



North Carolina
Department of Transportation

Efficiency – Establishing Baseline Unit Pricing & Streamlining Project Delivery

Report to the Joint Legislative Transportation Oversight
Committee and the Fiscal Research Division

December 1, 2015



PAT McCRORY
Governor

NICHOLAS J. TENNYSON
Secretary

December 1, 2015

Joint Legislative Transportation Oversight Committee Members
Fiscal Research Division

Dear Committee Members,

We continue to carry out the Department's mission of connecting people, products and places safely and efficiently to enhance the economy and vitality of North Carolina. We do this with a focus on customer service, accountability and environmental sensitivity and with a vision of being a global leader in providing innovative and reliable transportation solutions while restoring North Carolina's reputation as the "Good Roads State".

In order for us to achieve this vision, we must both ensure we are realizing efficiencies in carrying out our core maintenance activities as well as streamlining project delivery processes. Our partners in the consulting and contracting industries have met with me and have pledged full commitment of their resources to assist us in achieving our objectives. The established baseline unit pricing and target accomplishments set forth in this report will contribute significantly to the attainment of these goals.

In recognizing the importance of meeting these objectives, we held Data Summits in the fall of 2015 that will ensure better data collection practices. Beginning with Fiscal Year (FY) 2016-2017, I will establish planned targets for core maintenance accomplishments for each Highway Division to compliment the "DOT Report" established metrics on accountability for reactionary maintenance items. Accountability for performance will be ensured by a quarterly report submitted by each Division Engineer that details accomplishments and discusses action plans to address any non-compliance with established targets. I am planning a summit with Division staff in April 2016 to initiate this requirement and plan for successful implementation.

As we focus on improved data collection and accurate assignment of cost to work functions, we will achieve our objective of realizing efficiencies and decreasing unit costs where possible. Additionally, this will assist in right sizing the Department and aid in the fulfillment of the restructuring and personnel budget requirements.

Respectfully yours,

Michael L. Holder, PE
Chief Engineer



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Executive Summary

Session Law 2015-241, section 29.14.(b) states:

Efficiency ... By December 1, 2015, the Department shall establish a baseline unit pricing structure for transportation goods used in highway maintenance and construction projects and set annual targets for three years based on its unit pricing. In forming the baseline unit prices and future targets, the Department shall collect data from each Highway Division on its expenditures on transportation goods during the 2015-2016 fiscal year. Beginning January 1, 2016, no Highway Division shall exceed a ten percent (10%) variance over a baseline unit price set for that year in accordance with this subsection. The Department of Transportation shall institute quarterly tracking to monitor pricing variances. The ten percent (10%) maximum variance set under this subsection is intended to account for regional differences requiring varying product mixes. The Department of Transportation shall report to the Joint Legislative Transportation Oversight Committee and the Fiscal Research Division on December 1, 2015, on information required by this subsection. If a Highway Division exceeds the unit pricing threshold, the Department of Transportation shall report to the Joint Legislative Transportation Oversight Committee and the Fiscal Research Division no later than the fifteenth day following the end of the quarter on why the variance occurred and what steps are being taken to bring the Highway Division back into compliance. In order to drive savings, unit pricing may be reduced annually as efficiencies are achieved.

The Department engaged SAS, a data analytics software company, to assist in setting baseline unit cost for five areas: contract resurfacing, pavement preservation, bridge replacement, planned maintenance work activities and free-on-board (FOB) goods. This report contains an explanation of the data and the analytics performed to calculate these baseline unit costs. Results for baseline unit costs are presented in five different formats – statewide, regional, division, primary system and secondary system to illustrate how NC’s varied geography, highway system characteristics and local differences impact costs.

As part of Federal Highway Administration’s Moving Ahead for Progress in the 21st Century Act (MAP-21), the Department is currently developing a Transportation Asset Management Plan (TAMP). These established baseline unit costs are imperative to setting strategic goals and performance metrics to align with NCDOT’s TAMP. In order to achieve efficiency, the Department must prioritize the budgeted dollars by setting targets and expected outcomes. The following tables illustrate expected accomplishments using baseline unit costs for each activity. Table 1 describes the top planned maintenance activities with expected accomplishments. Table 2 lists reactionary maintenance activities (and corresponding historical expenditures) needed to ensure a safe transportation system for the motoring public. These reactionary maintenance activities are the foundation of the “Responsiveness” provision in “DOT REPORT”. Dependent on recurring and increased funding for the planned activities in Table 1, NCDOT should realize decreased spending on reactionary maintenance activities listed in Table 2. As NCDOT increases production on planned activities, we will maximize resources. For example, as we replace additional bridges and aging pipes and resurface more pavements, the need for bridge and pipe repairs and pavement patching will decrease. However certain items in Table 2, like emergency response and removal of obstructions, will likely increase as the system gets larger, population increases and more vehicle miles are travelled.

Table 1: Planned Maintenance Activities (Annual)

Activity	System	Cycle (Yrs)	Estimated Allocation (\$M)	Unit Cost (\$)	Anticipated Accomplishment	Unit of Measure
Contract Resurfacing (CR) Program						
Hot Mix Asphalt Overlays	Primary	12	\$247	\$100,000	2,470	Lane Mile
	Secondary	15	\$217	\$65,000	3,338	
	Total		\$464		5,808	
Pavement Preservation (PP) Program						
Chip Seals	Primary	7	\$4	\$12,500	300	Lane Mile
	Secondary	8	\$71	\$12,500	5,680	
	Subtotal		\$75		5,980	
Crack Seals	Primary	4	\$9	\$3,500	2,571	
	Secondary	4	\$6	\$3,500	1,714	
	Subtotal		\$15		4,286	
	Total		\$90		10,266	
Bridge Program						
Bridge Replacement	Primary	75	\$44	\$2,200,000	20	Each
	Secondary	75	\$145	\$760,000	190	
	Total		\$189		210	

While contract resurfacing, pavement preservation, and bridge replacement are all planned maintenance activities, they are also distinct, appropriated programs whereas the planned maintenance activities listed in the following two pages of Table 1 are funded from broader maintenance pots based on whether the activity is on the primary or secondary system.

Table 1 (continued): Planned Maintenance Activities (Annual)

Activity	System	Cycle (Yrs)	Estimated Allocation (\$M)	Unit Cost (\$)	Anticipated Accomplishment	Unit of Measure
Planned Maintenance Activities						
Drainage Pipe Replacement						
Install Pipe < or = 48"	Primary	50	\$7	\$200	35,000	Linear Foot
	Secondary	50	\$28	\$160	175,000	
	Subtotal		\$35		210,000	
Install Pipe >48"	Primary	50	\$2	\$1,100	1,818	
	Secondary	50	\$8	\$1,800	4,444	
	Subtotal		\$10		6,263	
	Total		\$45		216,263	
Shoulder and Ditching						
Drainage Ditch Maintenance	Primary	15	\$4	\$13,000	308	Shoulder Mile
	Secondary	12	\$13	\$10,500	1,238	
	Subtotal		\$17		1,546	
Shoulder Maintenance / Reconstruction	Primary	15	\$5	\$6,000	833	
	Secondary	12	\$16	\$4,500	3,556	
	Subtotal		\$21		4,389	
	Total		\$38		5,935	

Table 1 (continued): Planned Maintenance Activities (Annual)

