NORTH CAROLINA
Department of Transportation

Building a Best in Class DOT - Diagnostic Analysis

DRAFT AND CONFIDENTIAL

Final Deliverable | July 2019

Executive summary

- **NCDOT is among the most efficient managers of its network** (the second largest in the country), achieving top IRI ratings (4th best among peer states[1]), at a competitive spend per mile (5th best among peer states)
- But changes in the context in which it operates, may **require a change in how it operates**, in order to continue its success
  - **Need to meet cash targets requirements that are narrower than peer states' actual cash reserves** (e.g., 7.5-26% of revenues for NC vs. 30-50% for many peers)
  - **Disaster spending (FEMA, FHWA, and non-declared) has grown at a 25% CAGR since 2009**
  - **Changes in the nature of work** (e.g., increased decentralization, change in contracting strategy, increase in maintenance share of spend, increase in contributions to other modes (e.g., airports))
- This challenge has manifested itself in difficulty hitting its cash target in FY19; instead of spending down its cash balance by $670M, it **has been spent down by over $960M, a -$290M net variance** (or an $1.2B absolute variance, when accounting for how different category variances cancel each other out)
  - **49% of the absolute cash variance has been from a $578M overage in maintenance spend**
    - Although disasters have been a factor, FEMA **disasters ($151M) only account for ~25% of net maintenance variance;** total weather spend is larger ($296M of which $242M was maintenance); **though much of this other spend does not contribute to variance**
    - **Most of the variance instead comes from issues inherent in the operating model** of the operations team (e.g., reliance on **multi-year contracts** that reduce agility, divisions planning and **spending to allocations** not forecasts, divisions **can borrow against future year budgets** reducing controls)
  - **10% of the absolute cash variance has been from a $124M overage in construction – primarily preliminary engineering– spend**
    - **150% of this overage** (when considering construction projects as one category) is in **preliminary engineering**, an area **without sophisticated cash forecasting**, and where **cash forecasts are not prioritized**
    - Other drivers of variance include **not extending cash forecasts to divisions and other construction holdouts**; **Map Act explains only a small share of variance,** ROW forecasts are largely accurate
  - The remaining absolute variance was split but **primarily in revenues**: **3% other expenses; 29% revenue** and 9% working capital variance
    - While there have been historical variances in revenue projections, **overall revenues have been within 7% of forecasts in most years** not impacted by ARRA grants, though trends in the **future of mobility will present a forecasting and funding challenge**
- **Addressing these challenges** will require efforts to **improve forecasting, enhance contracting, embed accountability and decision rights for agile response to cash, and revise digital strategy**, as well as potentially include rule changes

1 Peer states defined as DOTs of the largest US states by population, as well as other select fast growing medium sized states (GA, OH, NC, TX, WA, CA, VA, NY, FL and MA)

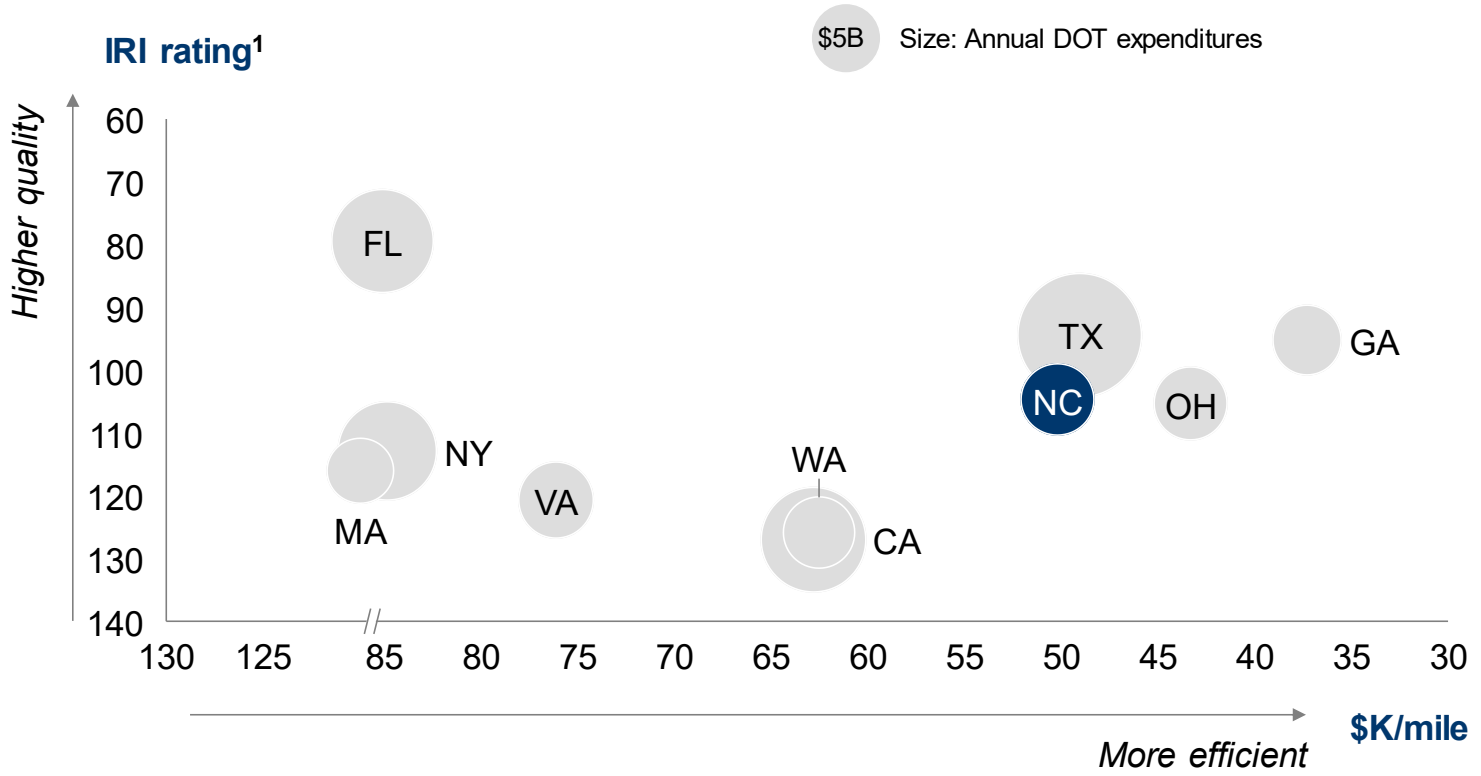
Contents

- **Context**
- Drivers of variance
  - Maintenance variance
  - Construction variance
  - Revenue variance
- Root causes and potential levers

Comparison of road conditions vs. spend per mile on roads

Efficiency at achieving road quality

IRI score, $K/mile



- NCDOT is **among the more efficient managers of its network among peers** (the second largest in the country)
- It **achieves favorable systemwide IRI ratings** (4th best among peer states), **at a spend per mile that rivals other best-in-class state DOTs** (5th best among peer states)

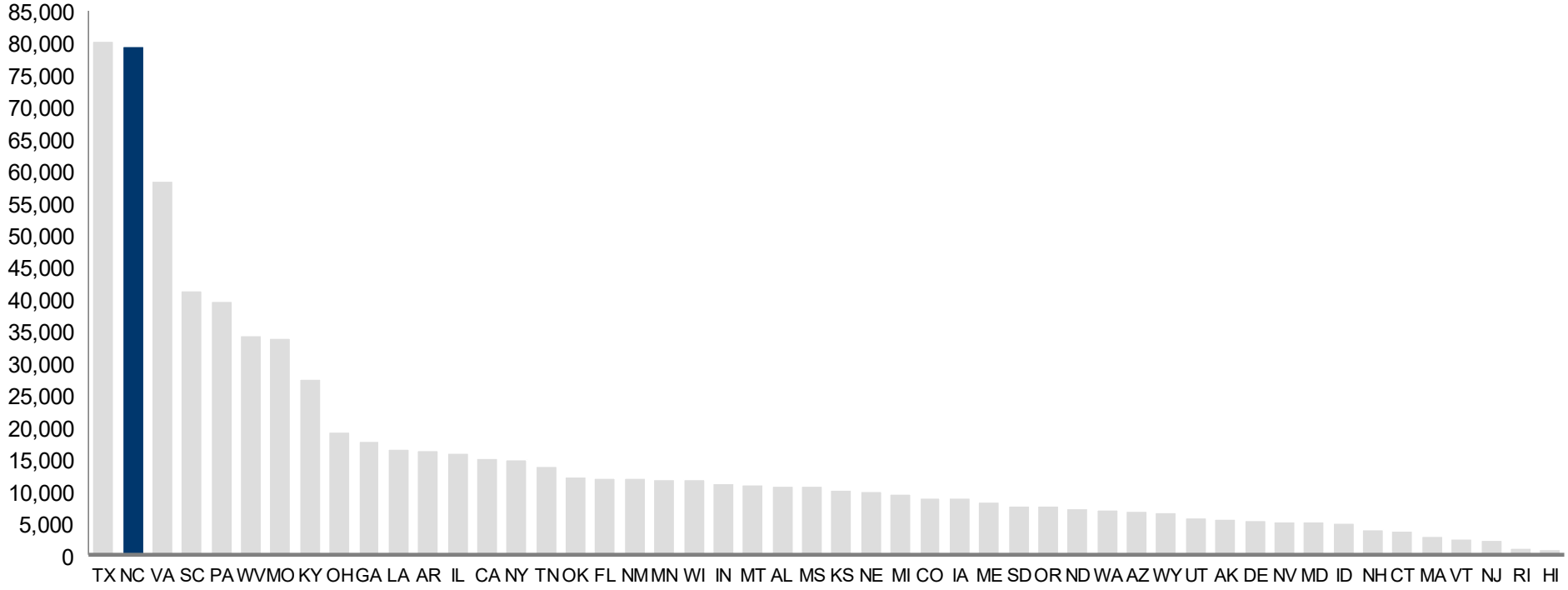
1 Weighted average IRI rating by mile
2 Annual state disbursements by total miles reported to FHWA

SOURCE: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics June 2015, State Disbursements 2017 (March 2019 Update)

NCDOT operates the 2nd largest network of roads of any State DOT in the US

Total miles in the state DOT transportation network

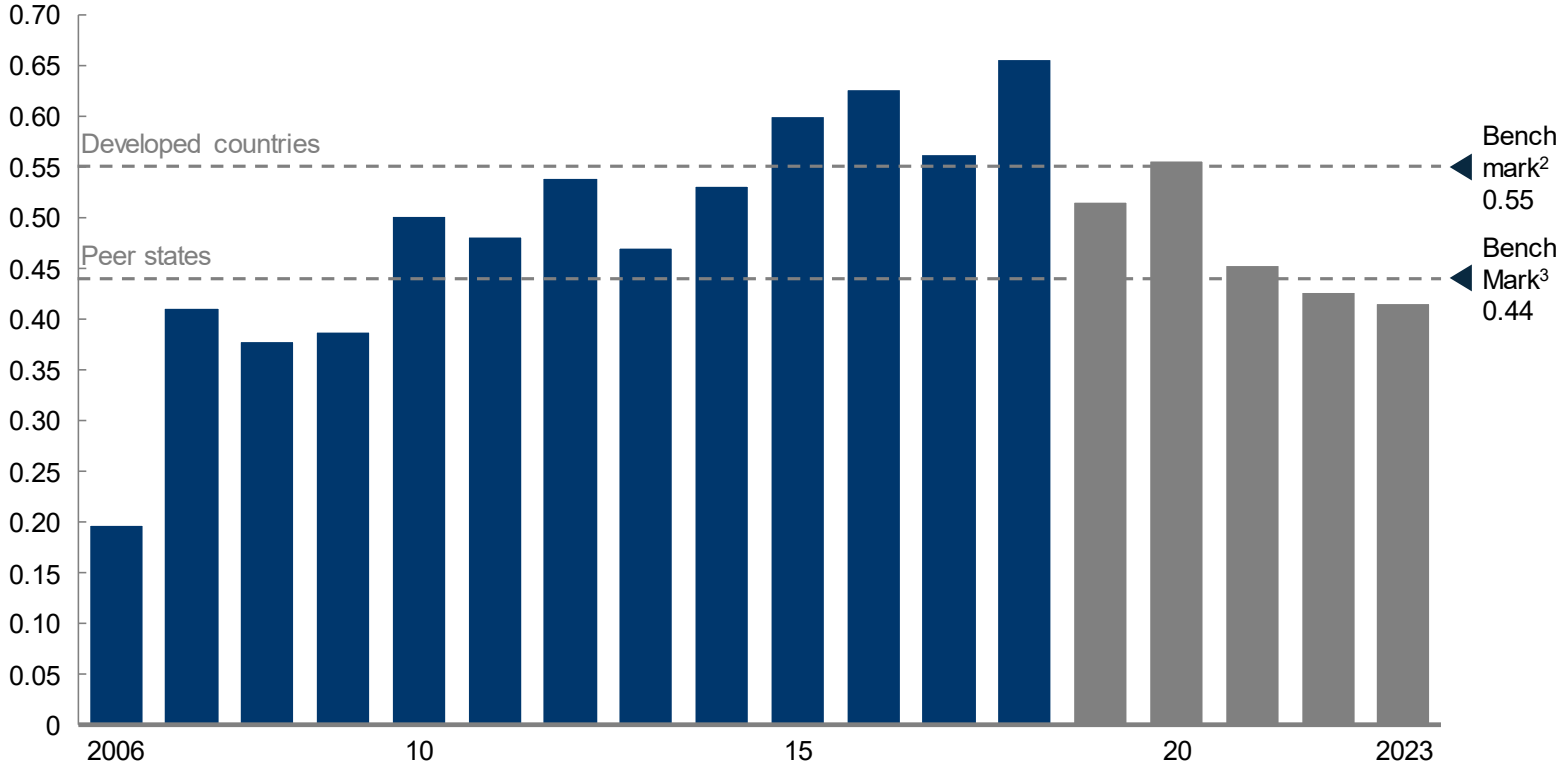
Miles



SOURCE: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics June 2015, State Disbursements March 2019

Comparison of road infrastructure spend, past and planned, as compared to peer US States and peer developed countries

Roads infrastructure spend in North Carolina, 2006-2018, projections 2019-2023, % of real GSP (2009 USD)



Since 2015, spending on roads has exceeded both peer states, and international benchmarks

Spending on roads **has grown since the financial crisis and has converged on developed-country benchmarks**

Pipeline of roads investment is expected to decrease to 0.47% of GSP per year between 2019-2023, in line with North Carolina's historical average and **between developed-country benchmark and the peer-state benchmark** of 0.55% and 0.44%, respectively of GSP

1 Investment includes public (includes federal, state, and local) and private investment
2 Benchmark is an un-weighted average of infrastructure spend (excluding oil and gas infrastructure) as a share of GDP between 2010 and 2018 for developed countries: European Union, Australia, New Zealand, Canada.
3 Benchmark is an un-weighted average of infrastructure spend roads including: Texas, Florida, Georgia, Tennessee, Virginia, Washington and Arizona

SOURCE: Dodge Data & Analytics; Bureau of Economic Analysis; Infrastructure Stock and Spend Analyzer

