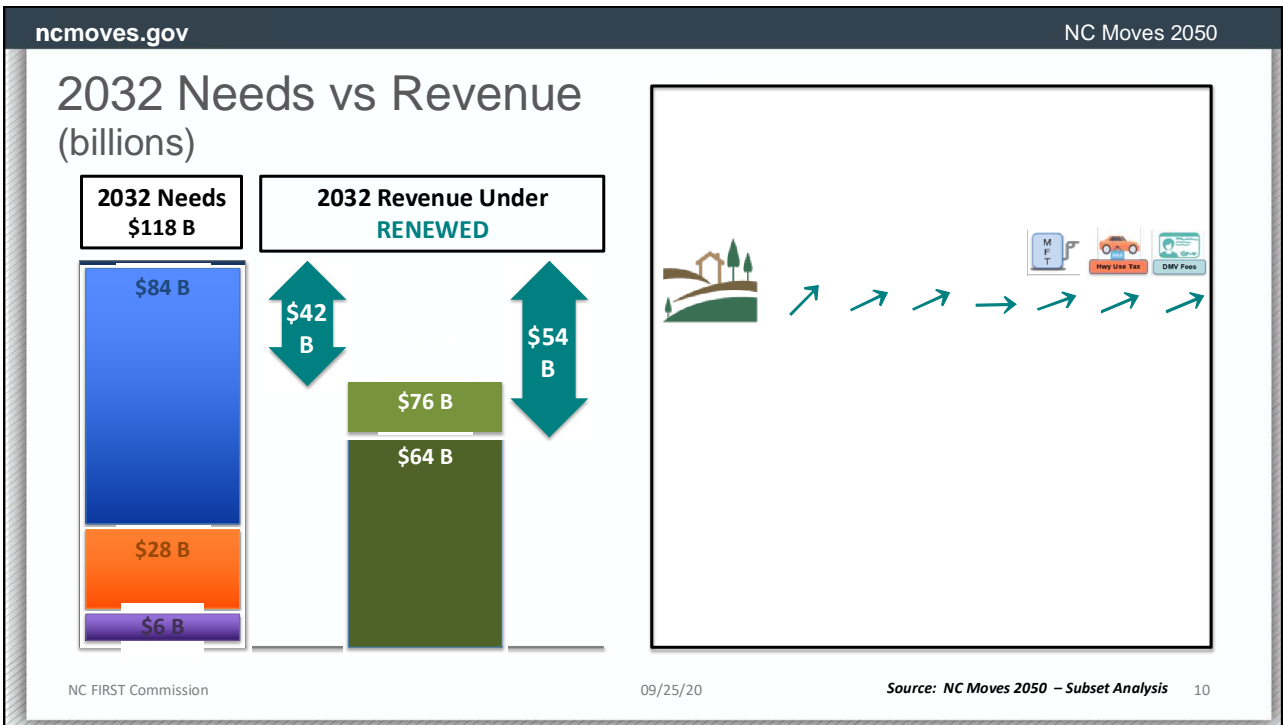
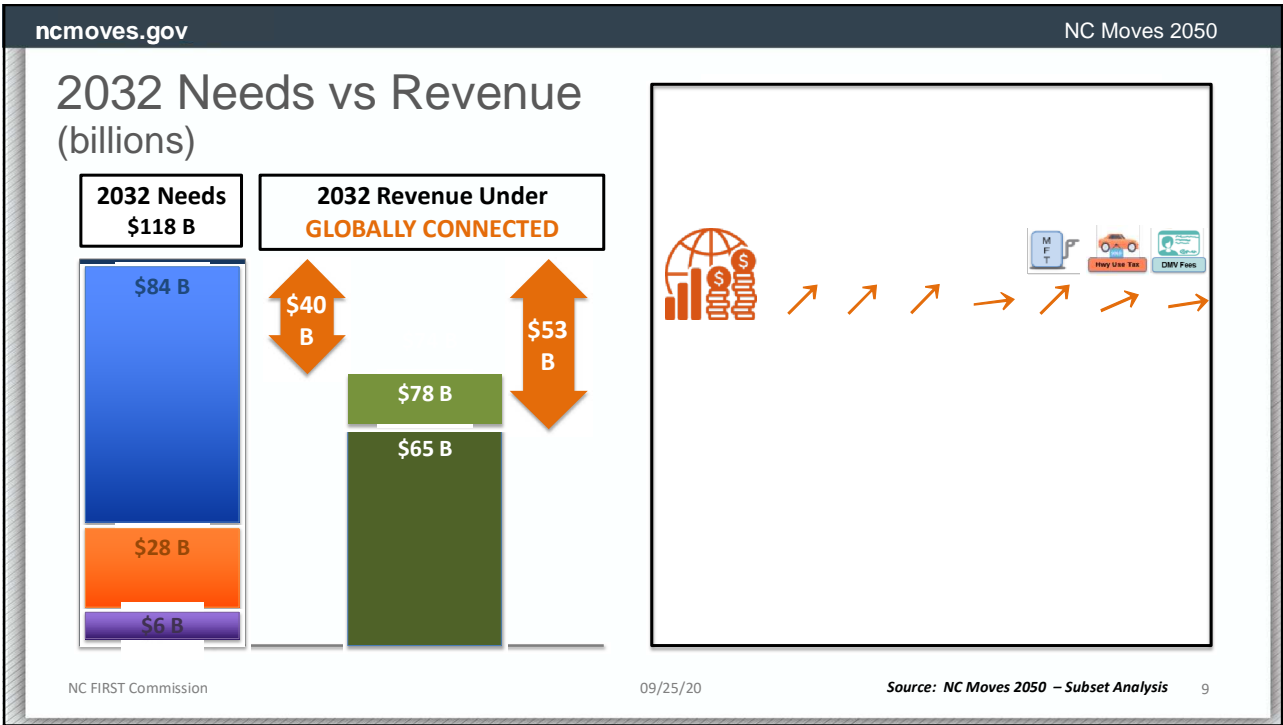