Activity	System	Cycle (Yrs)	Estimated Allocation (\$M)	Unit Cost (\$)	Anticipated Accomplishment	Unit of Measure
Mowing						
Mowing	Primary	0.2	\$5	\$64	78,125	Shoulder Mile
	Secondary	0.2	\$19	\$40	475,000	
	Total		\$24		553,125	
Litter						
Litter Removal	Primary	0.5	\$8	\$280	28,571	Shoulder Mile
	Secondary	0.5	\$7	\$335	20,896	
	Total		\$15		49,467	
Pavement Markings and Markers						
Long Line Painted Pavement Markings	Primary	4	\$4	\$0.16	25,000,000	Linear Foot
	Secondary	4	\$13	\$0.07	185,714,286	
	Subtotal		\$17		210,714,286	
Thermoplastic/Polyurea Pavement Markings	Primary	10	\$8	\$0.85	9,411,765	
	Secondary	10	\$2	\$0.85	2,352,941	
	Subtotal		\$10		11,764,706	
	Total		\$27		222,478,992	
Planned Maintenance Activities Grand Total			\$149 (does not include CR, PP, or Bridge Programs from p. 5)			

Table 2: Reactionary Maintenance Activities (Annual)

Unplanned Maintenance Activities	Expenditures (\$M)
Emergency Response	\$70
Roadway Surface Repairs	\$43
Removal of Obstructions	\$31
Drainage Repairs	\$16
Guardrail Repairs	\$12
Traffic Operations	\$37
Bridge Repairs	\$26
Total	\$235

Other essential activities are planned but are more service or support oriented such as maintenance of rest areas/welcome centers, roadside turf and vegetation management, incident management, roadway interchange lighting and inmate labor for maintenance support. These activities are essential to serving the citizens of NC and account for approximately \$53M annually.

Session Law 2015-241, section 29.14.(b) also states,

Efficiency ... The Department shall adopt procedures in all stages of the construction process to streamline project delivery, including consolidation of environmental review processes, expediting multiagency reviews, accelerating right-of-way acquisitions, and pursuing design-build and other processes to collapse project stages.

NCDOT is increasing Division managed projects while streamlining environmental processes (optimization of the new SEPA legislation), refining associated Division letting procedures, using private engineering firms and contracting Design Build projects, advancing acquisition of right of way to accelerate utility relocations, continuing to implement new technologies and accelerating bridge construction. Details on these practices can be found in the “Streamline Project Delivery” section of this report.

Baseline Unit Cost

In accordance with legislation, the Department has identified principal work activities and established baseline unit costs, for the following:

- Contract resurfacing
- Pavement preservation
- Bridge replacement
- 10 planned maintenance work functions
- FOB goods most commonly used by maintenance forces

The State is divided into 14 Highway Divisions encompassing several counties each. Figure 1 on the following page illustrates the highway divisions. The legislation directed the Department to collect data from each highway division on its expenditures during the 2015-2016 fiscal year, but using data for the partial fiscal year would likely result in incomplete and potentially inaccurate analysis results. Therefore, the Department expanded data collection to previous fiscal years to obtain a sufficient sample size.

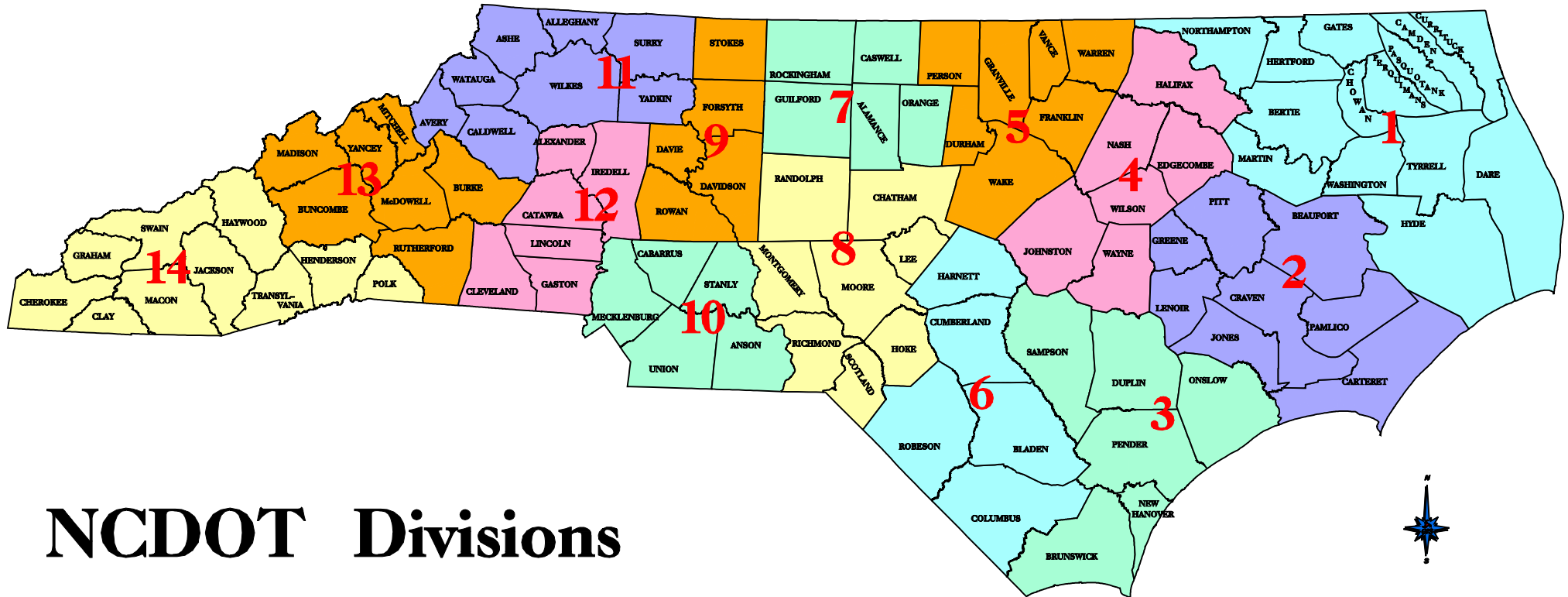
Analysis results include the determination of statewide, regional and division baseline unit costs for the five focus areas bulleted above. The regional baseline unit costs were determined by grouping the divisions as shown in Table 3, below. Regional grouping of the Department's 14 Divisions was done on a qualitative basis considering several variables such as: geographic terrain and associated travel times, proximity of asphalt and concrete batch plants, proximity of product manufacturing facilities, subsurface soils and, in some instances, contractor and/or workforce availability. For example, the divisions in the mountain region are predominately rural with travel times greater than would be anticipated for similar distances in other parts of the state due to the winding nature and steep grades of highways and long distances to asphalt and concrete batch plants and product manufacturing facilities. Generally, the combination of these variables results in higher baseline unit costs. The divisions in the piedmont region are predominately urban, with typically adequate accessibility to asphalt and concrete batch plants and product manufacturing facilities, but involve work that is often done around moderate to high traffic volumes and congestion. The combination of these variables often results in baseline unit costs that exceed statewide costs. The divisions in the coast/sandhills region are predominately rural with long distances to batch plants and product manufacturing facilities; however baseline unit costs often appear to be reflective of lower labor rates.

Table 3: Division Breakdown by Region

Region			
	Coast/Sandhills	Piedmont	Mountain
Divisions	1, 2, 3, 4, 6, 8	5, 7, 9, 10, 12	11, 13, 14

These defined regions are used consistently throughout the report except for the bridge baseline unit cost analyses; the bridge regions are defined and discussed later in the report.

Figure 1: Highway Divisions



NCDOT Divisions

Contract Resurfacing

Contract resurfacing (CR) operations primarily include resurfacing existing roadways with hot mix asphalt overlays. Per G.S. 136-44.16, CR funds may also be used to fund alternative pavement treatments such as slurry seal treatments, microsurfacing and thin lift asphalt overlays. CR funds may also be used for widening existing narrow roadways as long as the amount does not exceed 15% of the Board of Transportation's allocation of these funds.