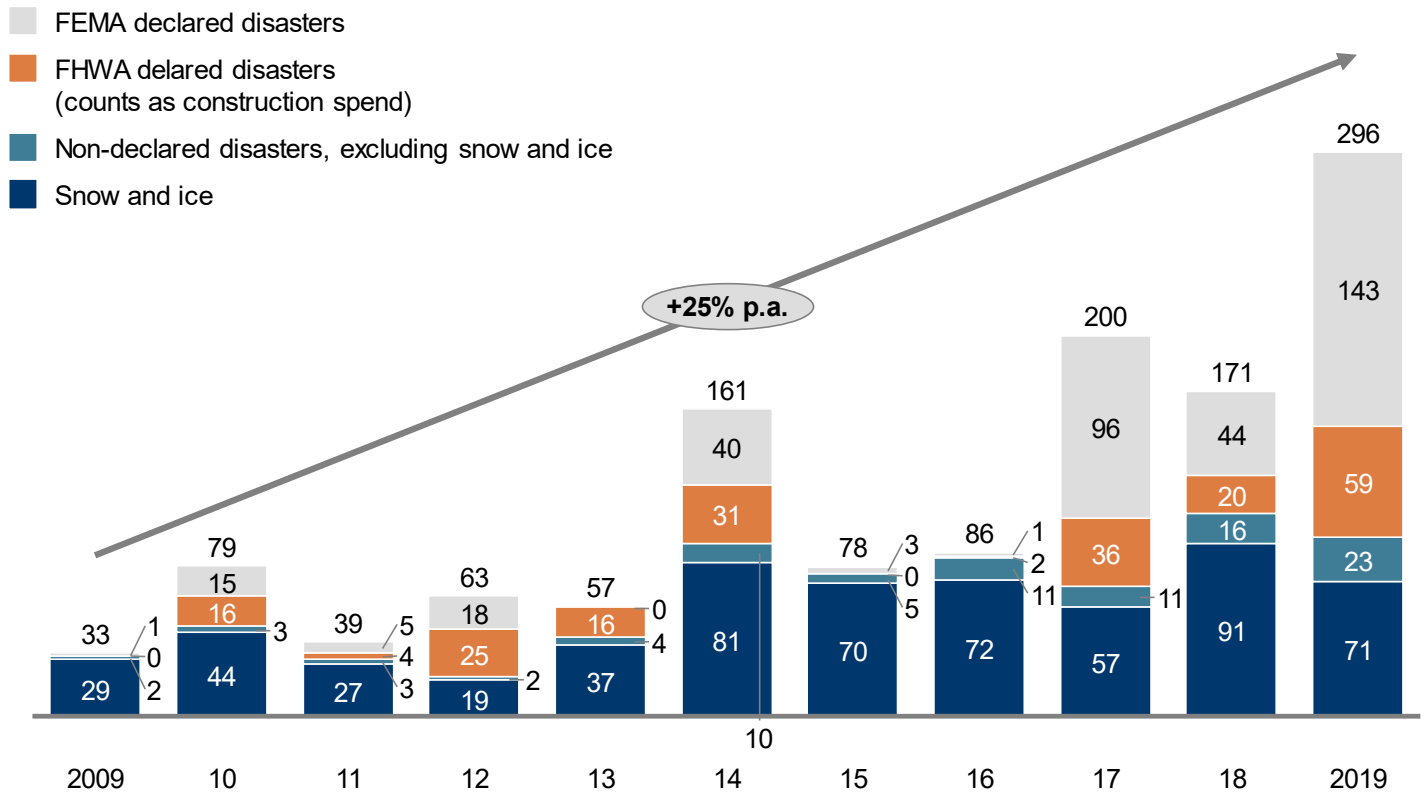
Evolution of NCDOT

Key trends	Past NCDOT	NCDOT today	NCDOT 2030+
Changing strategic context	▪ Complete IHS buildout ▪ Improve secondary system ▪ 'Build/Build'	▪ Shift from construction to maintenance ▪ More multi-modal focus ▪ 'Build/Maintain'	▪ Shift towards enabling mobility as a service, maintaining system
Larger projects[1]	▪ Projects >$10M: – FY07: 77% of lettings – FY08: 56% of lettings	▪ Projects >$10M: – FY19 Apr YTD: 87% of let spend	▪ Projects >$10M projected to be 90%+ of let spend FY23-25
More complex contracting	▪ DB is 6 – 23% of construction spend FY09 – FY11	▪ DB is 40% of FY19 Apr YTD construction spend	▪ DB likely to increase ▪ P3 likely to increase
Shift to focus on maintenance	▪ FY09: Maintenance expense 43% as much as construction expense	▪ FY19 Apr YTD: Maintenance expense 60% as much as construction expense	▪ Maintenance expense expected to continue to rise as share of portfolio
Greater decentralization	▪ FY15, 5% of construction spend, 47% of projects are division led	▪ FY19 Apr YTD, 9% of construction spend, 52% of projects are division led	▪ Divisions increase share in construction, maintain share in maintenance
Resourcing	▪ ~15K employees (1996)	▪ ~10K employees	▪ Potentially fewer employees, greater outsourcing
Approach to allocations	▪ Project specific funding ▪ Legislative driven priorities	▪ Outcomes-based prioritization ▪ Data driven approach	▪ TBD – e.g., greater focus on performance while managing multiple outcomes
More complex forecasting	▪ Use of Hi-CAMS ▪ Static excel based reporting	▪ Incorporation of SAS ▪ Static excel based reporting	▪ Need for more real time reporting, agile spend response to cash position

1 May be influenced by cost inflation factor as well

Disaster spend per year

NCDOT spend on declared and non-declared disasters, including snow and ice, FY09-19 ($, Millions)



- NCDOT **disaster expense has grown at a CAGR of 25% per year since 2009**
- **Snow and ice, as well as hurricanes, drove large increases** in 2014-2019 relative to 2009-2013

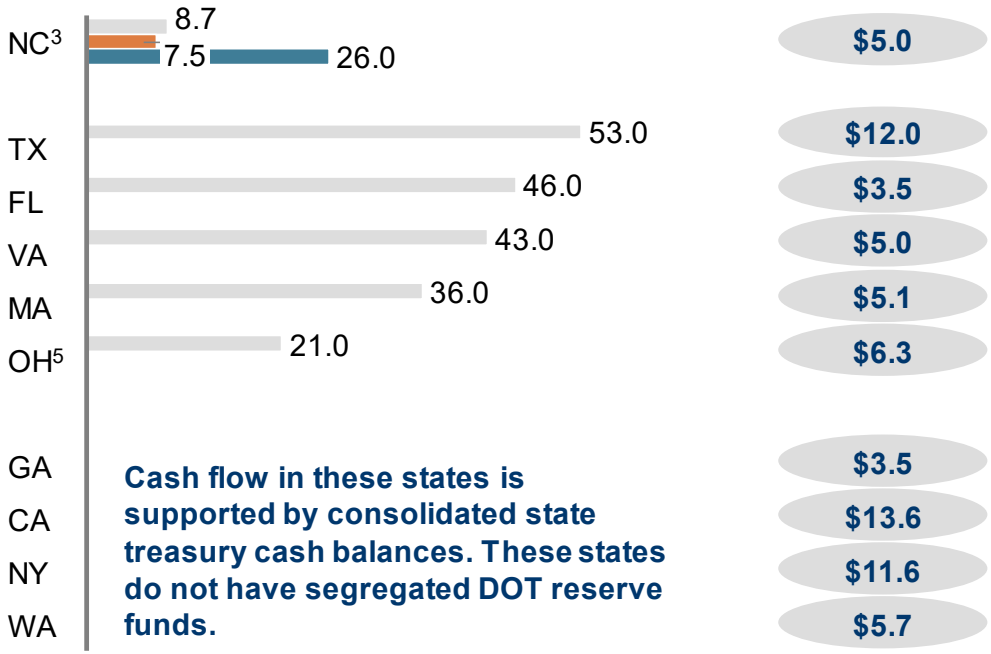
SOURCE: Historical Data_Emergency Expenditures & Reimbursement as of 6 Aug 2019

Benchmarking of NCDOT cash reserve requirements to peer states[1]

Current cash reserve
Legislative minimum
Legislative maximum

Cash as a percentage of annual budget for most recent year[2]
Percent

Total budget[2,4]
$,B



Cash flow in these states is supported by consolidated state treasury cash balances. These states do not have segregated DOT reserve funds.

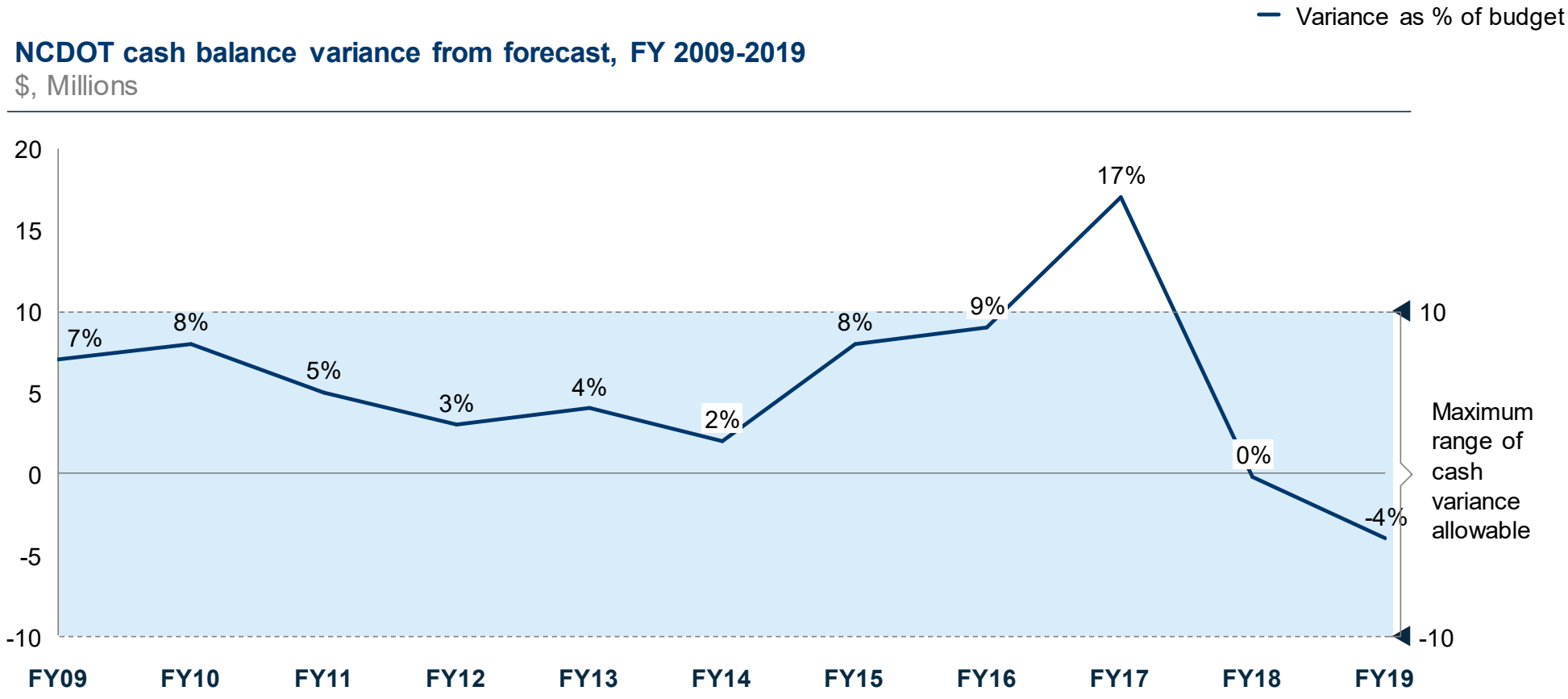
Implications

- **NCDOT currently has a legislative mandate to have a minimum cash balance of 7.5%** of DOT revenues; **maximum** cash balance **of $1 billion in order to issue BuildNC bonds**
- NC is unique among peers in having both floor and ceiling on cash position, **creating uncommon operational challenges and requiring tradeoffs and greater precision to meet cash needs**
  - **Private sector companies typically carry smaller ratios of cash on hand (5-11%)** yet have narrower scopes of responsibility, ability for short-term borrowing, and fewer external authorities influence resources
- **As NC transportation spending increases, an absolute upper limit of $1B (not % of revenue) will narrow the range of acceptable cash balances**, requiring increasingly precise forecasting and management controls

1 Peer states are other large or comparable states based on drivers of transportation needs (e.g., size, population growth, GDP growth)
2 Percentage is of state DOT appropriations, typically revenues; NC is from 2019; TX, VA, OH, MA, GA, CA, NY are from 2018; FL, WA is from 2017
3 NC's appropriated revenues (net federal receipts) are the basis for lower limit. The upper limit is $1 billion total cash balance--the equivalent of ~26% of appropriated state revenue not including federal revenues.
4 State DOT scopes vary (whether they include multi-modal and local roads); financial reporting approach varies by state, fund source, and accounting and reporting methodology (variations include restricted/unrestricted cash pooling and reporting of federal receipts)
5 OH: Significant tax increase under consideration to cover transportation funding liabilities.

SOURCE: State DOT Annual Financial Statements and State Annual CAFR

Cash balance variance from forecast in revenues and expenses, FY 2009-2019

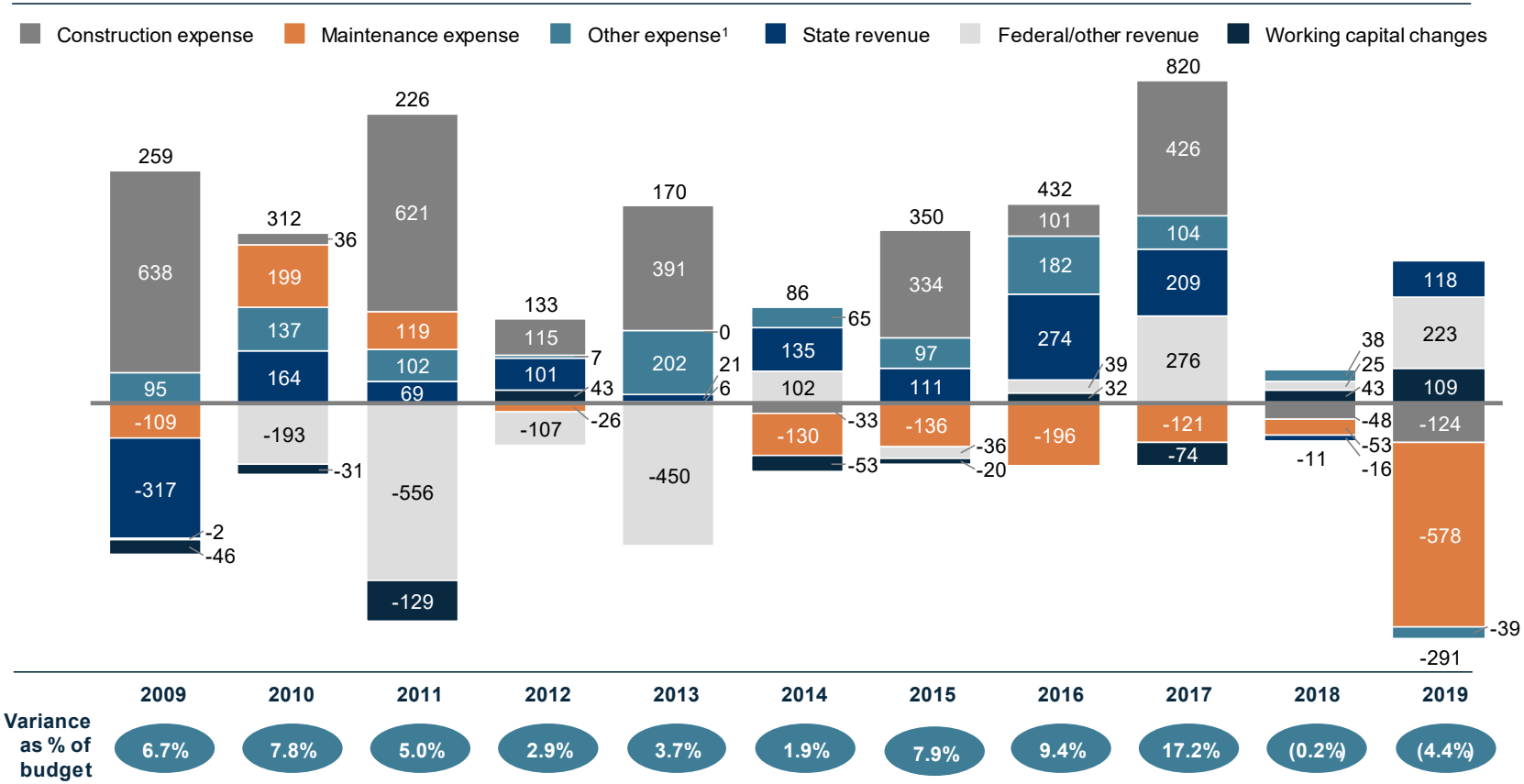


1 Includes Other Modes and Other Expenditures categories of cash model. Other expenditures includes Admin, State agency transfers, General Fund transfers, State aid to municipalities, debt service excluding GARVEE & Build NC, Other programs; Represents a precision that NCDOT has not often achieved (exceed or nearly exceed 4 of last 5 years)

SOURCE: NCDOT cash models 2014-19 as of 30 Apr 2019, "Qtr compare to baseline" tabs

Cash balance variance from forecast in revenues and expenses, FY 2014-2019

NCDOT cash balance variance from forecast, FY 2009-2019
$, Millions



Absolute value variance was significant FY09-13. Deficits in revenues provided some balance for under-budget expenses in terms of cash impact

From FY14 – FY17 saw significant variance, causing cash balance to continue increasing more than intended

New SAS forecasting systems reduced variance in 2018, but forecasting challenges re-emerged in 2019

2020 budgeting process starts soon; opportunity to bring forecasts more in line with actuals is now