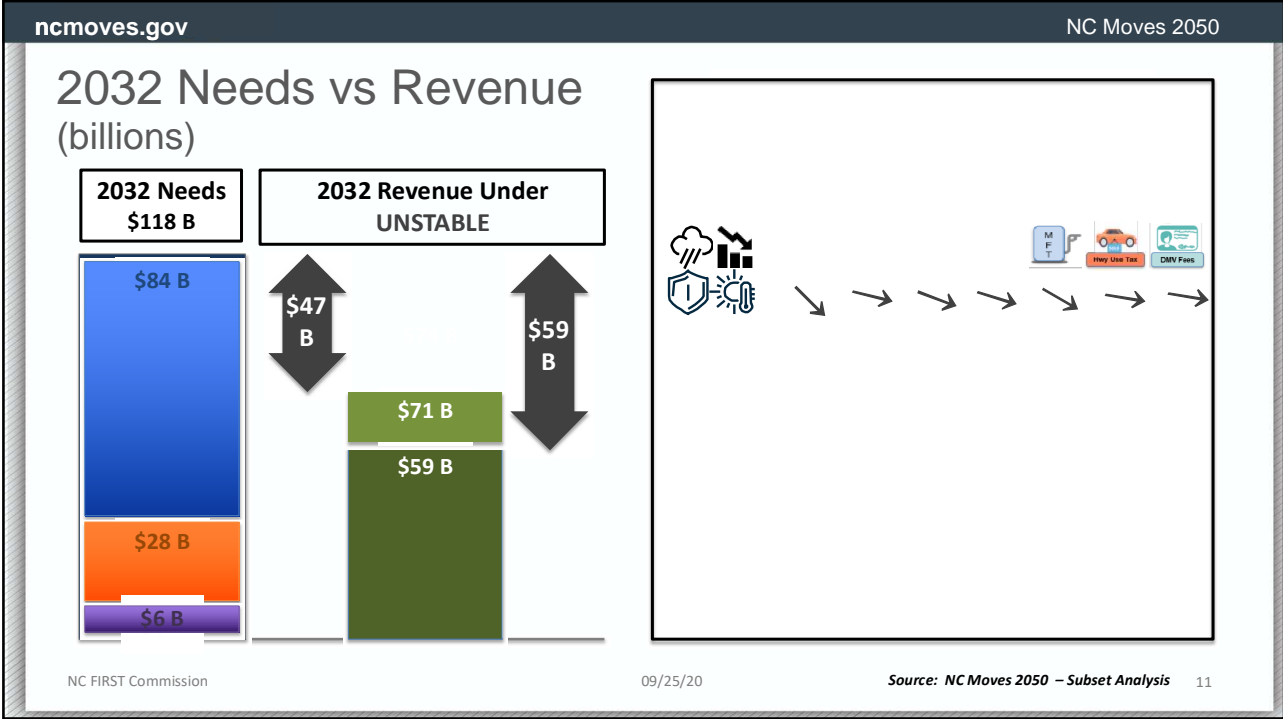
Revenue Forecast – Deviation from Near Term Trend Futures Influence