Thin hot mix asphalt overlays are what most people envision when they think about traditional asphalt paving. Hot mix asphalt consists of two basic ingredients - aggregate and asphalt binder. Selection of the right size aggregate, type of asphalt binder, and the optimum combination of these two ingredients is critical to pavement longevity. The life of this pavement treatment is approximately 12 years on a primary route and 15 years on a secondary route. The asphalt mixes are produced at an asphalt plant and hauled to job sites in dump trucks where they are then dumped into the hopper of an asphalt paving machine. Once the pavement is spread uniformly over the roadway surface by the paving machine, it is compacted to the proper density utilizing a series of steel and pneumatic tire rollers.



Figure 2: Hot Mix Asphalt Overlay Operations

Since thin hot mix asphalt overlays account for the majority of CR activities, the baseline unit cost for CR is based on thin hot mix asphalt overlays and is shown in Table 4 on the following page.

Table 4: Contract Resurfacing Baseline Unit Cost

Contract Resurfacing (\$/Lane Mile)		
	Primary	Secondary
Coast/Sandhills	\$83,093.87	\$51,770.74
Piedmont	\$110,099.70	\$97,196.32
Mountain	\$137,213.48	\$79,076.40
Statewide	\$97,940.30	\$61,422.01

Due to seasonal limitations and contract scopes, CR project timelines and expenditures routinely span across fiscal years; therefore, the data analyzed for CR includes hot mix asphalt overlay contracts placed and completed in calendar years 2014 and 2015. To ensure that all costs associated with these projects were accounted for, only projects for which final contract amounts had been paid were included in the data sample.

Thin hot mix asphalt overlays typically range in thickness from $\frac{3}{4}$ " to $1\frac{1}{2}$ "; therefore, the thickness of the overlay has a significant impact on the cost per lane mile resurfaced. In addition to the placement of the new pavement layer, it is important to note that there is additional work required to complete a CR project. Existing pavements routinely require patching, edge repair, and/or crack sealing prior to the placement of thin hot mix overlays to address major structural deficiencies and cracking that the overlay alone may not solve and to ensure that the new pavement layer does not fail prematurely. Additionally, in some cases, the existing asphalt surface must be partially or completely milled off prior to resurfacing. Then once the new surface has been placed, pavement markings and markers typically have to be installed, shoulders must be reconstructed, permanent vegetation reestablished, and utility and drainage structure appurtenances must be adjusted to the new surface level. Lastly, Title II of the Americans with Disabilities Act (ADA) requires the Department to provide and/or upgrade curb ramps where street level pedestrian walkways cross curbs whenever streets, roadways, or highways are altered through resurfacing. Thus, it is important to note that there are a series of route specific variables that can impact the cost per lane mile of a particular project.

To maximize CR funding and results, the Department is implementing a policy to limit charges by division personnel to only those necessary activities required to complete the CR project (i.e. shoulder reconstruction, pavement striping, seeding and mulching, signal loops, seals prior to resurfacing, and admin/inspection). After implementation of this policy it is expected that payments to private contractors will average 85% - 90% of the entire CR budget. The remaining 10% - 15% will be maintenance force account work for incidental activities necessary under CR.

Since the majority of CR work is performed by contractors, CR bid award prices will significantly drive future costs. Future costs will also be affected by any commodity price fluctuations. In addition to setting baseline unit costs for the CR work, as a further data review, analyses were performed on the corresponding asphalt plant mixes and liquid binder for the same contracts placed and completed in calendar years 2014 and 2015. Results are shown in Table 5 on the following page.

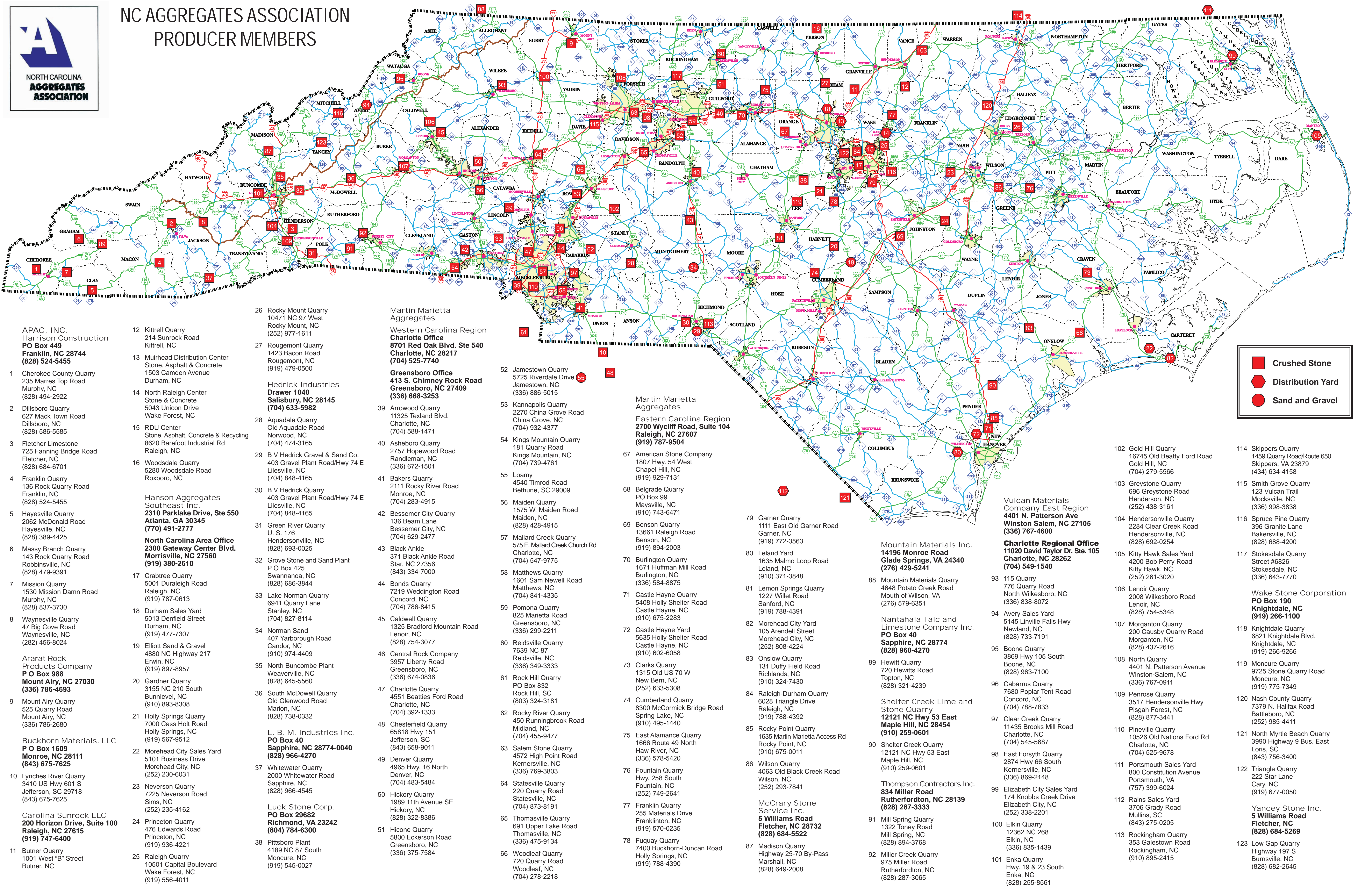
Table 5: Asphalt Plant Mix and Liquid Binder Baseline Unit Cost

	Surface Course S9.5A (\$/ton)	Surface Course S9.5B (\$/ton)	Surface Course S9.5C (\$/ton)	Asphalt Liquid Binder (\$/ton)
Coast/Sandhills	\$34.48	\$34.48	\$32.25	\$565.50
Piedmont	\$33.61	\$32.06	\$31.64	\$575.90
Mountain	\$44.26	\$48.10	\$44.97	\$596.74
Statewide	\$36.85	\$37.78	\$35.42	\$574.53

As indicated in Table 5, the surface course mixes in the mountain region exceed the 10% variance. This is to be expected due to quarry and asphalt plant locations in that region being more widely dispersed adding additional haul distances. A map of the quarry locations and asphalt plants can be found in Figures 3 and 4 on the following pages.