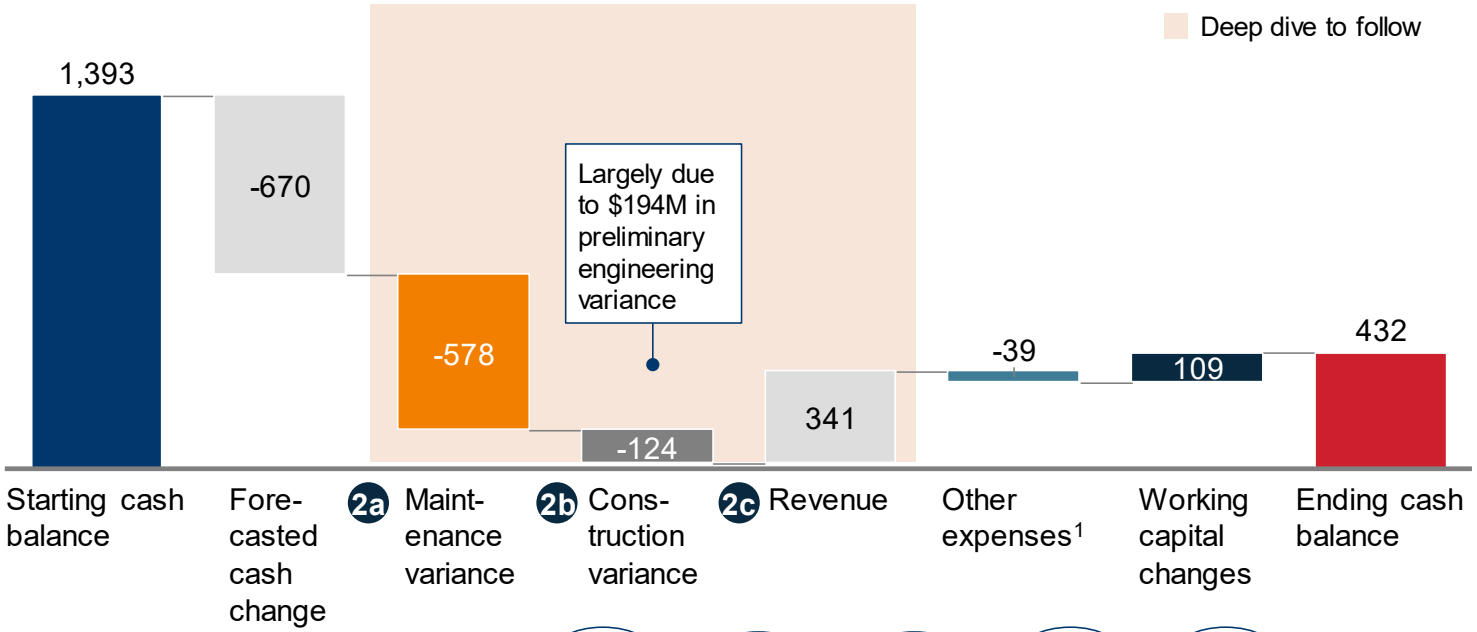
1 Includes Other Modes and Other Expenditures categories of cash model. Other expenditures includes Admin, State agency transfers, General Fund transfers, State aid to municipalities, debt service excluding Garvee & Build NC, Other programs.
SOURCE: NCDOT cash models 2014-19 as of 30 Apr 2019, "Qtr compare to baseline" tabs

Contents

- Context
- **Drivers of variance**
  - Maintenance variance
  - Construction variance
  - Revenue variance
- Root causes and potential levers

Impact of revenue and expense variance from forecast on cash balance, FY19 YTD

NCDOT cash balance variance from forecast, FY19
$, Millions



	Maint-enance variance	Cons-truction variance	Revenue	Other expenses[1]	Working capital changes
Share of absolute variance of FY19	42%	14%	30%	3%	10%
Variance as a % of category spend FY19	36%	4%	6%	4%	N/A

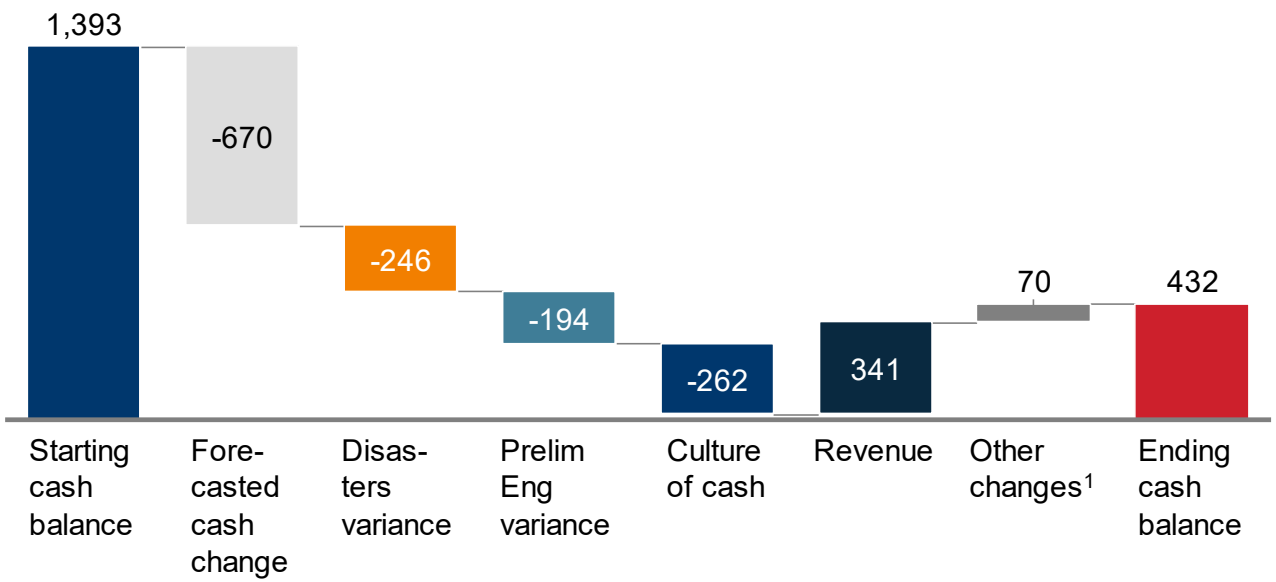
- **Nearly 60% of variance** on an absolute basis is either **construction (10%) or maintenance (49%) expense**
- **Revenue has been relatively well forecasted** in years without large federal interventions (e.g., ARRA, disaster reimbursements)
- **Other expenses and working capital changes are small contributors to** absolute variance

1 Includes "Other modes" category of cash model as well as "Other expenditures" category (includes state agency transfers)

SOURCE: NCDOT cash model FY19, "Qtr compare to baseline" tab, Historical Data_Emergency Expenditures & Reimbursement as of 5 August 2019

Impact of revenue and expense variance from forecast on cash balance, FY19 YTD -- alternative view of negative variance

NCDOT cash balance variance from forecast, FY19
$, Millions



Share of absolute variance of FY19

Disasters variance	Prelim Eng variance	Culture of cash	Revenue	Other changes
22%	17%	24%	31%	6%

- Collectively, the **negative variance** from construction and maintenance spend is **$702M**
- This negative variance appears to be from three primary causes **disasters, preliminary engineering, and broader performance / governance challenges** with contractors and Divisions
- These contribute roughly equally to **negative variance, with the governance challenges being the largest source** of negative variance, followed by weather and preliminary engineering

1 Includes Working capital changes as well as other expenses including "Other modes" category of cash model as well as "Other expenditures" category (includes state agency transfers

SOURCE: NCDOT cash model FY19, "Qtr compare to baseline" tab, Historical Data_Emergency Expenditures & Reimbursement as of 5 August 2019

Contents

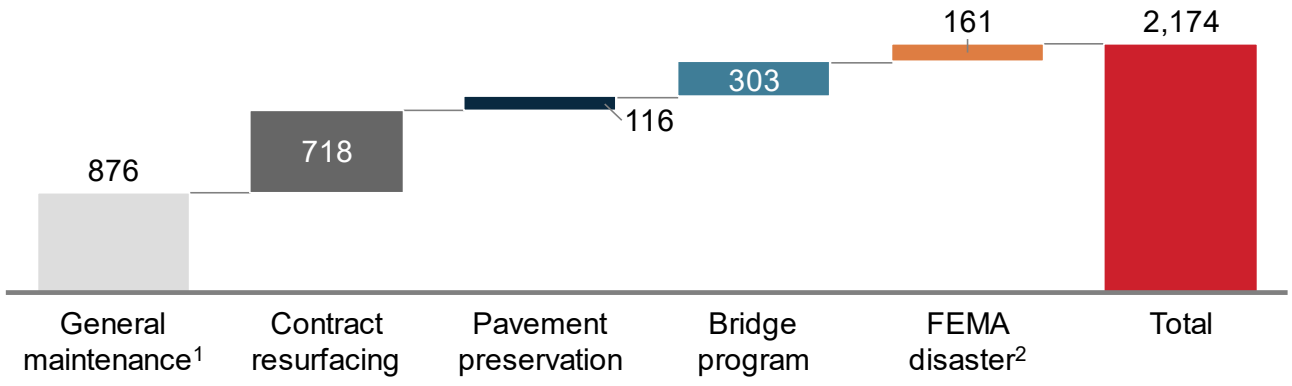
- Context
- **Drivers of variance**
  - **Maintenance variance**
  - Construction variance
  - Revenue variance
- Root causes and potential levers

Maintenance spend variance

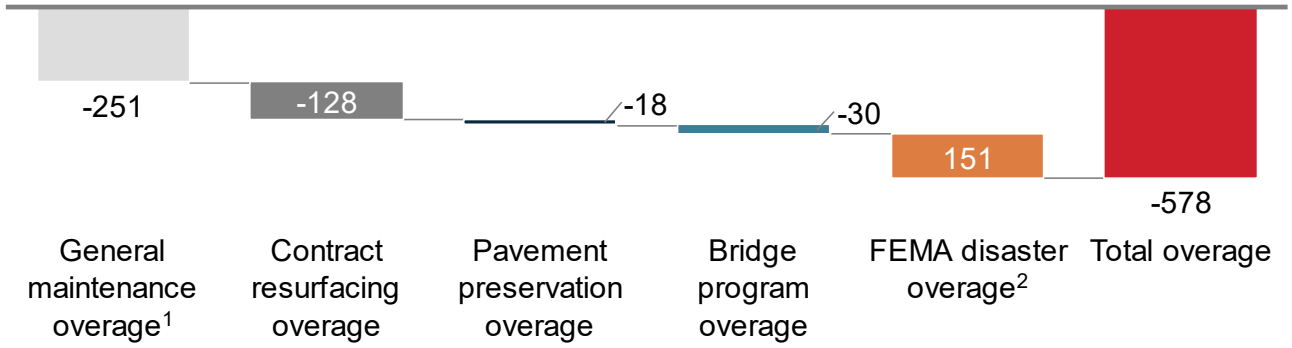
PRELIMINARY

FOR DISCUSSION

NCDOT maintenance spend, FY2019 ($, Millions)



NCDOT maintenance spend variance from total allocations, FY 2019 ($, Millions)

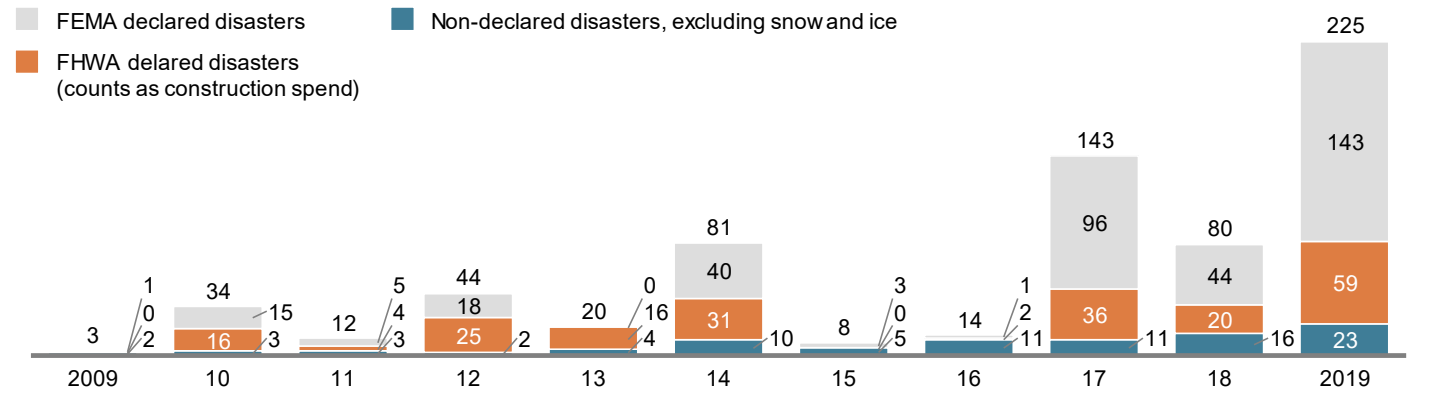


1. Although hurricanes have been a factor, **FEMA disaster overage ($151M) is only a quarter of total maintenance variance**
2. **Most of the variance instead comes from issues inherent in the operating model** of the operations team, e.g.,
   - Reliance on **multi-year contracts** that reduce agility, lack of **project controls**
   - **Forecasted amount for maintenance** driven by start-of-year appropriations from GA; **divisions plan spend against total allocations from central spend operating plan** (which includes mid-year supplemental appropriations), rather than forecasted amount

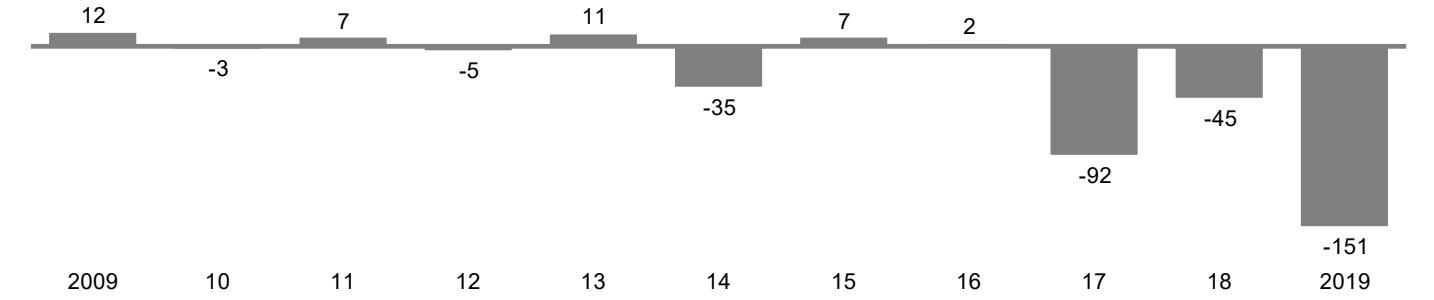
1 Includes primary maintenance, secondary maintenance, roadside environmental, and bridge preservation
2 Includes $143M in FEMA declared disasters and $33M in non-declared disasters (excluding snow and ice), excludes $5M not included in the NCDOT cash model; variance is this spend minus the $10M budgeted for FEMA spend
SOURCE: NCDOT cash model FY19 "Qtr compare to baseline" tab, Ops spend plan versus actuals FY19

1 Disaster deep dive

NCDOT spend on declared and non-declared disasters, excluding snow and ice, FY09-19 ($, Millions)



NCDOT maintenance[1] disaster spend variance from planned spend[2], FY09-19 ($, Millions)



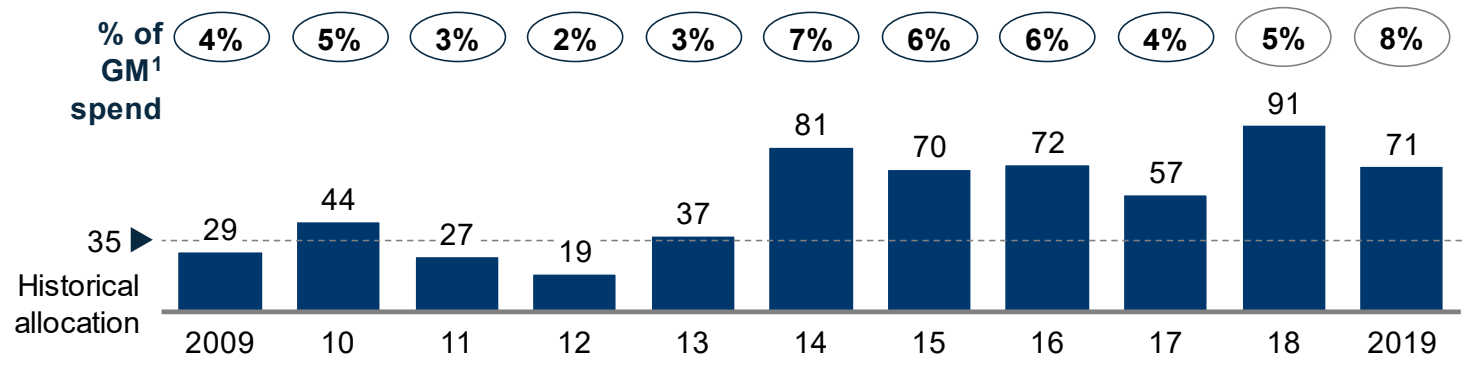
- NCDOT **only plans $10-15M in maintenance disaster spend[1] a year,** leading to significant variances – especially since FY17
- The majority of FEMA/FHWA expenses will not be reimbursed within the fiscal year, so **NCDOT must have enough cash on hand to accommodate emergency spending**
  - In FY19 NCDOT received $68M in reimbursement – **only 30% of in-year disaster spend,** most of which was retroactive for prior disasters
  - Since 2003 it has taken on average **3.3 years for final reimbursement for FEMA declared disasters**
- State portion of disaster spend is not "held against" maintenance budget until federal reimbursements are finalized and can be "paid" from GMR reserves over multiple years, **so maintenance has not decreased other spending in heavy disaster years**

1 FHWA disaster expenses not included because they come out of the construction budget
2 Maintenance budgets $10M annually for FEMA disasters and an additional few million dollars (exact amount changes annually) for enterprise non-declared disasters excluding snow and ice. This amount assumed to be $5M annually here.