- Sensitivity analysis modeled through economic and demand variables
 - Gross Domestic Product (GDP)
 - Population
 - Vehicles Miles Traveled (VMT)
 - Vehicle Registration/Auto Ownership
- Future fleet size, miles per gallon (MPG) efficiency
- Alternative funding options
- High – low ranges by future









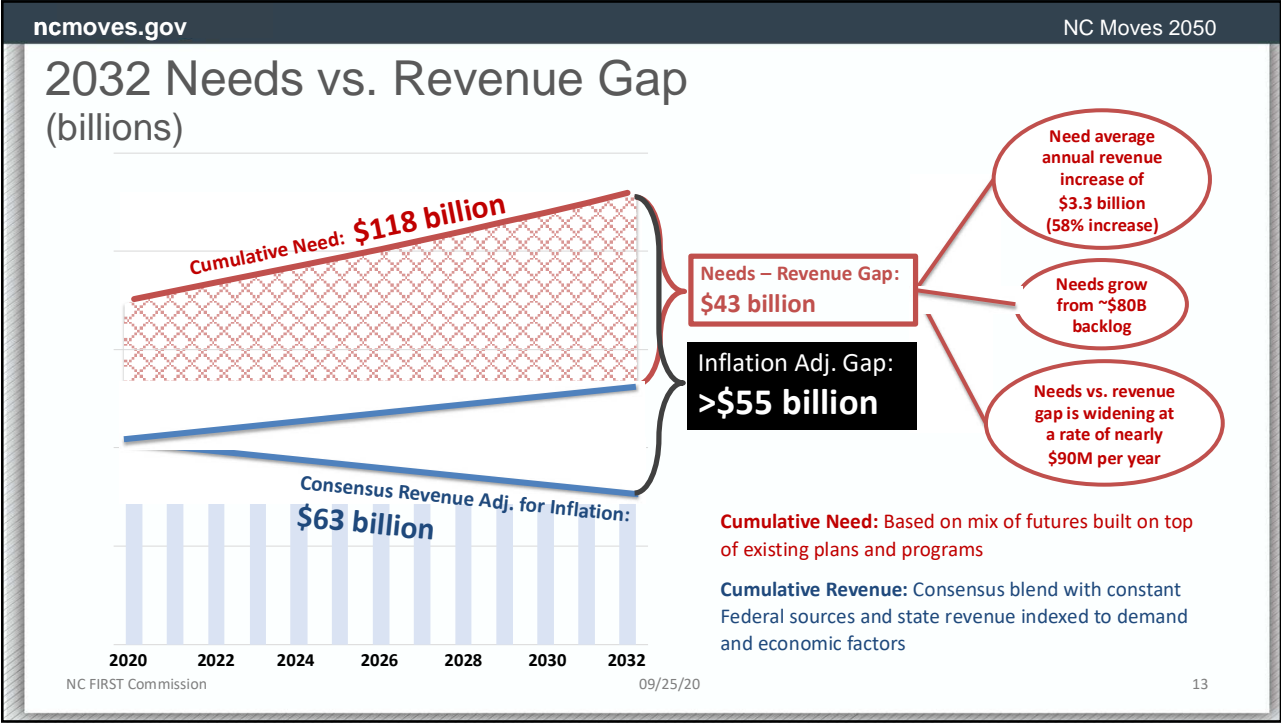
ncmoves.gov NC Moves 2050

2032 Consensus Revenue Forecast

TAKEAWAYS

- Consensus revenue forecast reflects mix of all futures to represent diversity of potential conditions, assumptions
- Additional sensitivity analysis can reveal further risks or revenue source dependencies associated with one or more “leading” futures

NC FIRST Commission 09/25/20 12



ncmoves.gov NC Moves 2050

Summary

Implications for NC FIRST

Multimodal Transportation Needs	Transportation Revenue
<ul style="list-style-type: none"> Continued economic growth drives growing & diversifying needs The projected magnitude of these needs is unlikely to change substantially over the next decade (they are more likely to increase, rather than decrease) Even if the economy grows slower than anticipated, the scope of the system to maintain and operate and the backlog of needs will always exceed revenue 	<ul style="list-style-type: none"> Existing sources are generating less revenue relative to the growth in needs Alternative futures create more risks than opportunities for existing revenue sources Alternative futures create opportunities for new sustainable revenue sources Costs increases will outpace revenue growth, further widening the needs versus revenue gap

NC FIRST Commission 09/25/20 14

QUESTIONS