Liquid binder is combined with surface course material and used in the production of asphalt pavement. Liquid binder is paid for separately due to the high variability in cost. This material is directly tied to the petroleum industry and experiences seasonal and monthly fluctuations based on supply and global economy influences. The Department maintains a monthly price index which is determined by averaging posted prices at several liquid asphalt terminals. Over the last three years, the low index price for this material was \$423.21 per ton which occurred in November 2015 and the high was \$593.14 which occurred in September 2014. The historical high index price, \$793.08 per ton, occurred in August 2008. To minimize pricing risk to NCDOT and contractors, NCDOT contracts include a price adjustment clause for liquid binder that allows for a monthly adjustment. This adjustment is based on the index price when the work occurs as compared to the price at bid time. Payment is adjusted up or down based on what is occurring in the market.

Figure 3: Quarry Locations



NC PRIMARY ROUTES

LEGEND

INTERSTATE HIGHWAYS

US HIGHWAYS

NC HIGHWAYS

BLUE RIDGE PARKWAY

RUTHERFORD

COUNTY NAMES

5

DIVISION NUMBER

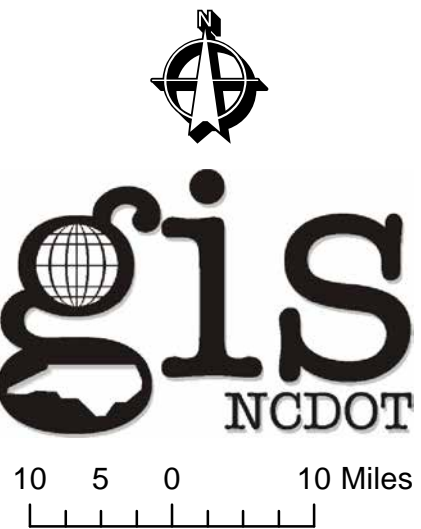
Figure 4: Asphalt Plant Locations

NCDOT CERTIFIED ASPHALT PLANTS

	Producer	# of Plants
1	Adams Construction Co.	2
2	APAC - Harrison	12
3	APAC-Atlantic - Thompson-Arthur	9
4	Asphalt Paving Of Shelby, Inc.	1
5	Banks Brothers Asphalt	1
6	Barnhill Contracting, Inc.	21
7	Blythe Brothers Asphalt Co.	2
8	Blythe Construction, Inc	6
9	Boggs Materials, Inc.	5
10	Burke Paving and Grading Company	1
11	C & L Concrete Works, Inc.	1
12	C.K. Earnhardt & Son, Inc.	1
13	C.W. Matthews Contracting Co., Inc.	2
14	Carl Rose & Sons, Inc.	3
15	Carolina Paving Of Hickory, Inc	1
16	Charles Blalock & Sons, Inc.	1
17	Colwell Construction Co., Inc.	1
18	D & S Asphalt Materials, Inc.	1
19	Eastern Asphalt	1
20	Ferebee Asphalt Corp.	3

	Producer	# of Plants
21	Fortner Contracting Inc. (FCI)	1
22	Fred Smith Company	4
23	Garris Grading & Paving	1
24	Gelder & Associates, Inc.	1
25	Granite Construction Company	1
26	Granite Contracting, LLC	1
27	Hanes Construction Co.	1
28	HHM Management	1
29	Highland Paving	2
30	Hudson Paving Co.	1
31	J.T. Russell & Sons, Inc.	4
32	Johnson Brothers Utility & Paving	1
33	Johnson Paving Co.	1
34	Lakeside Asphalt	1
35	Lane Construction Corporation	11
36	Larco Construction Co.	2
37	Malmö Asphalt, Inc.	1
38	Maymead Materials, Inc.	9
39	Midstate Contractors	1
40	NCDOT - Division 1 Plant	1

	Producer	# of Plants
41	Onslow Grading & Paving, Inc.	1
42	Palmetto Paving Inc.	1
43	Piedmont Asphalt, LLC	7
44	Rightmyer Machine Rentals, Inc.	1
45	Riley Paving Co.	4
46	Rogers Group, Inc.	3
47	Rose Brothers Paving Co.	6
48	RPC Contracting, Inc.	2
49	S.T. Wooten Corp.	14
50	Sharpe Bros. Paving - Div Vecillio & Grogan	3
51	Sloan Construction Co.	2
52	T. R. Vernal	1
53	The Sunrock Group	4
54	Tugalo Construction Co.	2
55	Weaver Company, Inc.	1
56	Yadkin Valley Paving Co.	1



North Carolina
Department of Transportation
Geographic Information Systems Unit

Based on HICAMS spreadsheet
data received by NCDOT GIS Unit

Map date: February 2015

Pavement Preservation

Pavement preservation (PP) is a proactive approach to pavement maintenance where pavement distresses and deterioration are repaired before serious damage occurs. This results in extended roadway life, improved safety, increased motorist satisfaction and decreased life cycle costs. PP operations include chip seals, slurry seals, fog seals, cape seals, full depth reclamations and thin lifts of asphalt. Chip seals account for the majority of PP activities; therefore, the baseline unit cost for PP has been established for chip seals.

Chip seals consist of the application of a bituminous liquid tack coat immediately followed by the application of an aggregate which is then embedded into the binder using pneumatic-tired rollers. Multiple layers may be applied and various binder and aggregate types may be utilized to address specific distress modes or traffic situations. The primary advantages of chip seals include improved skid resistance, cost effectiveness, durability, ease of construction and an approximate life cycle of seven (7) years. Disadvantages of chip seals include cure time, loose aggregate chips, noise considerations and a rough surface. Chip seals are mostly applied to lower volume, secondary roads and in accordance with NCGS 136-44.3A(e) and (f) the majority of chip seals used are double seals.



Figure 5: Chip Seal Operations

The data analyzed for PP includes chip seal activities completed in FY 2014-2015. Table 6 shows the baseline unit cost for PP that was established for chip seals in the NCDOT Legislative Report on Outsourcing Pavement Preservation.

Table 6: Pavement Preservation Baseline Unit Costs

Pavement Preservation - Chip Seal (\$/Lane Mile)		
	Contract	Force Account
Statewide	\$15,942.76	\$11,694.17

Crack sealing was added to the list of eligible pavement preservation treatments during the 2015 session of the NCGA. Crack sealing is the placement of sealant materials into cracks in asphalt and concrete pavements to prevent the intrusion of water and incompressible materials into the cracks. Crack sealing is a critical pavement preservation treatment with a life cycle of four (4) years, and beginning in FY 2015-16, pavement preservation funds will be used to fund this treatment. Estimated baseline unit cost for crack sealing is shown in Table 7.