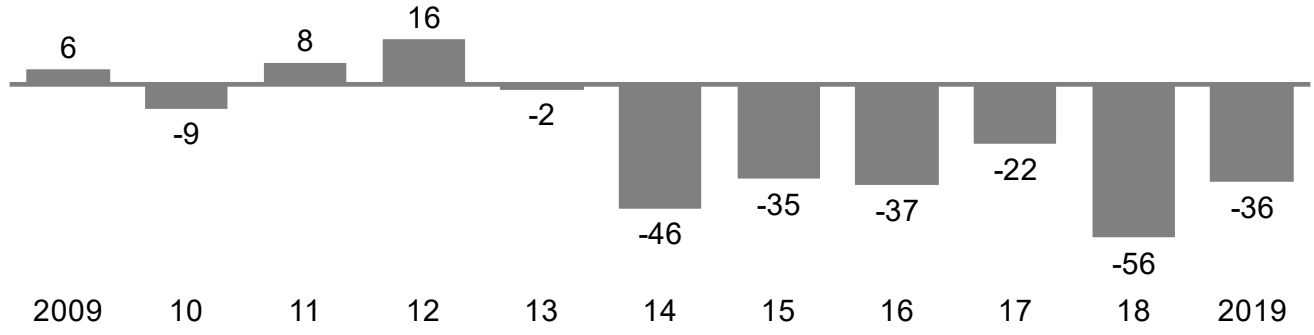
SOURCE: Historical Data_Emergency Expenditures & Reimbursement, NCDOT cash models 2009-2019, "Qtr compare to baseline" tabs

1 Snow and ice deep dive

NCDOT maintenance spend on snow and ice, FY09-19[2] ($, Millions)



NCDOT snow and ice spend variance from planned spend, FY09-19 ($, Millions)



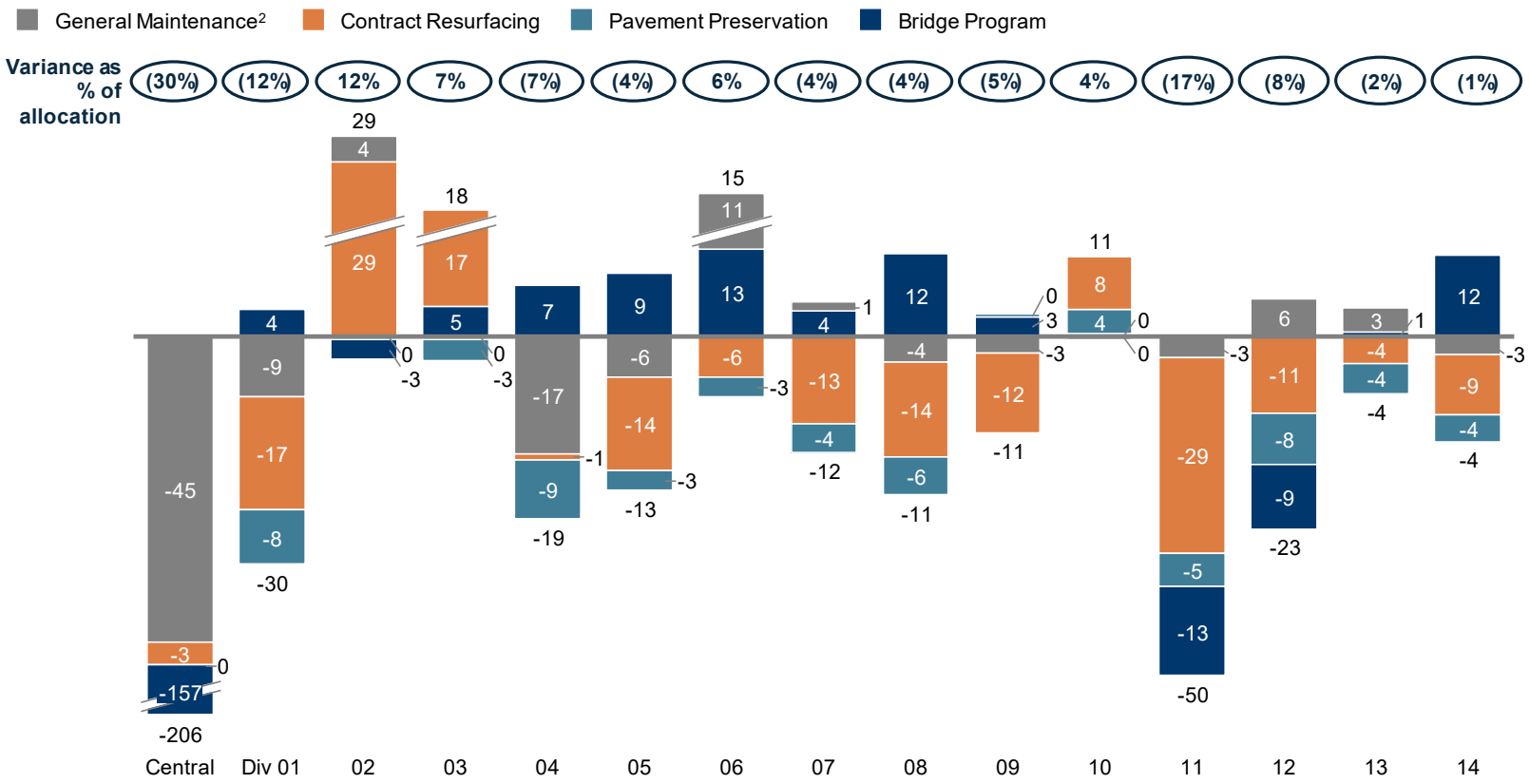
- Snow expenses **rose in 2014 and have remained consistently higher since**
- NCDOT **estimates ~$35M in snow/ice spend per year, but has spent at least $20M above plan since 2014**
- Planned statewide general maintenance, such as condition assessments, **must be delayed or minimized to accommodate overages in snow/ice spend**

1 General maintenance
2 Assumes a constant historical forecast of $35M for illustrative purposes; actual annual forecast may vary

SOURCE: Historical Data_Emergency Expenditures & Reimbursement, NCDOT cash models 2009-2019, "Qtr compare to baseline" tabs

2 Variance from spend plan allocations by division: FY 16-18

NCDOT maintenance spend variance from allocations by division, FY16-18 cumulative[1] ($, Millions)



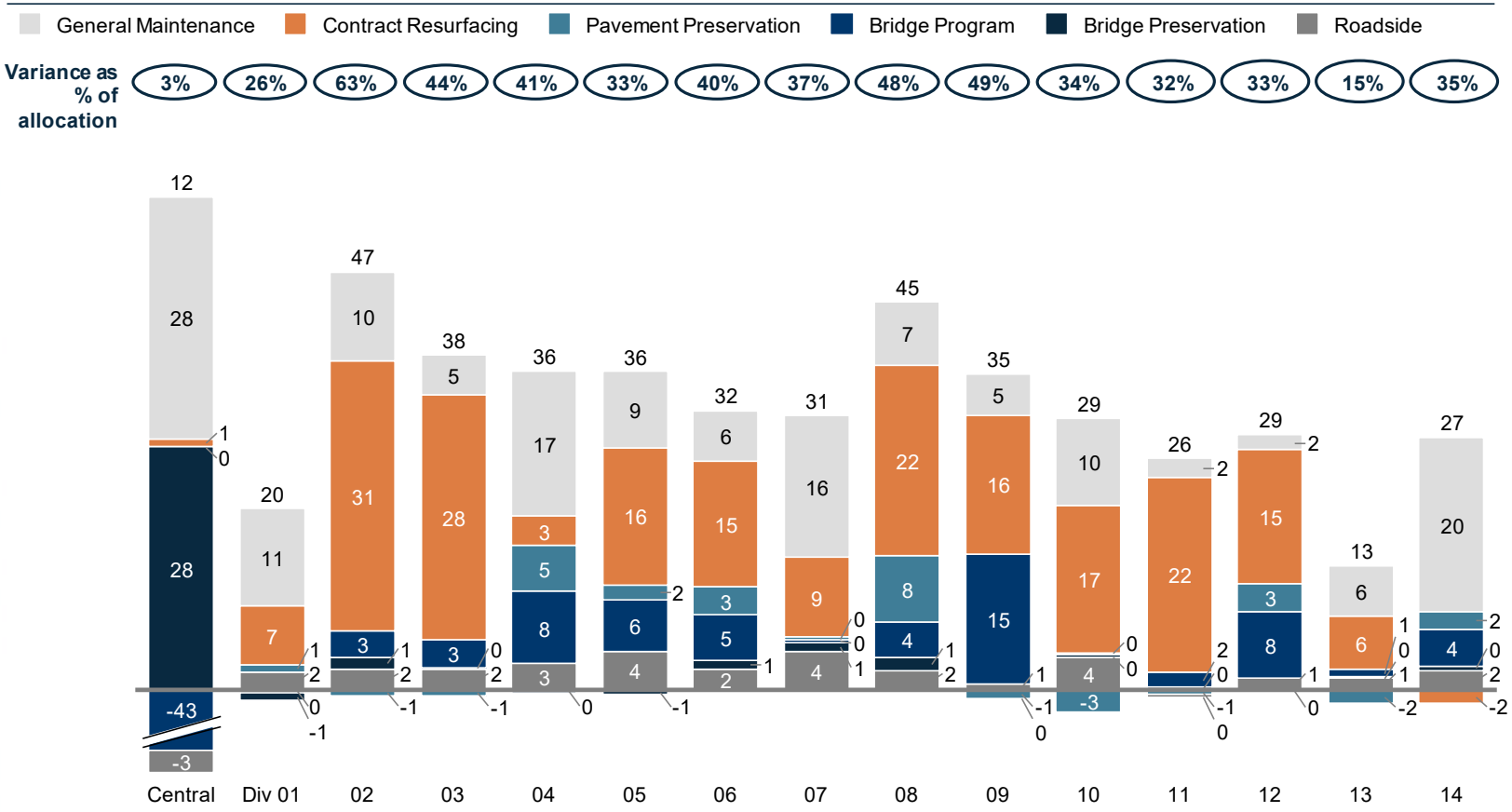
- In recent years, most divisions spent less than allocated from the SOP **with the exception of overspending by divisions 2, 3, 6, and 10**
- Central has historically underspent, **primarily due to project delivery challenges** rather than intentional mitigation of division over-spending
- Divisions **can carry forward unused funds or borrow from next year indefinitely, leaving them little incentive** to tightly control in-year spending overall or in specific categories

1 Allocation minus actuals. Actual spend is derived from Ops SAP data and therefore excludes local, public/private match, damages and fees and will differ slightly from cash model actuals
2 Roadside environmental and bridge preservation were part of general maintenance allocation prior to 2018
Note that 2017 division actuals used in this analysis are $16M lower than aggregate 2017 actuals, indicating an issue with the division-level data indicating actual variance from allocations may be slightly higher than depicted here

SOURCE: NCDOT maintenance allocations and actuals by division by year, FY 2015-19

2 Variance from spend plan allocations by division: FY19

NCDOT maintenance spend variance from allocations[1] by division, FY19 ($, Millions)



- FY19 over-spending primarily in **contract resurfacing and general maintenance, of similar magnitude across divisions**
  - Contract resurfacing **managed at division level** even if let centrally
  - New RMIP process and metrics increased general maintenance spending
- **FY19 snow/ice and disaster spend is not part of division general maintenance overages,** as this is paid from statewide funds or GMR
- Ops spend plan forecasted FY19 spend 5% over GA appropriations, **but spend was 30% over**

1 Actual minus allocation. Actual spend is derived from Ops trackers and therefore excludes local, public/private match, damages and fees and will differ slightly from cash model actuals

SOURCE: NCDOT maintenance allocations and actuals by division by year, FY19

2 Maintenance planning and review process prior to FY19

Review

Year-end analysis of work completed vs. goals & expenditures

Baseline unit cost reports available, but do not include unplanned spend

Planning

1 year prior

Fall = Many divisions let 100% of following FY allocation, often plus portion of the next year

Apr 1: Divisions submit HMIP based on last year's allocations. RMIP included as of FY18

June-July: Appropriations released by General Assembly, Ops spend plan created

July: Beginning of fiscal year

Between July and Sept: Divisions receive initial allocations, adjust annual plans

Nov/Dec: Credit reserve balance from prior year is finalized and distributed to divisions in supplemental allocation

June: End of fiscal year

Divisions provide justification for any H/RMIP activity that did not occur

Pain points

A Infrequent letting and long lead times mean **maintenance cannot periodically adapt letting based on actual appropriations** or forecasted spend

B Division budget **planning does not incorporate expected "unplanned" spend**

C Budget often delayed until after FY begins. **Spend plan created at statewide level and may not reflect division plans**

D Historically ops **spend plan has been based on matching to appropriated amount**, not a forecast-driven view of estimated in-year spend

E **Limited credit reserve maintained for disaster spend.** Cash model forecast not updated to reflect higher spend planned from new allocations

F **Central has limited ability to enforce** divisions to spend less and divisions have little incentive to do so

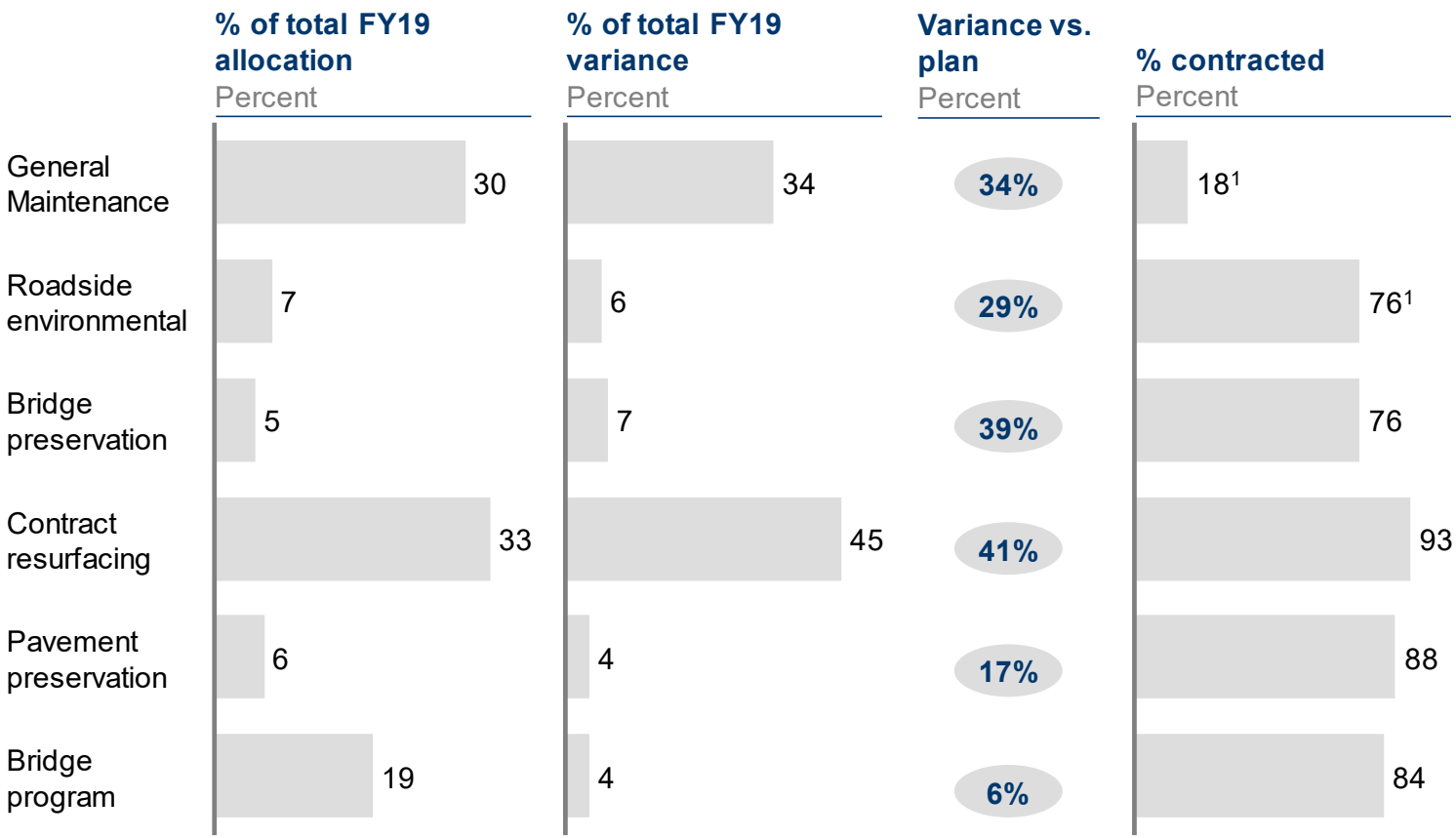
SOURCE: Highway operations and division leadership