Table 7: Crack Seal Baseline Unit Costs

Pavement Preservation - Crack Seal (\$/LM)		
	Primary	Secondary
Statewide	\$3,100.00	\$3,300.00



Figure 6: Crack Sealing Operations

With the increase in funding and additional allowable menu of pavement treatment options, we will treat significantly more mileage than the approximate 5,000 lane miles treated in FY 2014-2015. Furthermore, we anticipate outsourcing approximately 50% of the pavement preservation work for FY 2015-2016 which will help us in achieving the Legislatively mandated pavement preservation outsourcing target of 80% by FY 2017-2018. The Department continues to maintain its goal of outsourcing 100% of chip seal work during the 2017 paving season.

Bridge Replacement

Baseline unit costs have been established for typical secondary system bridge replacement projects funded by the Bridge Program, and awarded in SFY 2014-2015, as shown in Table 8. These costs are shown on a “dollars per square foot” basis. That is, the contract bridge costs are divided by the square feet area of the bridge deck. This average cost per square foot is a common calculation in the bridge industry. This calculation is consistent with annual Federal Highway Administration reporting requirements for bridge replacement projects that are federally funded. Note that, while all major bridge components are included in the costs shown, miscellaneous items are excluded (i.e., bridge approach slabs, under-bridge slope protection, construction/maintenance/removal of temporary detour structure, removal of existing bridge). In addition, engineering, right of way, utility relocation and approach roadway construction costs are not included; these costs are variable and site dependent.

As explained below, the Department recommends setting baseline unit costs on regional bases while accounting for project delivery methods – Division Managed and Express Design Build.

Table 8: Bridge Baseline Unit Costs (\$/SF)

Bridge Unit Cost per SF				
	Division Managed		Express Design Build	
	Average Cost	# of Bridges	Average Cost	# of Bridges
East	\$110.54	16	*\$92.21	6
Central	\$101.77	14	\$123.09	19
West	\$150.34	10	\$220.75	14
Statewide	\$117.42	40	\$153.40	39

*Average cost may not be representative as sample size includes only one contract in Division 6.

While these replaced bridges are typically very similar in width and length and are constructed of precast and cast-in-place concrete materials, the in-place bridge costs can vary significantly due to regional differences such as: distance to concrete batch plants, shipping costs for prefabricated bridge components and foundation types. For example with regard to foundation types, uniform subsurface sands in the coastal plain allow the use of driven pile foundations while subsurface rock in the mountains dictates the use of more costly drilled pier foundations. Therefore bridge regions have been defined in accordance with Table 9.

Table 9: Division Breakdown by Region for Bridge Analysis

Region			
	East	Central	West
Divisions	1, 2, 3, 4, 6	5, 7, 8, 9, 10	11, 12, 13, 14

Maintenance Work Activities

To set baseline unit pricing of maintenance work functions, the Department focused on top planned work activities for pavements, drainage pipes, shoulders, ditches, roadside vegetation, litter pickup and pavement markings/markers. These maintenance activities represent the majority of the top function codes by expenditures, and contribute to the Department's goal of making our transportation network safer and making our infrastructure last longer. As shown below, 10 maintenance work function activities were included in the analyses.

2817 – Mechanical Asphalt Patching (tons): Asphalt surface patching, pavement edging, leveling or spot replacement with hot mix asphalt using a mechanical device. Includes short, full width asphalt overlays less than 1000' in length and partial width patches of any length. Includes work accomplished with patching sleds and asphalt maintainer patching machines. This does not include spray injection patching.

2900 – Grass Mowing (shoulder mile): Machine mowing of a grass-covered median, island, shoulder, slope, or other areas of the right of way.

2912 – Mechanical Brush and Tree Control (shoulder mile): Machine clearing of woody vegetation by the use of heavy duty mowers with extension arms, such as the motor grader mower, contour mower or similar machinery, to clean beyond the limits of routine mowing or to supplement routine mowing where regular mowing equipment cannot operate.



Figure 7: Mechanical Brush and Tree Control

3104 – Litter Removal (shoulder mile): Removal and disposal of small litter from the edge of pavement to the right- of-way for aesthetic purposes. Includes refuse such as cans, bottles, paper, and trash from within the right of way.

3108 – Drainage Ditch Maintenance (shoulder mile): Repair, maintenance, reshaping of side ditches or slopes. Includes removal and disposal of surplus material. Also includes all erosion control measures including minor seeding and mulching.



Figure 8: Showing Drainage Ditch Maintenance

3112 – Shoulder Maintenance/Reconstruction (shoulder mile): Repair, maintenance, reshaping of unpaved shoulders. Includes reconstruction after resurfacing and placing stone at mailbox turn outs and driveways. Includes furnishing material and hauling and/or disposal of material. Also includes all erosion control measures including minor seeding and mulching.



Figure 9: Shoulder Maintenance/Reconstruction

3126 – Install Pipes (48” or Less) (linear feet): Installation or replacement of pipe culverts 48” or less in diameter. This function includes excavation, all necessary base/ pavement repairs, traffic control, striping and all erosion control measures including seeding and mulching. Any environmental permitting associated with the pipe replacement should be included. Also includes the installation of pipe liners.

3222 – Long Line Painted Pavement Markings (linear feet): The placement of pavement markings with paint for centerline or barrier lines, lane lines and edge lines for planned marking activities only.

3232 – Install/Replace Pavement Markers and Vertical Delineators (each): The installation, repair, and replacement of all retro-reflective raised or recessed pavement markers, lens, castings, and upright flexible delineators.

3300 – Install Pipes > 48” (excludes pipes included in Federal bridge inventory) (linear feet): Installation of pipe & box culverts greater than 48” in diameter, and extensions to existing pipe or box culverts. Work includes all material, labor and equipment, including but not limited to excavation, foundation material, backfilling, hauling, erosion control measures, traffic control, necessary base and pavement repairs and end treatment.

These work functions represent approximately \$118M of the State's annual highway system maintenance expenditures. With the exception of 2900 – Grass Mowing, these planned maintenance work activities are typically performed by NCDOT forces. Mowing is contracted out except for limited mowing that is needed for safety purposes. Baselines for these 10 maintenance work function activities are shown in Table 10.

Table 10: Maintenance Activity Baseline Unit Costs

Maintenance - Statewide Baseline			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$250.32	\$222.53	per ton
2900-Grass Mowing	\$63.34	\$39.41	per shoulder mile
2912-Mechanical Brush and Tree Control	\$698.81	\$684.19	per shoulder mile
3104-Litter Removal	\$279.65	\$334.91	per shoulder mile
3108-Drainage Ditch Maintenance	\$12,934.22	\$10,153.76	per shoulder mile
3112-Shoulder Maintenance/Reconstruction	\$5,672.95	\$4,114.58	per shoulder mile
3126-Install Pipes (48" or Less)	\$194.92	\$155.14	per linear foot
3222-Long Line Painted Pavement Markings	\$0.16	\$0.07	per linear foot
3232-Install/Replace Pavement Markers and Vertical Delineators	\$20.37	\$15.79	each
3300-Install Non NBIS >48" Up To NBIS Structures	\$1,084.13	\$1,781.52	per linear foot

Maintenance work function data, in particular, represents an area in which the Department sees the need for improvements. Efforts to improve data reliability and reporting include initiatives such as simplifying work functions, decreasing data entry errors, capturing work accomplishments more accurately, and ensuring contract work costs and accomplishments are captured appropriately. As these actions take effect and cost and accomplishment data reliability is improved, the Department anticipates that revisions to the baseline unit costs will be necessary. Additionally, we want to emphasize that certain work functions may capture a wide variety of project scopes, and variation in excess of the 10% requirement is likely inevitable. As these situations occur moving forward, the Department will explain any variances as required by the legislation and take actions to reduce these variances, either through work efficiencies or changes in business practices.