2 Maintenance has implemented process changes that will relieve some pain points in FY20/21

Pain point	FY 19/20 changes to address	Remaining pain points
A Maintenance cannot periodically adapt letting based on forecasted spend	50% of estimated allocation for FY starting in July will be let in the spring, with remaining 50% let in the fall after appropriations are known	Lack of sophisticated forecasting tools prevents maintenance from adjusting lettings based on expected payout schedules of multi-year contracts. More than two letting cycles may be needed, especially for divisions that typically let monthly
B Budget planning does not incorporate "unplanned" spend	New RMIP process requires divisions to incorporate 3-year averages of unplanned expenditures	Several spend types that could be planned for are in the "unplanned" category because they are not affiliated with HMIP or BMIP work (e.g., (gravel road maintenance, engineering)
C Budget often delayed until after FY begins, spend plan created at statewide level	FY20 spend plan will have a division by division projection, which divisions can track against their actuals in new spend dashboard	Historically maintenance forecast has not been updated regularly or to include supplemental allocations mid-year. High variation in division forecasting and central communication of plans may lead to spend plan inaccuracies
D Spend plan is based on appropriated amount, not forecast-driven view of estimated in-year spend	RMIP, HMIP, BMIP will merge for FY21. Divisions and central can access real-time MMS dashboard of KPIs vs. goals as well as SAS dashboard of baseline unit costs including unplanned spend	Cash model forecasting has not been elevated in priority, still spending to allocations, though with greater transparency. Divisions have no incentive to spend less in one are if another is overbudget since appropriations are separate
E Limited credit reserve maintained for disaster spend	SB 605 created the Disaster Relief Cash Flow Fund which will create segregated accounting for disaster spend	Ops tracked actuals do not match those in cash model because ops only includes spend "held against" their budget". Spending is held accountable to appropriations, not forecast.
F Central has limited ability to enforce that divisions spend less, divisions have little incentive to do so	Monthly operations staff meeting, attended by each division's chief engineer, reviews monthly KPI and budget reports	Divisions can borrow from next year's budget indefinitely with no penalty, are held accountable to specific performance KPIs, and see long-term consequences to abandoning planned maintenance

SOURCE: Highway operations leadership

2A Relationship of variance to outsourcing



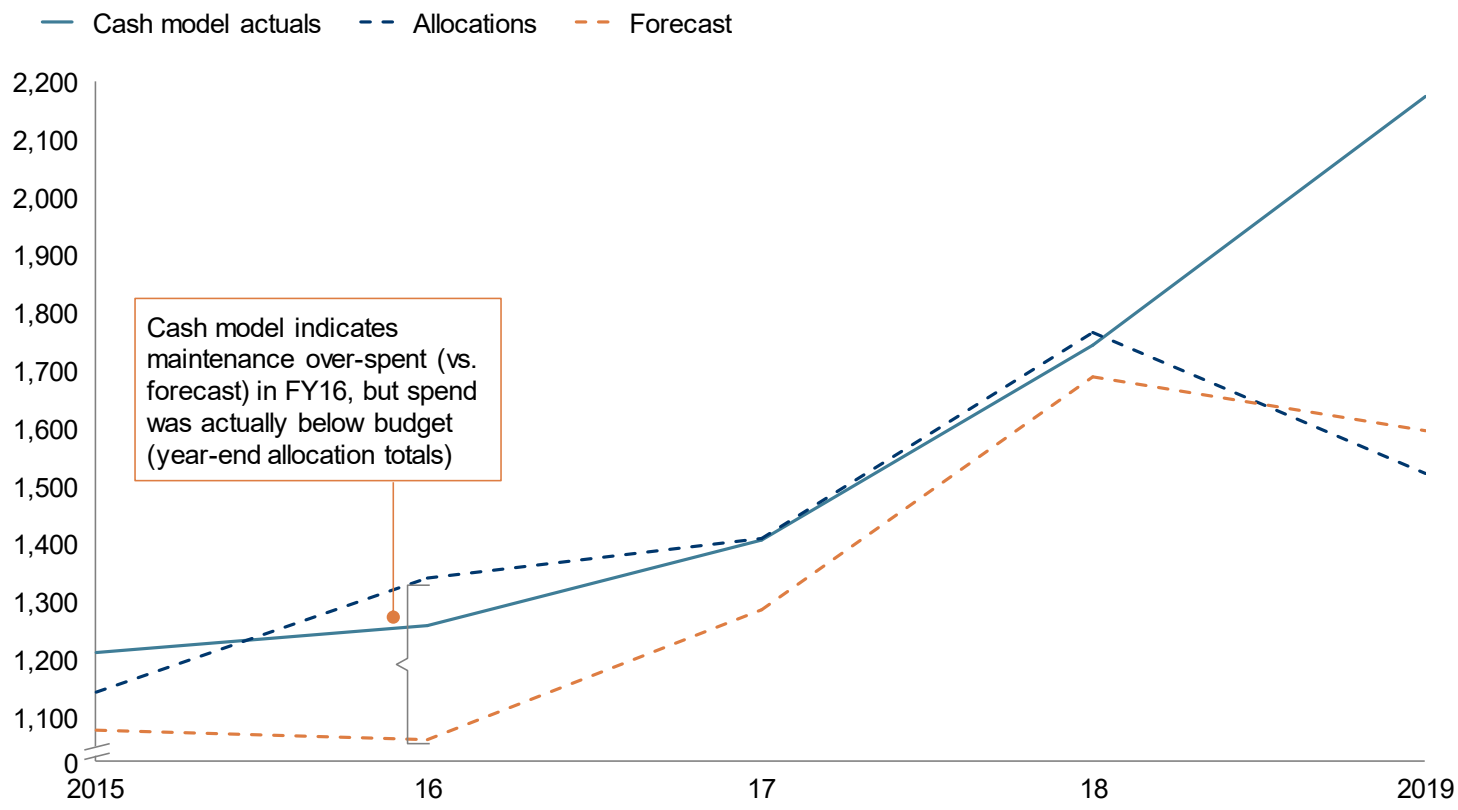
- **No evident correlation between variance and contracted amount**
  - Contract resurfacing has high variance, other highly outsourced categories (e.g., pavement preservation) do not
  - General maintenance and roadside, primarily done in-house or with flexible on-call contracts, also high variance
- **Challenge to estimate in-year contracted** resurfacing spend:
  - Contracts often have terms of 10 – 24 months and **give only availability and completion dates, with window often ~8 months > estimated work time**
  - Contractor flexibility **may decrease costs** but makes it difficult to forecast in which fiscal year costs will hit

1 General maintenance and roadside use primarily on-call contracts which do not guarantee a certain amount of work

SOURCE: Operations fund center spend by payment type FY15-19, Maintenance allocations vs. actuals FY15-19, Highway operations and division leadership

2D Operations forecast vs. plan

NCDOT maintenance forecast, allocations, and spend FY15-19, $ Millions

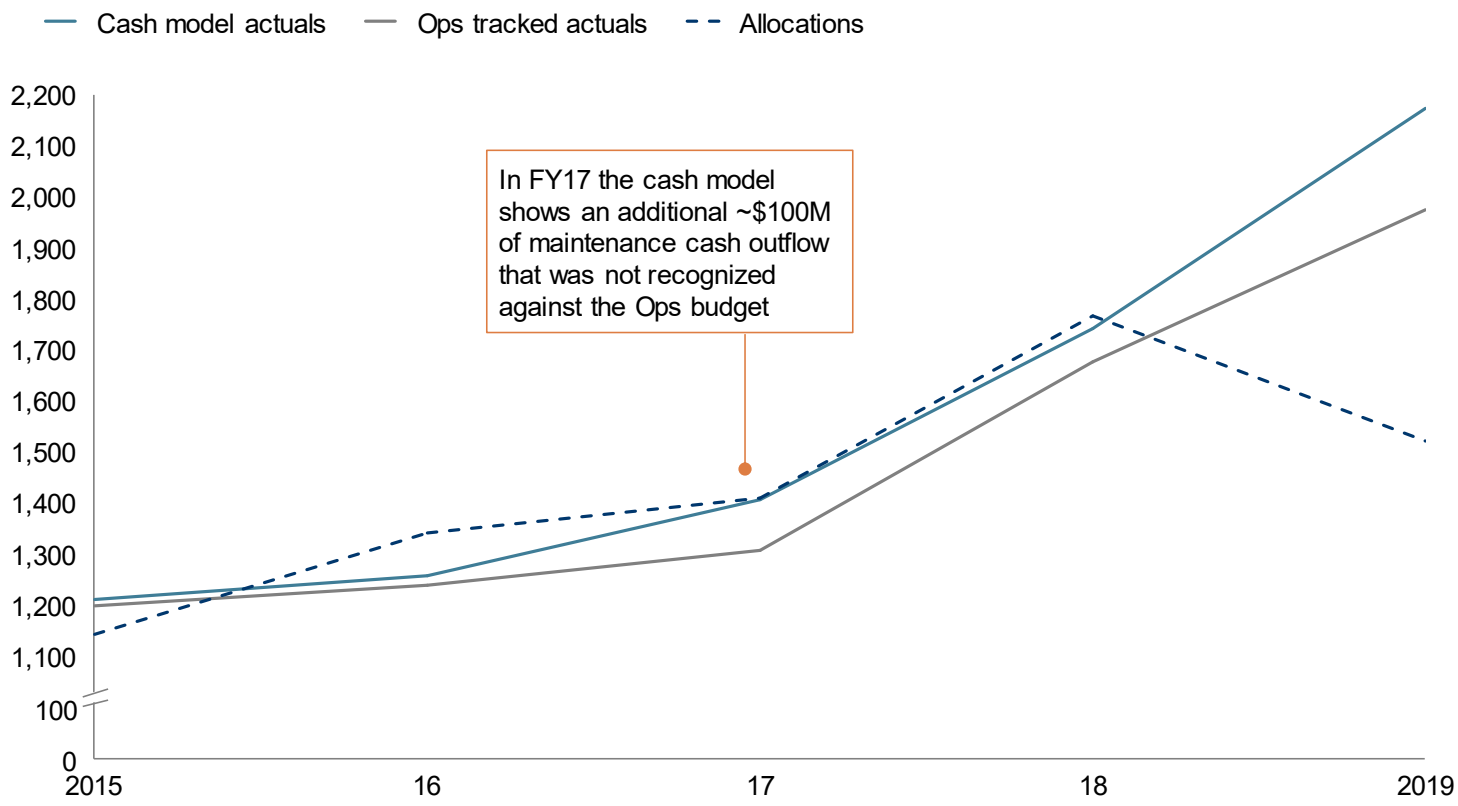


- Ops forecast is created at start of fiscal year based on General Assembly appropriations, but **is not updated throughout the year as supplemental spend plan allocations are made** (prior year GMR distributions, etc.)
- Maintenance spend therefore consistently exceeds cash model forecast, but **is actually below or roughly in-line with year-end allocations to divisions from central spend operating plan** in most years before FY 19
  - Divisions managing more to allocations, not forecast
  - Prior to 2019, maintenance had a credit balance to GMR every year since FY15

SOURCE: NCDOT maintenance allocations and actuals by division by year, FY 2015-19, NCDOT cash models 2015-2019, "Qtr compare to baseline" tabs

2E Cash flow actuals vs. operations actuals

NCDOT maintenance allocations and spend FY 15-19, $ Millions



- **Maintenance actuals in the cash model are higher than actuals tracked by the operations team**
  - Spend that does not "count against" maintenance allocations (fees, damages, local/other expenses) **are not tracked by Ops team** and not forecasted
  - The cash model tracks actual in-year spend for disasters, while **Ops actuals reflect spend "held against" their budget that year** (the state portion of closed out storms from prior years)

SOURCE: NCDOT maintenance allocations and actuals by division by year, FY 2015-19, NCDOT cash models 2015-2019 as, "Qtr compare to baseline" tabs

Contents

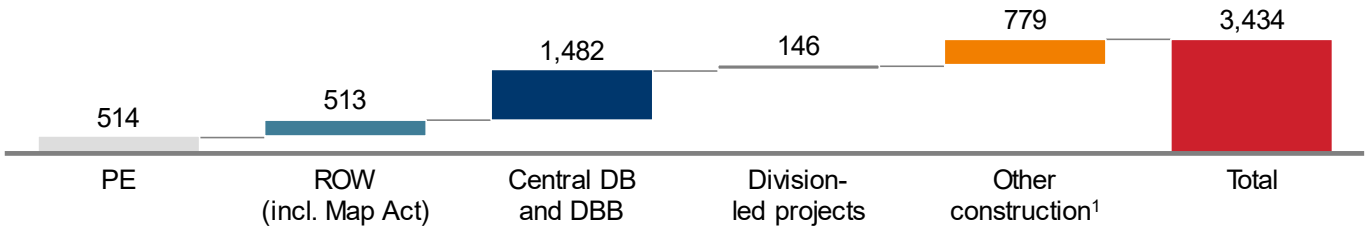
- Context
- **Drivers of variance**
  - Maintenance variance
  - **Construction variance**
  - Revenue variance
- Root causes and potential levers

Construction spend variance FY19

X% Variance from forecast

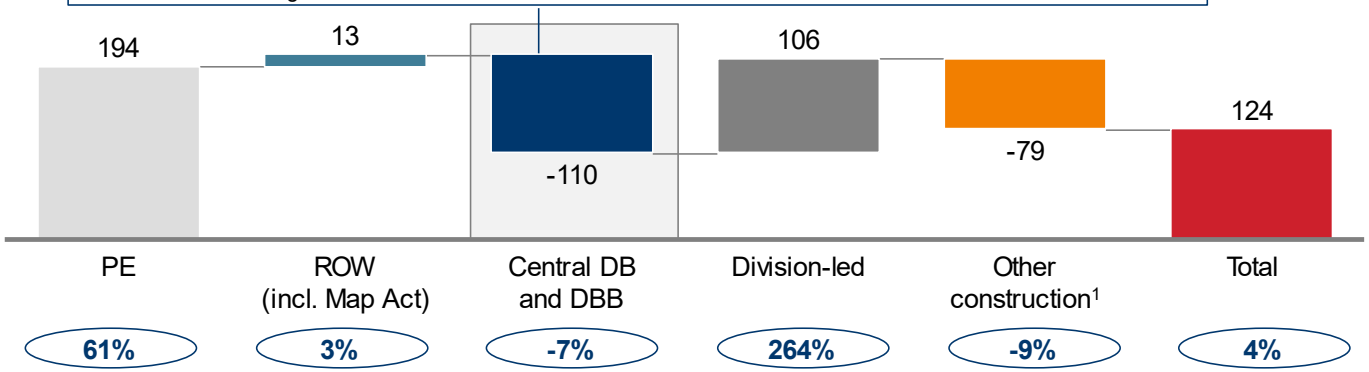
PRELIMINARY FOR DISCUSSION

Construction spend, FY19, $M



NCDOT construction spend variance from forecast[2], FY19, $M

Late stage decision to use DB on ~5 **projects shifted ~$190M in forecasted amount from DBB to DB and additional underspending due to cash constraints**; deliberate contracting decision rather than indication of inaccurate forecasting



1 **In FY19, PE overspending represented ~150% of the overall $124M variance** when non-PE and non-ROW spend is grouped

2 **ROW, including Map Act, has been relatively accurately forecast with only $13M variance on $513M of spend**

3 **When breaking apart construction spend, some variances exists at sub-level**, with mix of over and underspending mitigating aggregate effect, possible drivers include:

- 3a **Variance in rigor of forecasting** processes across units
- 3b **Divisions led construction projects** are a growing part of the portfolio; currently forecasted at aggregate with +250% variance
- 3c Two drivers **account for differences in forecast vs. actual for DBB and DB**
  - Deliberate decision to push projects to future years due to cash shortfall
  - Late stage decision to use DB on 5 projects, as well as lack of baseline forecasts for 2 DB projects due to unexpected delays