NCDOT performs numerous other work functions and operations that are critical to the maintenance of the State Highway System. However, those operations are either much more reactionary in nature, are areas for which the establishment of a baseline unit cost is less mission critical, and/or are highly variable from year to year. These additional maintenance activities represent approximately \$287M of the State's total annual highway maintenance expenditures as shown in Table 11 on the following page.

Table 11: Other Maintenance Activities

Activity	FY 2014-15 Maintenance Expenditures
Emergency Response	\$70,373,056.91
Traffic Operations	\$37,267,853.96
Removal of Hazards/Debris from the ROW	\$30,553,678.61
Pothole & Spot Pavement Patching/Repair	\$31,244,949.22
Bridge Repairs	\$26,109,594.22
Repairs to Pipes and Drainage Structures	\$16,495,568.51
Maintenance of Rest Areas / Welcome Centers	\$14,312,929.65
Roadside Turf & Vegetation Management	\$13,449,251.19
Maintenance of Guardrail	\$11,792,816.92
Incident Management	\$11,025,752.96
Inmate Labor	\$9,666,585.80
Unpaved Road Maintenance	\$9,431,457.24
Concrete Pavement Repair	\$2,464,961.98
Maintenance Condition Assessment	\$1,546,589.87
Roadway Interchange Lighting	\$1,365,959.56
Total	\$287,101,006.60

The recent legislative increases in CR and pavement preservation funding along with the Department working to be more proactive and planned in our approach to maintaining our highway system, will aid in reducing expenditures for reactive/corrective pavement maintenance work such as pothole repair and patching areas of localized pavement deterioration. Instead, more effort can be applied towards minor pavement rehabilitation and preventive pavement maintenance which will assist in enhancing pavement performance, ensuring cost-effectiveness, extending pavement life, reducing user delays, and providing improved safety and mobility. The Department also recommends consideration of additional increases in funding for the top planned maintenance activities so adequate resources are dedicated to major components of the highway system that support and facilitate good pavements and bridges and provide the motorists with a superior travel experience.

Outstanding bridge maintenance needs identified during the 2 year bridge safety inspections currently total in excess of \$300M. Needs are categorized as routine, priority or critical. The majority of annual bridge maintenance activities are performed to address critical findings. These activities typically consist of repairing safety items, like bridge railing, or restoring structural capacity so that severe weight restrictions are not needed.

The remaining \$15M not accounted for under planned and unplanned functions covers activities such as review of driveway permits, right of way encroachment agreements, design and construction of residential subdivisions, road addition petition investigations, as well as citizen reported maintenance concerns. This also includes training for division personnel and central office support for maintenance related design and engineering tasks.

Free on Board (FOB) Goods

Maintenance forces use free-on-board (FOB) materials to accomplish various maintenance activities. Most materials are FOB destination meaning the Department does not take title/ownership of the products until they arrive at the destination. Other materials are FOB origin, meaning state forces obtain them from quarries or plants and take ownership once loaded onto a state truck for conveyance. The following commodities were selected for analysis because they are most commonly used by NCDOT forces:

- CRS-2L – Liquid asphalt binder used for chip seals and tack coats for patching.
- S9.5A and S9.5B Surface Courses – Used for plant mixes, patches and pothole repair.
- ABC – Used as bedding material for pipes, base course aggregate for secondary roads, stabilization of unpaved roads and construction of shoulders.
- No. 78M Stone – Used for chips seals and bedding for pipes.

Data was used from calendar year 2014 to ensure one full construction season was captured in the data set analyzed. Results are shown in Table 12.

Table 12: FOB Baseline Unit Costs

	CRS-2L (\$/gallon)	S9.5A & S9.5B (\$/ton)	ABC (\$/ton)	No. 78M Stone (\$/ton)
Coast/Sandhills	\$2.15	\$78.66	\$16.80	\$25.14
Piedmont	\$2.21	\$65.99	\$17.24	\$23.69
Mountain	\$2.18	\$77.13	\$12.63	\$18.39
Statewide	\$2.18	\$74.10	\$15.86	\$22.00

SAS Analysis

SAS assisted NCDOT in setting baseline unit pricing based on data provided by the Department. As described in more detail below, SAS provided an in depth statistical analyses of the data to ensure established baseline unit costs were as accurate as possible. SAS also analyzed the data by aggregating by region, division, county, system (primary or secondary), account (force or contract), and functional area. A few of the work activities were assessed for extreme values and SAS made the determination, when necessary, to remove outliers.

The steps below outline the methodology employed by SAS to determine the unit pricing for three types of transportation programs and four types of transportation goods.

1. Imported data files.
2. Implemented business rules where applicable.
3. Verified which variables are needed for each program and good type.
4. Cleansed data.
 - a. This involved removing duplicate records and populating missing values if the value could be determined.
 - b. Missing values were populated in data sets in order to properly join to the other data sets within the same program.
5. Restructured the data sets in such a way that unit pricing could be established with ease or so they could join properly to another data set by a primary key. Also, a division/region lookup table was established. This lookup table was used for all programs to determine which region was associated with each division.
6. When applicable, data sets were aggregated down to the desired level in order for unit pricing to be established. Aggregation was performed by grouping by the desired hierarchy and taking the average over the associated unit cost variable.

In some cases outliers were removed. Outliers were only determined from within groups of interest. For example, if the only observed hierarchy was Division and System, then the data set was assessed for each distinct combination of Division and System. Outliers were not removed from the data set as a whole unless the hierarchy called for that. Outlier definition employed: any record where a particular value of the variable of interest is 1.5 times the interquartile range (IQR) below the first quartile or above the third quartile. If a detailed view is looked at, such as County/Functional Area level, then it is likely that no records were removed since the group of interest contained one or very few observations.

In other words, while data may have been considered an outlier and therefore removed when calculating the statewide baseline, it may not have been removed when calculating the corresponding regional or division baselines. For example, if the data set used to calculate a division baseline for a specific maintenance function was particularly small, no outliers would have been identified and removed. Therefore an obvious data entry error would not have been removed resulting in an inaccurate division baseline for that particular item.

Monitoring & Targets

Each of these transportation construction and maintenance items for the five focus areas will be monitored and tracked for compliance with the established baseline unit cost. Maintenance work functions and FOB goods will be tracked in SAP and reported out by division. Pavement Preservation, Contract Resurfacing and Bridge Replacements will also be monitored using SAP as well as through bid awards. Per the legislation, any variance over 10% will be reported to the Joint Legislative Transportation Oversight Committee and the Fiscal Research Division on a quarterly basis by the 15th day following the end of the quarter along with an explanation of why the variance occurred and steps being taken to bring the Highway Division back into compliance.

Through this monitoring and reporting exercise, improved practices related to documentation of work accomplished and ensuring that activities are charged to the appropriate work function code will be realized. To that end, work function codes have already been updated to reflect work accomplished and to differentiate between force account and contract work. Additionally, the Department has initiated a renewed focus on data reliability and education by completing several data summits and has plans for additional training for field staff responsible for capturing and entering this data into our management systems. The Divisions will be required to report out monthly to the Chief Engineer's Office on their status of compliance with their maintenance plans and baseline unit costs. As the Department finds discrepancies and variations through the quarterly reporting process, continued process improvement efforts will be implemented to address any cost overruns and improve efficiencies. These baselines will be adjusted accordingly each year as efficiencies are achieved while adjusting for inflation.