1 Includes Garvee Debt Service, Division of Mitigation Services, Build NC Expenditures, BuildNC Debt Service, Other Construction, Turnpike Authority, Internal Orders, CMAQ; Includes GARVEE expenditures, holdouts for pre-modeled capital projects in STIP without let dates and cost estimates, holdouts for overruns, TF bridge holdouts, safety, bonus allocations, I-77 holdouts, CEI; may include FHWA disaster construction spending

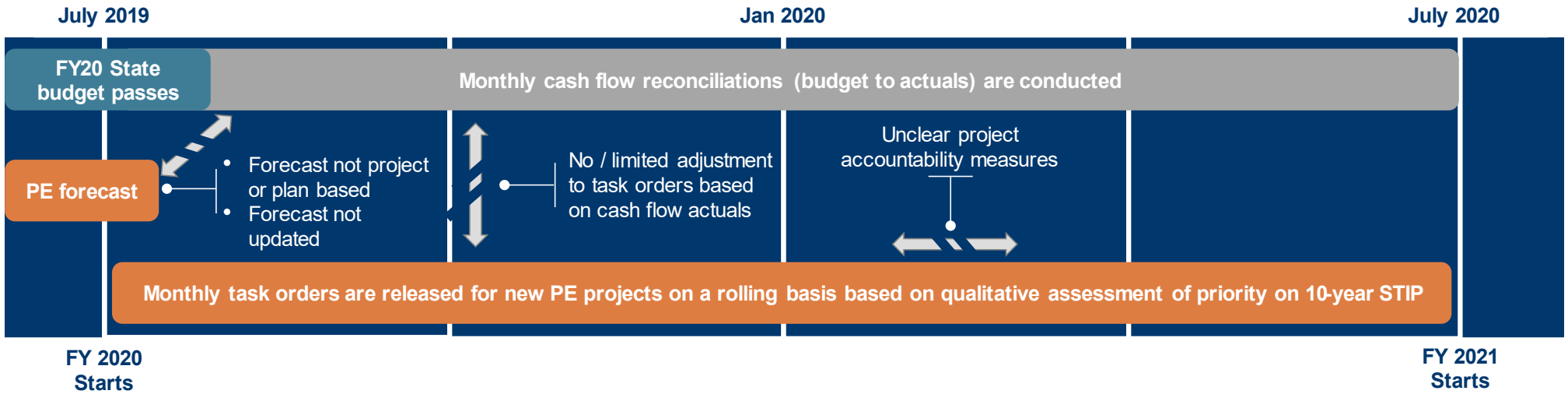
2 Baseline forecasts from Aug 18 SAS data; actual spend data from Aug 19 SAS data

SOURCE: NCDOT FY19 Cash Model as of August 2019, SAS Model DB and DBB Project Data (Aug 2018, Aug 2019), HiCams Project Forecasting Data (Aug 2019)

1 Preliminary engineering process flow

General Assembly | DOT Finance | Preliminary engineering

PRELIMINARY



Key implications

- **Preliminary engineering forecasting is based on prior-year budget,** rather than a project demand-based model (dissimilar to construction forecasting methodology, frequency, or precision)
- **Mid-year PE spending adjustments are hindered** by > 1-year task orders to the 'limited services contract'
- PE efforts in recent years intentionally overspend budget to build pipeline of projects, **fundamentally different practice that lacks agility or precision to adjust mid-year**, if desired
- **Cash flow budgeting has minimal effect** on PE planning; monthly cash meetings with key stakeholders but no formal processes for action

Practices found in other states

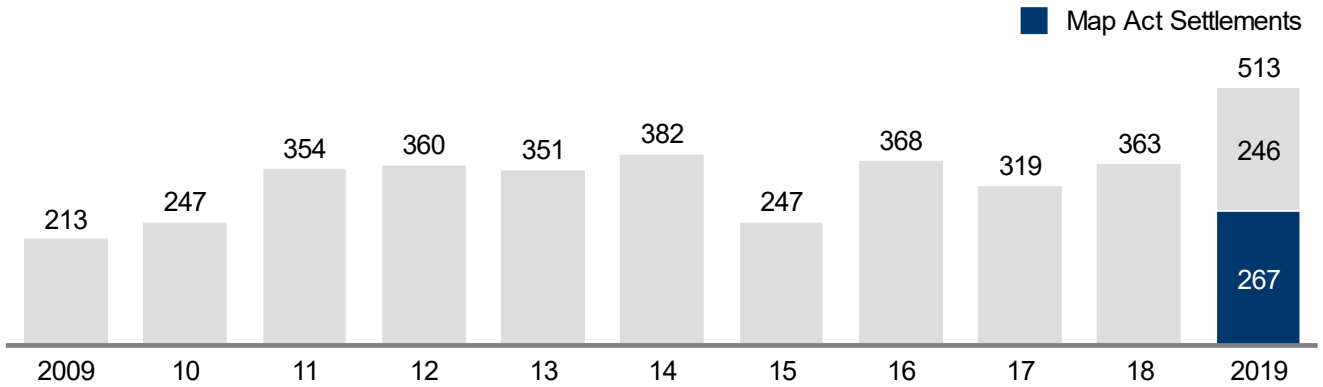
- **Preliminary engineering and construction costs** are forecast by project basis with historically-based statistical models
- **Preliminary engineering plans are more directly and clearly prioritized** based on letting schedules
- **Mid-year adjustments are made to PE spending** based on cash flow or budget actuals

SOURCE: Interviews with NCDOT Preliminary Engineering staff leadership

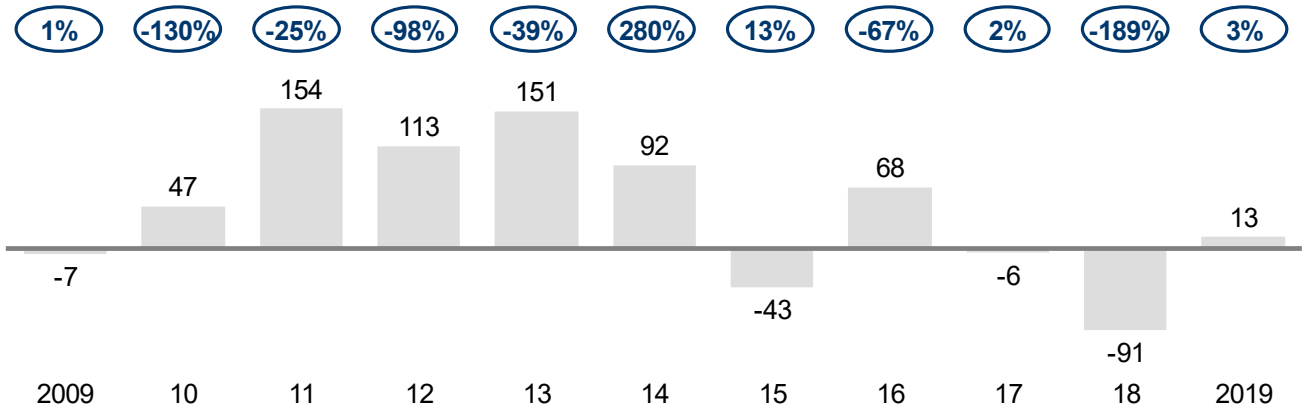
2 Map Act and ROW expenditures

ROW expenditures, FY09-19, $M

X% % total ROW forecast variance



ROW spend variance, FY09-19, %



- In FY19, **ROW forecasting close to accurate, with $13M (3%) in overage**
- **Map Act settlements entirely within ROW spending**; paid out $267M for 370 Map Act settlements in FY19, which were projected in overall SAS ROW forecast
- **Additionally, non-Map Act ROW spend being ramped down this year with total of $246M**, given more focus on imminent projects; overall conservative spending for FY19
- **While some level of uncertainty with future Map Act settlements,** suggests Map Act settlement projections accurate and on pace

SOURCE: NCDOT ROW expenditures FY09-19, Client Interviews

3a Forecasting method

Spend category	Forecasting method	Level of sophistication
Preliminary Engineering (PE)	▪ Aggregate holdout forecasted; no project-level forecasting	
Right of Way (ROW)	▪ SAS for Map Act settlement projections and project estimates	
Design Build (DB) and Design Bid Build (DBB) projects	▪ SAS for monthly aggregates, project-level forecasts and for monthly forecast adjustments	
Division-managed projects	▪ No forecast; $40M aggregate holdout and divisions spend against allocations ▪ In process of developing project-level forecasting	
Other expenditures	▪ Primarily aggregate holdouts rather than individual forecasts	

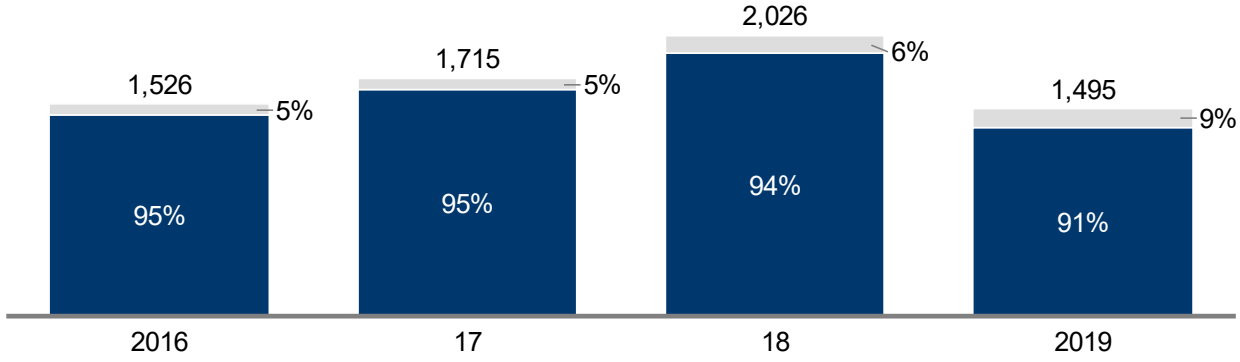
SOURCE: Client interviews, NCDOT Cash Model as of August 2019

3b Construction spend by division vs. central

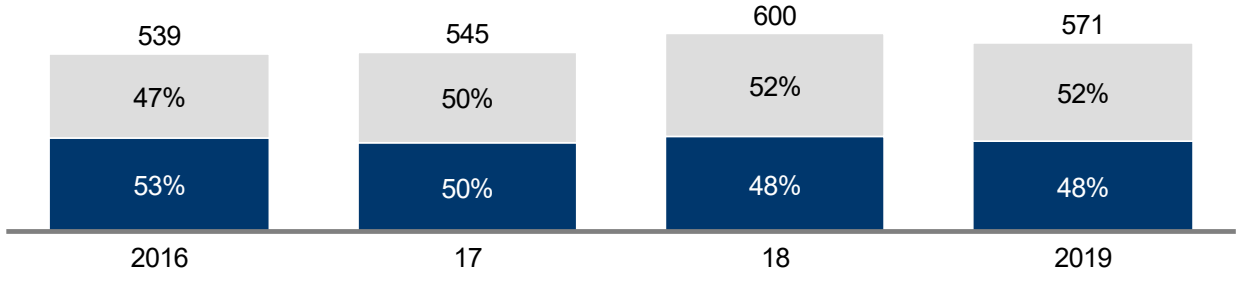
DATA FOR FY19 IS THROUGH APR 19

Division led
Central

Project construction spend, central[1] vs. division, FY16-19, $M



Project volume, central[1] vs. division, FY16-19



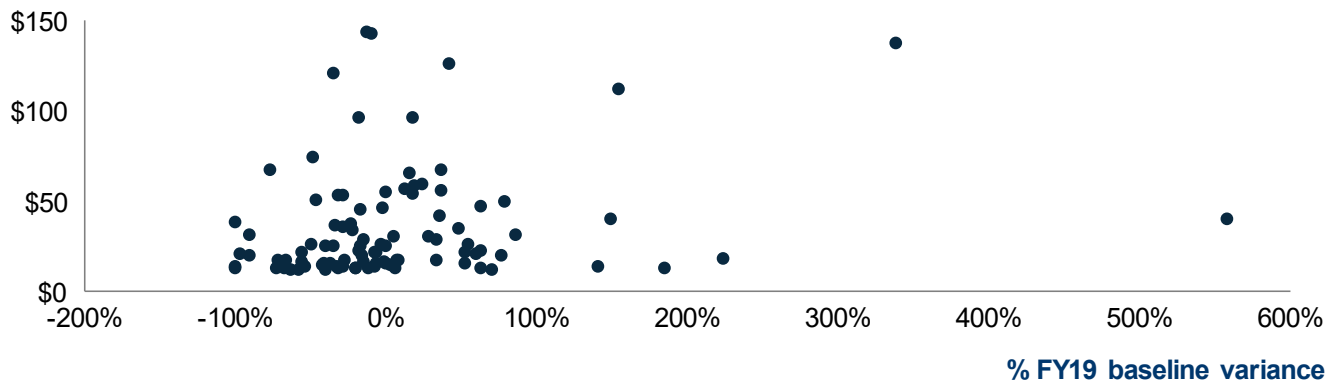
- **Since 2016, more decentralization of construction portfolio;** division-managed projects have become larger percentage of total project construction and spend
  - Divisions manage large portfolio of small projects: In FY19, represent **9% of spend and 52% of the total project volume**
- No forecasting methods for division-led projects; **aggregate $40M holdout forecasted in cash model**, and divisions track spend against individual allocations instead of forecast
  - Currently in the process of **developing project-level, bottom-up forecasting**

SOURCE: NCDOT POC Contract Payments FY15-19, Client Interviews

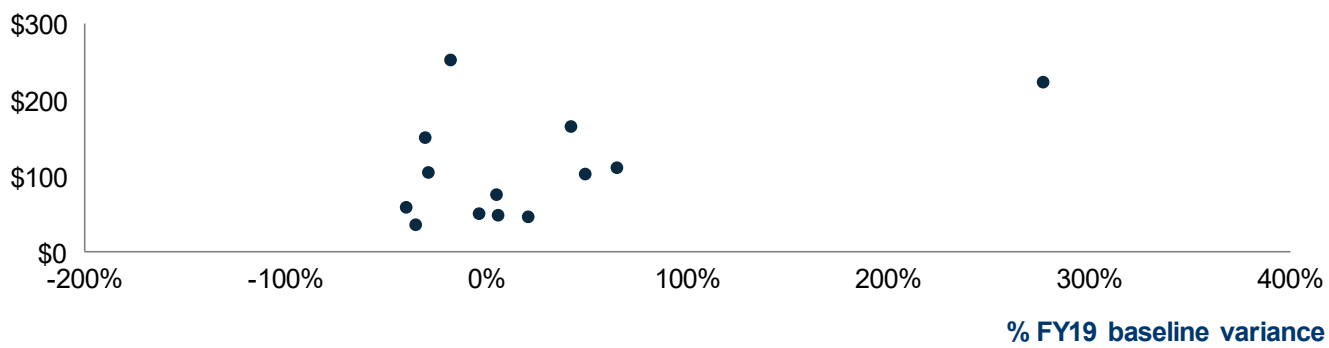
3c DB and DBB project-level forecasts

DATA FOR FY19 IS THROUGH APR 19

Top 100 DBB construction projects, FY19 variance from baseline forecast vs. total contract value, %, $M



DB construction projects, FY19 variance from baseline forecast vs. total contract value, %, $M



- At aggregate, **forecasts for DB and DBB projects in FY19 within 1%**
- **At the project level, variances between actuals and baseline forecast**, largely due to supplemental agreements and delays not accounted for in SAS
- Given SAS is a new model, **potential to continue improving accuracy of project-level forecasts** by improving ongoing feedback loop