Streamline Project Delivery

The following procedures have been identified or adopted to streamline project development and delivery. Additional opportunities and process improvements are being identified and realized through a review of the organization, staffing and operations as required by the restructuring study in Session Law 2015-214, section 29.14(d).

Division Managed Projects and Environmental Streamlining

NCDOT has established new procedures to promote efficient project delivery. At the inception of each project, the most effective project lead is identified by analysis of the project scope which encompasses cost and environmental impacts. Projects that result in higher cost and environmental impacts will remain centrally managed, whereas all others will be managed through NCDOT Divisions. Currently, more than 50% of all new projects have been delegated to the Divisions for management. Central projects are being grouped by geographic area and Divisions are developing teams that are dedicated to their assigned projects. Private engineering firms have been assigned to each region (Eastern, Central, and Western) to ensure all firms used by the Divisions are qualified and equipped with subject matter experts in order to succeed on an accelerated schedule. With the Divisions managing the firms directly, project tasks can be completed in a more simultaneous manner versus the sequential approach used with projects of higher impact. As a result of Division management, reporting on the progress with private engineering firms will allow the Department to identify potential unnecessary tasks and streamline internal policies in order to further expedite project delivery. In order to assist the divisions and central staff in project delivery, the Department has improved lines of communication with the US Army Corps of Engineers. A framework has been negotiated to establish an Army Corps of Engineers project manager, dedicated exclusively to NCDOT. This project manager will assist in coordinating with all review agencies and expedite the permitting of the increasing number of upcoming capital projects. The North Carolina office of the Federal Highway Administration (FHWA) has also recently reorganized to assist and facilitate rapid decision making to ensure success of accelerated division project delivery.

As a result of the Strategic Transportation Investments act and recent transportation revenue reform, NCDOT has been able to program nearly 500 new start projects. New start meaning no planning or design activities have taken place on those projects. More than 50% of these projects (over 250 projects with an estimated construction cost of \$1.5B) have been delegated to the Divisions for management. These projects have minimal environmental impacts and can be predominantly built within existing right of way. A programmatic decision was made to fund many of these projects with state funds to capitalize on the flexibility the recently amended State Environmental Protection Act (SEPA) thresholds allows us. The Department has a strong partnership with FHWA but federal funds tend to increase project costs and time. Conservatively, NCDOT estimates an overall project cost reduction of \$75M by minimizing exhaustive federal review requirements. This estimate does not account for deferring time delays or acceleration of projects.

Division Letting Procedures

Similar to centrally let projects, NCDOT is considering implementing uniform 3-week advertisements and electronic bidding and exploring developing a method to include “banking” of WBE/MBE goals. “Banking” would allow contractors to apply credits from previously awarded projects when they exceeded WBE/MBE contract goals. Expected results include an increase in the number of bidders, increased competition and increased success in attainment of diversity goals. NCDOT is also looking at adjusting letting dates to provide as much balance as possible between central and division projects as well as utilizing “floating” dates of availability for chip seal and resurfacing projects. This technique allows for expedited let and commitment of resurfacing and chip seal funds while allowing the contractor more flexibility in successful, timely project completion.

Private Engineering Firm Use

Implement the use of turn-key private engineering firms for both Division and Central managed project delivery. Advantages include reduced contract administration cost, quicker delivery, as well as elimination of handoffs between multiple firms and Business Units.

Design Build

Increase utilization of the Design Build process for projects: where design and construction need to be expedited for the public good or to capitalize on advanced or specific funding opportunities, with complex constructability or traffic phasing issues, or that afford opportunities for innovation. The following types of projects are particularly suitable to the Design Build process: new location projects, large interstate widening or rehabilitation projects, projects with heavy traffic volume and large or unique bridge projects. In the 10 year STIP program, approximately 35 projects will utilize the Design Build process.

Right of Way Acquisition

The Department has the ability to acquire right of way (ROW) parcels early in the acquisition process when there are complex or hardship issues involved. To further minimize construction delays, decrease construction costs and ensure timely project completion, the Department will increase usage of advanced acquisition for complex utility relocations. The Chief Engineer’s Office is also performing a process review of the ROW acquisition process with an objective of making it more of a “vertical” project delivery component that establishes early acquisition of ROW to reduce project delivery schedules a primary goal.

New Technology

Continue to work with industry to identify, pilot and implement new technologies. For example, explore utilizing a Geotextile Fabric Interlayer placed directly underneath concrete pavement to act as a drainage layer in lieu of placing a 3” permeable asphalt drainage layer. Expected benefits include cost savings and advanced project completion. As an additional example, explore the use of non-tracking tack coat products. One benefit is that trucks will not pick up the

tack and track existing pavement markings on roads near the project. Also, it is expected that these products will ensure a longer pavement life due to a better bond between the asphalt layers. The Product Evaluation Program/Increase Innovation legislation will ensure new technologies such as these are being highlighted in the Department on a monthly basis.

Accelerated Bridge Construction

Increase the use of accelerated bridge construction by implementing protocol for the early identification of projects and development of cost commensurate construction techniques when benefits are clearly indicated. Expected benefits include decreased road user interruptions and advanced project delivery.

Some of the techniques include the use of precast bridge components, construction of components at nearby locations without effecting traffic and moving into place during a shorter impact period, installation of foundations in advance of removing the existing bridge, use of materials and designs that allow for longer bridge spans and less foundations, and use of optional construction details that allows the contractor to select the quickest option based on their experience.

Specific contracting mechanisms can also be used in conjunction with above items to further facilitate accelerated construction. This can include strategic letting dates with delayed start of on the ground construction to allow upfront material purchasing and stockpiling; this ensures work can start and continue uninterrupted immediately after the road is closed. Other examples include the use of contract language that allows the contractor to competitively bid the amount of days needed to close the road along with cost to construct the projects. This is termed A + B bidding where “A” is the number of days to construct and “B” is the cost to construct; the contract assigns a monetary value for each day to consider time in the overall lowest bid analysis. Also providing incentive payments for early completion in addition to disincentives for late completion can assist with accelerated project delivery.

Appendix A – Contract Resurfacing Division Data & Anticipated Accomplishments

Contract Resurfacing Division Baseline (\$/Lane Mile)		
Division	Primary	Secondary
1	\$80,477.68	\$50,772.19
2	\$91,253.61	\$53,448.13
3	\$132,985.66	\$60,561.47
4	\$66,637.14	\$45,989.93
5	\$117,761.51	\$74,630.50
6	\$82,280.60	\$66,137.86
7	\$109,667.18	\$84,866.72
8	\$88,176.70	\$59,647.85
9	\$95,504.61	\$80,838.16
10	\$113,293.82	\$107,739.01
11	\$120,926.96	\$73,144.14
12	\$126,247.55	\$52,526.44
13	\$90,402.04	\$72,641.82
14	\$170,634.61	\$82,188.80

Asphalt Plant Mixes and Liquid Binder Division Baselines				
Division	Surface Course S9.5A (\$/ton)	Surface Course S9.5B (\$/ton)	Surface Course S9.5C (\$/ton)	Liquid Binder (\$/ton)
1	\$37.37	\$36.31	\$28.50	\$623.72
2	\$35.88	\$37.10		\$496.50
3	\$30.20	\$45.50		\$578.05
4	\$29.46	\$29.18	\$36.83	\$579.67
5	\$31.89	\$30.54	\$24.85	\$574.43
6	\$32.47	\$29.54	\$26.47	\$610.14
7	\$33.55	\$34.91	\$36.32	\$544.74
8	\$32.63	\$32.38	\$30.13	\$484.50
9	\$33.77	\$35.01	\$35.25	\$559.20
10		\$30.50	\$30.59	\$588.09
11	\$41.52	\$44.90	\$42.97	\$657.13
12	\$35.33	\$31.51	\$32.50	\$608.81
13	\$39.50	\$38.38		\$511.80
14	\$56.77	\$51.94	\$55.00	\$593.49