SOURCE: NCDOT SAS DBB and DB Project Data, as of August 2018 and June 2019

Contents

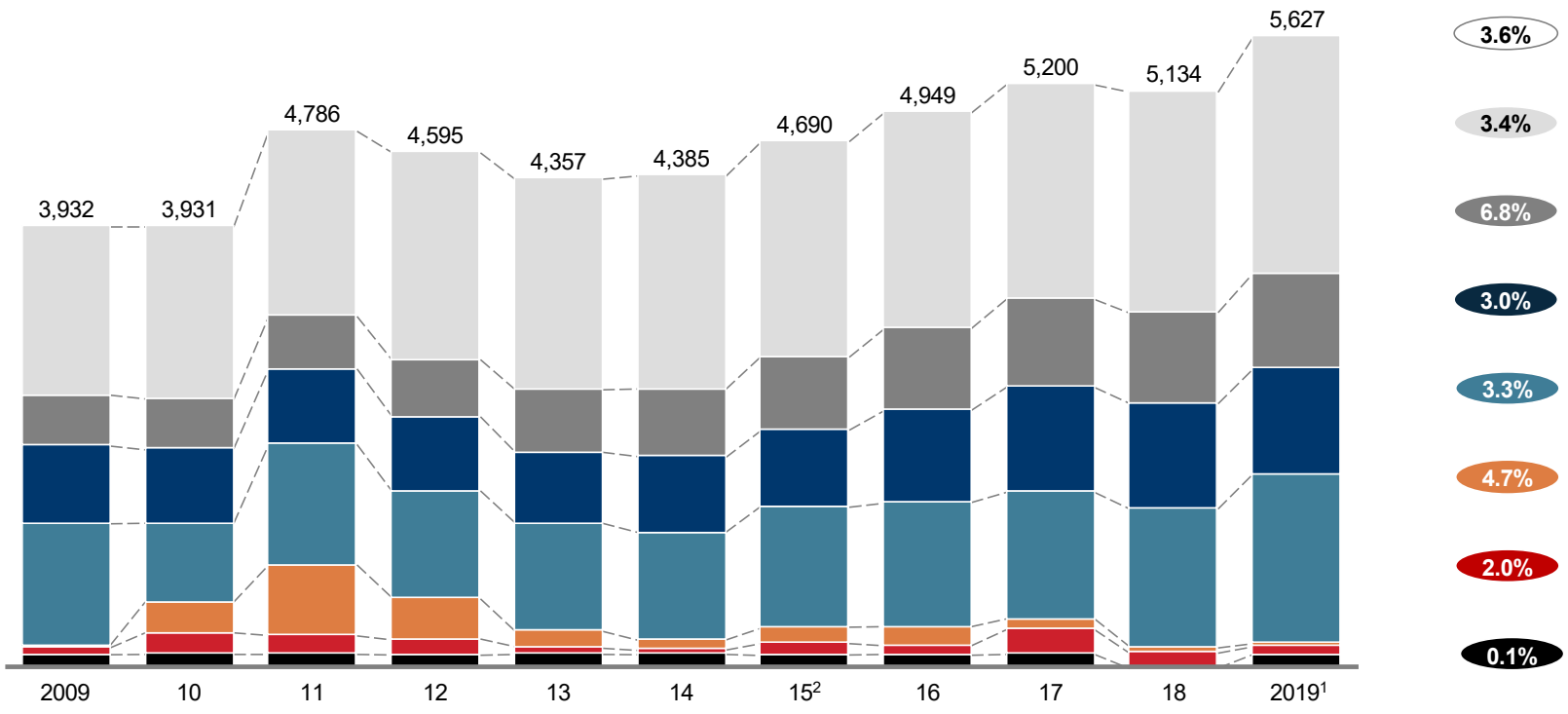
- Context
- **Drivers of variance**
  - Maintenance variance
  - Construction variance
  - **Revenue variance**
- Root causes and potential levers

Historical revenue by source

State Motor Fuels | State Highway Use Tax | State DMV / Other | Federal aid | Federal grants[2] | Bonds | Other revenues[1]

NCDOT revenue by source, historical FY 2009-2019

$, Millions



- **Revenues have grown** at a small clip since 2009
- From 2010-2012, **large increase in ARRA federal grants** inflated revenues
- From 2015-2017 **bonding became an increasing** source of funding
- **Changes in state law has made the State Highway Use Tax** an increasingly critical source of funding

1 Includes municipal revenues
2 Includes Turnpike, InfraGrant, ARRA

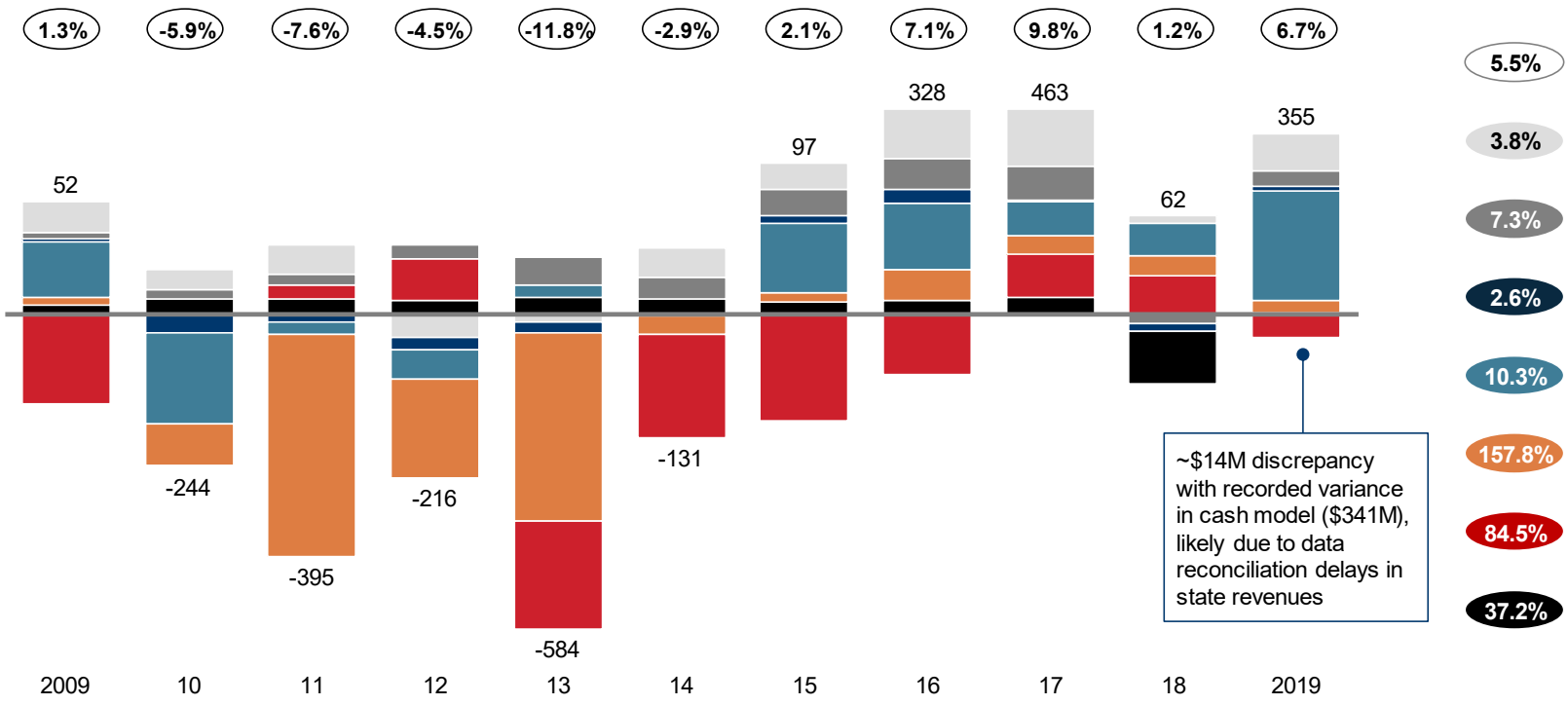
SOURCE: Certified Budget Revenues FY19, NCDOT Cash Flow Model as of August 2019

Historical variance by source

X% Percent over/under forecast

State Motor Fuels | State Highway Use Tax | State DMV / Other | Federal | Federal grants[2] | Bond reimbursements | Other revenues[1]

NCDOT cash balance variance, actual minus forecasts
$, Millions



Avg. historical variance '09-'19 (abs value)

5.5%
3.8%
7.3%
2.6%
10.3%
157.8%
84.5%
37.2%

- While there have been **historical variances in revenue projections**, overall revenues have been within 6-7% of forecasts in most years not impacted by ARRA grants
- **Major sources of variance have been federal**, while non-federal revenues have been within +/- 5-8% of forecasts
- **New SAS system in 2018 increased accuracy** but may face difficulties in medium-to-long run given changes in future of mobility, and NC's particular revenue mix

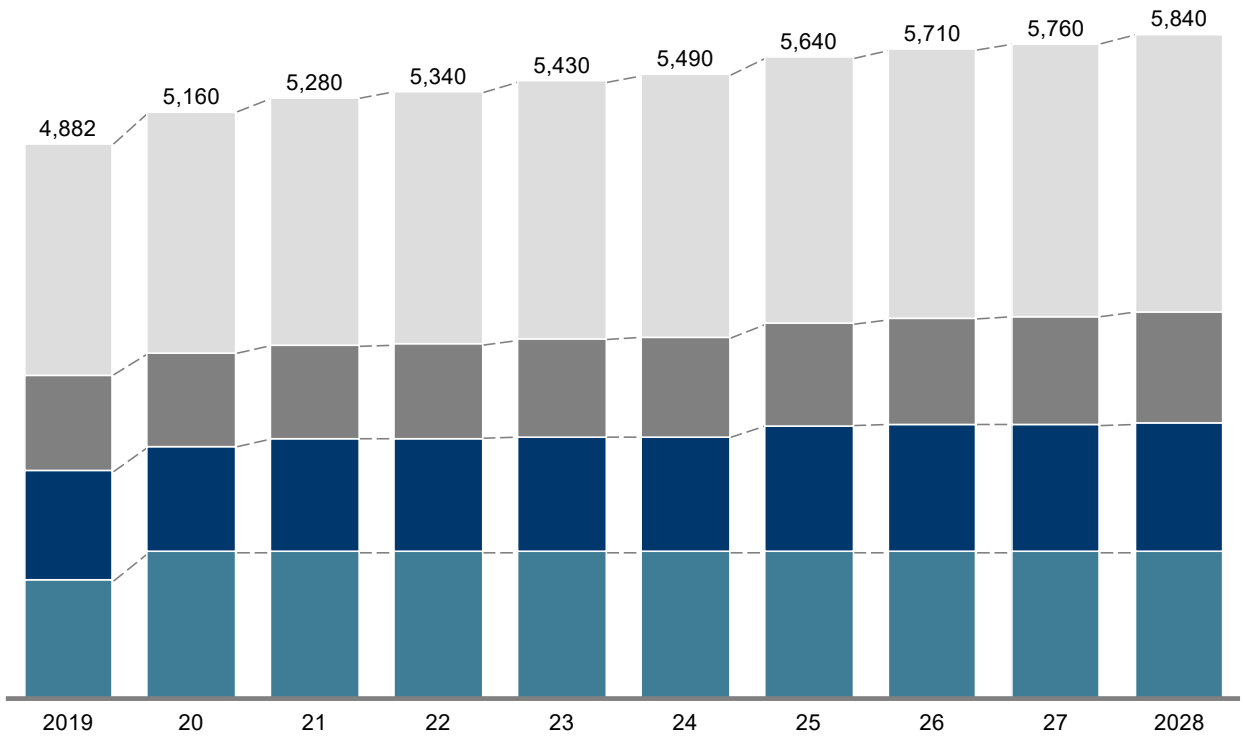
1 Includes municipal revenues
2 Includes Turnpike, InfraGrant, ARRA

SOURCE: Certified Budget Revenues FY19, NCDOT Cash Flow Model as of August 2019

Revenue projections

PROJECTION IS OF APR 19

NCDOT revenue projections for state revenues and federal aid, 2019-2028
$, Millions



	'09 – '18 CAGR[2]	'19 – '28 CAGR
State Motor Fuels	3.2%	2.0%
State Highway Use Tax	3.1%	2.0%
State DMV / Other	7.3%	2.1%
Federal[3]	3.3%	2.2%
	2.1%	2.4%

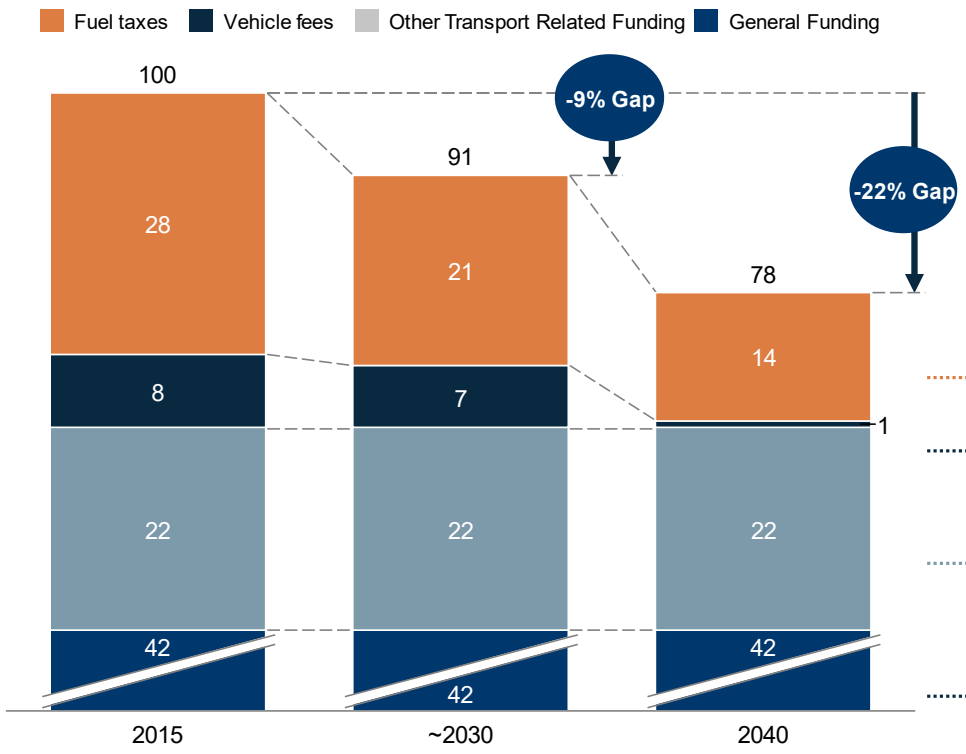
- **Future forecasts in 2023 and beyond likely to change**
- Future projections are for slow, but steady, revenue growth, **may be difficult to achieve given trends in the future of mobility** particularly for key revenue buckets (e.g., motor fuels tax)

1 Budget approved year of revenue account
2 Only includes CAGR for state motor fuels, state highway use tax, state DMV, and federal aid; total revenue CAGR pending projections of other categories (federal grants, bond reimbursements, municipal)
3 Federal forecasts come from cash model

SOURCE: Certified Budget Revenues, NCDOT Cash Flow Model April 2019

Road spending and the future of mobility

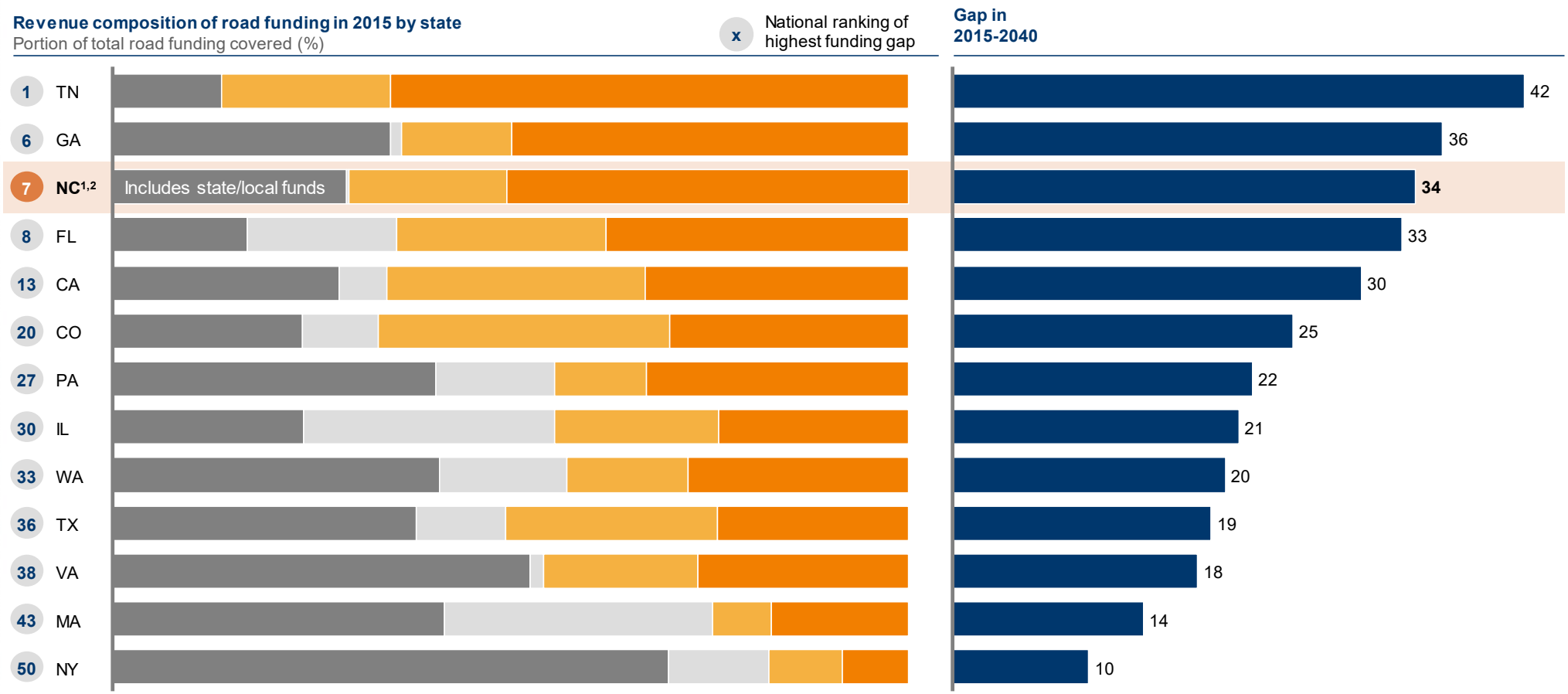
Funding for State and Local road spending across U.S., historical (2015) mixed traffic (~2030) fully autonomous world (~2040)
Portion of total road funding covered (%)



Change in funding 2015-2030	Change in funding 2015-2040	Rationale
-27%	-51%	**Fuel taxes:** ▪ EV adoption will lower fuel tax revenue ▪ Higher fuel economy standards will also lower fuel tax revenue
-15%	-90%	**Vehicle related fees:** ▪ Drivers will not be required for L4 AVs, lowering licensing revenue ▪ AV adoption will decrease need for parking and lower parking revenues
0%	0%	**Other transport related funding:** ▪ Assume tolls will remain constant to vehicle growth ▪ Assumes funding from property taxes will not change
0%	0%	**General funding:** ▪ Assuming funding from general revenue will remain proportional

SOURCE: Federal Highway Authority, 2015

Revenue compositions of road funding in 2015 vs. other US states



1 Timing, different data sources account for a small mismatch; 2 NC general funds include state and local; general funding for other states includes parking fees, investments, bonds, general funding, and other non-fuel and non-vehicle taxes at state/local/federal levels; 3 Includes tolls and property taxes;
4 Includes all motor vehicle taxes and fees; 5 Includes local, state, and federal fuel and gas taxes

SOURCE: Federal Highway Authority Revenue Tables HF1, LDF, LGF21 (2015)

Contents

- Context
- Drivers of variance
  - Maintenance variance
  - Construction variance
  - Revenue variance
- **Root causes and potential levers**

Root causes of variance and cash shortfall

External shocks have pushed requirements tighter than existing performance levels

- **Cash target for NCDOT set narrower than peer states (~7.5-26% as compared to ~30-55% balances seen in other states)**, and represents a level of precision of forecast vs actuals that NCDOT has not often achieved (target requires roughly +/-10% variance overall, which was exceeded or nearly exceeded 4 of last 5 years); led to rapid spenddown
- **Disaster spending (FEMA, FHWA, and non-declared) has grown at a 25% CAGR since 2009;** though total disaster spend is only responsible for about a third of negative variance in FY 19

Operating model has insufficient agility to respond to dynamic changes in cash position

- Categories of spend (e.g., preliminary engineering, maintenance allocations) **do not utilize forecasting methods with the required level of sophistication**, lacking alignment with methods used for construction
  - **Many of these categories are driving variance** (e.g., PE is 150% of construction variance, when considering construction projects as a whole)
  - For **division-managed construction, divisions spend against allocations instead of $40M aggregate holdout in forecasting**, accounting for ~$106M in overage in FY19; no project-level forecasting in place
- **Use of multi-year contracts (often 50-60% of operations spend)**, let well in advance of forecasts (historically many divisions have let **100% of their fiscal year maintenance contracts ~8 months before** and appropriations for that year are known)
  - Used throughout operations teams, **reduces agility to respond to real time changes in cash**

Operating model could employ greater controls to ensure adherence to/prioritization of cash forecast across organization

- Not all parts of the organization (e.g., PE, division operations teams) prioritize cash forecasting; **processes and performance management have not embedded this objective** (e.g., targeting appropriations spend instead)
  - **All 14 divisions have surpassed their yearly allocations in FY19 YTD; Ops forecasted spend 5% over FY19 allocations, but actual spend was 30% over allocations**
  - **Many divisions do not use payout schedules from contractors or historical averages to forecast spend** across the construction season, which crosses two fiscal years
- Flexibility in program management by divisions (e.g., ability to borrow from next year's allocation) **limits the ability for central DOT to hold divisions accountable to forecast**

Synthesis of initiatives within NCDOT's control

PRELIMINARY

Focus area	Initiative	Root cause addressed
1 Forecasting	1a Improve coordination between divisions/modes and central 1b Enhance learning loop of SAS 1c Develop plan for snow/ice and disaster budget 1d Add rigor to PE forecasting	▪ Op model agility ▪ Op model controls ▪ External shocks
2 Contracting	2a Investigate contracting landscape and potential structures 2b Develop processes and operating model to implement new contract structure	▪ Op model agility
3 Organizational performance and governance	3a Establish and prioritize cash variance-based KPIs 3b Cascade cash reporting and decisions thru NCDOT 3c Establish governance for timely cash decisions across NCDOT 3d Establish consequences for performance	▪ Op model controls ▪ Op model agility
4 Digital/Data	4a Develop diagnostic baseline on existing data 4b Create single source of truth of data across organization 4c Improve data governance structure 4d Improve real-time data 4e Embed predictive analytics	▪ Op model agility ▪ Op model controls

Emerging cross-cutting themes

- **Improve communication** (e.g. standard cash definition, cascading comms throughout organization)
- **Increase coordination** (e.g. between divisions and central, across DOT decision-making, standardized data)
- **Embed prediction** (e.g. embed predictive abilities, make decisions in advance, advanced analytics)

SOURCE: Best practices, NCDOT leadership workshop, team analysis

Other initiatives that require involvement by outside stakeholders

PRELIMINARY

Sample initiatives

Changes in legislative rules could help alleviate cash reserve pressures could include:

- Align the current cash ratio with peer states by adjusting reserve requirements
- Consolidate funding sources into one fund to facilitate cash response agility
- Establish a working capital loan facility to mitigate unforeseen short-term cash crunches
- Exclude disaster spending from cash balance requirements, e.g., ensuring that disaster spending, including that covered by Disaster Relief Cash Flow Loan Fund, does not count against legislative mandated cash balance, or borrow out of general fund for disasters

Considerations

- Working capital loans are not frequently used in peers states. However, short-term loans or short-term contract debt are more frequently used to buffer cash flow variance in design-build projects

Impact

- Shifts demands on cash flow from management practices and operations to financing mechanisms

1 Forecasting

PRELIMINARY

Initiative	Where we are now	Where we want to go
1a Improve coordination between divisions/modes and central	▪ Divisions track project-level data on day-to-day but data does not get communicated to central on real time basis ▪ $40M aggregate held for division construction forecasts, project-level forecast not taking place ▪ Division maintenance allocations done through SOP but do not align with cash forecasts ▪ Additionally, potential to improve coordination on cash forecasting across other units, (e.g. modes, DMV)	▪ **Mandate divisions develop spend operating plans and modes/DMV to develop budgetary plans** to build bottom up maintenance cash forecasts and increase ownership ▪ Create **communication mechanism between organizational units and central** for real time data flow (e.g. dashboard) ▪ **For construction, bring relevant stakeholders from divisions and central to monthly meetings** to coordinate and align on bottom-up project forecasts and project progress
1b Enhance learning loop of SAS	• Lack of formal mechanisms to communicate on-the-ground project changes to model in real-time • SAS model not comprehensive (e.g. does not incorporate disaggregation of supplemental agreement changes) and requires manual reconciliation - In process of implementing supplemental agreements	▪ **Develop formal real-time mechanism to communicate project changes** to SAS model (e.g. monthly meetings between construction and forecasting teams with project updates) ▪ **Incorporate tools to flag early warning signs** of projects being over budget or over time (e.g. dashboards) ▪ **Develop metrics to assess accuracy of model**
1c Develop plan for snow/ice and disaster budget	▪ In past years, disaster and snow/ice spend increased but aggregate forecasted allocation remained at $10M and $25M, respectively	▪ **Develop budgetary plan for snow/ice and disaster spend to reflect historical increase in spend** (e.g. reserve, budgetary set aside); changes in forecasting done in concert with other reforms
1d Add rigor to PE forecasting	▪ Aggregate holdout forecasted based on historicals; no project-level forecasting ▪ Focus on getting projects out the door and accelerated PE spend, not spend to forecast ▪ PE overage accounted for 90% of construction overage in FY19 (year to date April)	▪ **Plan yearly PE portfolio** in advance based on letting schedule, rather than uncontrolled acceleration ▪ **Conduct project level forecasts** using historical curves and build bottom-up forecasts ▪ **Improve contractor estimates** by developing internal benchmark estimates

SOURCE: Best practices, NCDOT leadership workshop, team analysis

2 Contracting

PRELIMINARY

Initiative	Where we are now	Where we want to go
2a **Investigate contracting landscape and potential structures**	• Current contracting process creates lock-in that prevents dynamic cash management, and shifts risk to DOT rather than contractors	• **Examine current contract categories** (e.g. engineering vs. maintenance) to understand competitive landscape, NCDOT's contracting objectives, and potential contract structures - **Document pain points** across the process (e.g., spend management, cost, delivery) - Conduct an **analysis of vendor and key stakeholder** landscape to understand optimal structure and vendor needs - Define **future state objectives of a revised contract process** (e.g., greater agility, shorter timelines, improved cost profile, better delivery)
2b **Develop processes and operating model to implement new contract structure**	• Inconsistency in contract structures between divisions • Current structures of long-term contractual obligations inhibit agile responses to cash flow needs • Not taking advantage of scale in contracting approach	▪ **Determine which contract structures** best meet state's objectives and **develop rollout plan to implement, e.g.,** – Define **critical enablers to achieve objectives** in conjunction with structures – Create stronger **central procurement oversight** to ensure standardization and guidance for divisions – **Build processes for how additional inputs** will feed contracting (e.g. real time budget/cash availability) – **Define vendor management process** and **identify critical supporting contract** terms (e.g., outcome based terms)

SOURCE: Best practices, NCDOT leadership workshop, team analysis

3 Organizational performance and governance (1/2)

PRELIMINARY

Initiative	Where we are now	Where we want to go
3a Establish and prioritize cash variance-based KPIs	▪ 47 KPIs exist at secretary level, but challenges rolling them out to field; very few KPIs concern cash ▪ At division-level, spending to deliver projects and against RMIP, not cash forecast ▪ Across organization, divisions and business units report that performance plans are not viewed as driving decisions, including cash priorities	▪ **Develop cash-related KPIs** to tie performance to finance (e.g. maximum cash variance of +/- 3% a enterprise and division levels before interventions occur) ▪ **Cascade and embed KPIs** into all aspects of organization (e.g. every division convenes a 'cash council to review the project delivery decisions and cash impact) ▪ **Develop incentives** to follow KPIs across organization (e.g. leadership celebrates those who improve cash metrics, performance reviews include cash KPIs)
3b Cascade cash reporting & decisions throughout organization	▪ Reporting and decisions on cash do not cascade down to employees who need it ▪ Inconsistent understanding of cash across organization ▪ Councils do not meet regularly with consistent attendance ▪ Implications of trends are analyzed after meetings ▪ Decisions are often made after meetings	▪ **Develop and communicate** consistent definition for cash across organization and emphasize importance ▪ **Embed cash reporting, review and decisions across all aspects of organization** (e.g. incorporating cash conversations in unit/division meetings) ▪ **Establish a council where cash decisions are made in balance with other strategic priorities** (e.g. reconstitute the 'strategic management council'), meeting regularly with required attendance, materials prepared in advance, and decisions made with follow-up ▪ **Establish an SOP for cash levers that will be methodically evaluated** with every cash flow need ▪ Use **consistent views of the data**

SOURCE: Best practices, NCDOT leadership workshop, team analysis

3 Organizational performance and governance (2/2)

PRELIMINARY

Initiative	Where we are now	Where we want to go
3c Establish governance for timely cash decisions across NCDOT	▪ NCDOT successful at handling crises, but needs ways to prevent crises and get earlier visibility ▪ Allocations and forecasting occur, though often not in enough time to react to shortages/concerns ▪ Decisions made for cash flow reasons are not coordinated consistently with all affected parties (in the planning, decision and execution phases) ▪ Cash overruns in one area of NCDOT are not intentionally offset by decisions elsewhere ▪ No formal process or governing body exists to ensure cash decisions are planned, deliberated and executed consistently	▪ **Shift to shorter time periods for cash targets** (e.g. quarter vs. annual) ▪ **Adjust division spend plans every 3-6 months** based on YTD performance ▪ **Embed early warning signal tools** to predict potential shortfalls (e.g., cash decision today triggered by projected shortfall in 18 months) ▪ **Require each division to create contingency plans** so they have agreed in advance to plans for flexing spending up or down in-year as needed – **Integrate broader stakeholders into the planning, decision, and execution of cash flow decision** (ex. STIP, divisions affected by other division overruns) – **Ensure overruns have offsetting decisions** in cash elsewhere
3d Establish consequences for performance	▪ Divisions periodically have overspent on cash plans without consequence ▪ Controls are not in place or interventions are escalated adequately	▪ NCDOT executive **leadership intervenes** regularly (e.g., divisions who miss their max cash variance KPI for 2 months undergo review) ▪ **Add fiscal year budget targets and cash management KPIs to performance evaluations** for division leadership ▪ **Heighten executive scrutiny of business plans** for divisions that miss targets for 2 quarters or more ▪ **Disallow 'borrowing' from future year budgets** for current year expenses (or create higher hurdles to do so)

SOURCE: Best practices, NCDOT leadership workshop, team analysis

4 Data, digital, tools to enable agility and controls

PRELIMINARY

Initiative	Where we are now	Where we want to go
4a Develop diagnostic baseline on existing data	▪ Lack full understanding of data sources and analytical capabilities across organization ▪ Different divisions have different capabilities and, occasionally, different systems	▪ **Develop data lake** with existing data to enable real-time analytics across organization, allows **NCDOT to determine baseline and** next steps
4b Create single source of truth	▪ Use of multiple data sources for similar purposes ▪ NCDOT currently on path to establish single source of truth with SAP, but potential to expedite	▪ **Build a roadmap to a single source of truth** (e.g. use and requirement of SAP for all data entry, development of common SOPs to ensure consistent results, consolidation of redundant data sources) ▪ **Coordinate with the Department of IT** on digital roadmap
4c Improve data governance	▪ Data governance built around reporting requirements not business needs ▪ Department is beginning to focus on data governance solutions (e.g., newly established data architect for NCDOT), potential to expand on efforts	▪ **Assign clear owners to individual data elements** ▪ **Increase coordination between NCDOT IT and Finance** ▪ **Establish data governance structure based on business needs** rather than reporting requirements (e.g. determine distinct data owners and flow of data reporting) ▪ **Create procedures for data use and changes**
4d Enable real-time data	▪ Lags in data updates/comms across organization ▪ New dashboard in design that allows for better access to data, but does not pull data in real time, or incorporate forecast information to track cash	▪ **Reduce lag times** between SAP and HI-CAMS ▪ **Create a clear and consistent process** on pulling data for reports (e.g., data updated on daily basis across all sources in centralized location) ▪ Incorporate **cash forecast data into dashboard** to assess real time cash position across organization
4e Embed predictive analytics	▪ Advanced analytics not used to full potential, missing opportunities to pick up red flags in cash forecasting and improve decision making (e.g. predictive maintenance)	▪ Automate analysis of data and processes to **create 'red flags'** on key issues (e.g. contractor performance predictions, predictions on potential cash flow concerns) ▪ **Advanced analytics for asset disposition and other business needs** (e.g., tool to determine utility and value)

SOURCE: Best practices, NCDOT leadership workshop, team analysis

For discussion: potential sequencing of initiatives

PRELIMINARY

Rationale for sequencing:
- Level of impact
- Interdependencies between initiatives
- Desire to generate real progress fast

Timeframe to full impact

Early wins | Building a foundation for transformation | Best-in-class DOT

	Initiatives	Potential owner
1a	Improve division/modal coordination with central	Hancock/Norman
1b	Enhance learning loop of SAS	Bowen
1c	Develop plan for snow/ice and disaster budget	Norman
1d	Add rigor to PE forecasting	Werner
2a	Investigate contracting landscape/structures	Robbins/Mitchell
2b	Develop processes/model to implement contracts	Robbins/Mitchell
3a	Establish and prioritize cash variance KPIs	Tasaico/Lewis
3b	Cascade cash reporting and decisions	Rodewald
3c	Establish governance for timely cash decisions	Overby
3d	Establish consequences for performance	Lewis
4a	Develop diagnostic baseline on existing data	Padfield
4b	Create single source of truth	Padfield/Jones
4c	Improve real-time data	Winn/Gupta
4d	Improve data governance structure	Winn/Gupta
4e	Embed predictive analytics	Gupta/Bowen

SOURCE: NCDOT leadership workshop, team analysis