Contract Resurfacing HMA - Primary Anticipated Accomplishments FY 2016								
Division	Allocations	95% Allocation to HMA Overlay	Division Baseline (\$/LM)	Regional Baseline (\$/LM)	Statewide Baseline (\$/LM)	Anticipated Lane Miles using Division Baseline	Anticipated Lane Miles using Regional Baseline	Anticipated Lane Miles using Statewide Baseline
1	\$20,208,343	\$19,197,926	\$80,477.68	\$83,093.87	\$97,940.30	238.55	231.04	196.02
2	\$22,806,394	\$21,666,074	\$91,253.61	\$83,093.87	\$97,940.30	237.43	260.74	221.22
3	\$24,491,847	\$23,267,255	\$132,985.66	\$83,093.87	\$97,940.30	174.96	280.01	237.57
4	\$22,059,927	\$20,956,931	\$66,637.14	\$83,093.87	\$97,940.30	314.49	252.21	213.98
5	\$18,640,096	\$17,708,091	\$117,761.51	\$110,099.70	\$97,940.30	150.37	160.84	180.80
6	\$18,050,197	\$17,147,687	\$82,280.60	\$83,093.87	\$97,940.30	208.40	206.37	175.08
7	\$7,848,847	\$7,456,405	\$109,667.18	\$110,099.70	\$97,940.30	67.99	67.72	76.13
8	\$19,785,478	\$18,796,204	\$88,176.70	\$83,093.87	\$97,940.30	213.17	226.20	191.91
9	\$9,479,765	\$9,005,777	\$95,504.61	\$110,099.70	\$97,940.30	94.30	81.80	91.95
10	\$12,241,718	\$11,629,632	\$113,293.82	\$110,099.70	\$97,940.30	102.65	105.63	118.74
11	\$20,707,607	\$19,672,227	\$120,926.96	\$137,213.48	\$97,940.30	162.68	143.37	200.86
12	\$14,075,105	\$13,371,350	\$126,247.55	\$110,099.70	\$97,940.30	105.91	121.45	136.53
13	\$16,258,921	\$15,445,975	\$90,402.04	\$137,213.48	\$97,940.30	170.86	112.57	157.71
14	\$20,655,178	\$19,622,419	\$170,634.61	\$137,213.48	\$97,940.30	115.00	143.01	200.35
TOTAL	\$247,309,423	\$234,943,952				2356.76	2392.95	2398.85

* It is estimated that approximately 95% of the CR allocation will be used for HMA overlays.

Contract Resurfacing HMA - Secondary Anticipated Accomplishments FY 2016								
Division	Allocations	95% Allocation to HMA Overlay	Division Baseline (\$/LM)	Regional Baseline (\$/LM)	Statewide Baseline (\$/LM)	Anticipated Lane Miles using Division Baseline	Anticipated Lane Miles using Regional Baseline	Anticipated Lane Miles using Statewide Baseline
1	\$12,871,776	\$12,228,187	\$50,772.19	\$51,770.74	\$61,422.01	240.84	236.20	199.08
2	\$12,831,947	\$12,190,350	\$53,448.13	\$51,770.74	\$61,422.01	228.08	235.47	198.47
3	\$14,078,965	\$13,375,017	\$60,561.47	\$51,770.74	\$61,422.01	220.85	258.35	217.76
4	\$7,663,167	\$7,280,009	\$45,989.93	\$51,770.74	\$61,422.01	158.30	140.62	118.52
5	\$29,594,025	\$28,114,324	\$74,630.50	\$97,196.32	\$61,422.01	376.71	289.25	457.72
6	\$8,105,645	\$7,700,363	\$66,137.86	\$51,770.74	\$61,422.01	116.43	148.74	125.37
7	\$25,249,329	\$23,986,863	\$84,866.72	\$97,196.32	\$61,422.01	282.64	246.79	390.53
8	\$17,644,483	\$16,762,259	\$59,647.85	\$51,770.74	\$61,422.01	281.02	323.78	272.90
9	\$7,719,149	\$7,333,192	\$80,838.16	\$97,196.32	\$61,422.01	90.71	75.45	119.39
10	\$25,047,952	\$23,795,554	\$107,739.01	\$97,196.32	\$61,422.01	220.86	244.82	387.41
11	\$6,115,053	\$5,809,300	\$73,144.14	\$79,076.40	\$61,422.01	79.42	73.46	94.58
12	\$19,190,661	\$18,231,128	\$52,526.44	\$97,196.32	\$61,422.01	347.08	187.57	296.82
13	\$17,764,962	\$16,876,714	\$72,641.82	\$79,076.40	\$61,422.01	232.33	213.42	274.77
14	\$13,011,077	\$12,360,523	\$82,188.80	\$79,076.40	\$61,422.01	150.39	156.31	201.24
TOTAL	\$216,888,191	\$206,043,781				3025.68	2830.23	3354.56

* It is estimated that approximately 95% of the CR allocation will be used for HMA overlays.

Appendix B – Pavement Preservation Division Data & Anticipated Accomplishments

Pavement Preservation - Chip Seal (\$/Lane Mile)		
Division	Contract	Force Account
1	\$12,635.05	
2		\$11,338.29
3		\$10,363.39
4	\$10,345.37	\$10,372.74
5		\$12,867.74
6	\$18,951.20	\$12,268.90
7	\$14,074.34	\$14,120.44
8	\$16,810.82	\$12,651.88
9	\$18,129.71	\$10,989.99
10	\$16,539.16	\$11,636.22
11	\$14,778.45	\$10,684.54
12	\$15,935.94	\$8,872.85
13	\$25,098.34	\$11,702.07
14	\$24,316.16	\$12,443.75

Pavement Preservation - Crack Seal (\$/Lane Mile)		
Division	Primary	Secondary
1	\$2,994.82	\$3,659.44
2	\$3,085.97	\$3,342.84
3	\$3,170.57	\$3,148.44
4	\$3,074.46	\$2,629.52
5	\$3,142.50	\$3,710.12
6	\$2,556.73	\$3,017.80
7	\$5,118.85	\$3,810.41
8	\$3,000.84	\$3,449.38
9	\$2,740.40	\$2,672.70
10	\$2,104.44	\$2,387.18
11	\$3,454.57	\$3,521.49
12		
13		\$3,483.81
14	\$3,015.17	

Pavement Preservation - Chip Seal (\$/Lane Mile)									
Division	Contract or Force Account work	Allocations	85% Allocations to Chip Seal*	Contract Division Baseline (\$/LM)	Force Division Baseline (\$/LM)	Contract Statewide Baseline (\$/LM)	Force Statewide Baseline (\$/LM)	Anticipated Lane Miles using Division Baseline	Anticipated Lane Miles using Statewide Baseline
1	Contract	\$4,974,613	\$4,228,421	\$12,635.05		\$12,199.17	\$14,524.22	334.66	346.62
2	30% Contract & 70% Force	\$4,891,425	\$4,157,711		\$11,338.29	\$12,199.17	\$14,524.22		302.63
3	Contract	\$5,871,762	\$4,990,998		\$10,363.39	\$12,199.17	\$14,524.22		409.13
4	Contract	\$6,380,375	\$5,423,319	\$10,345.37	\$10,372.74	\$12,199.17	\$14,524.22	524.23	444.56
5	Contract	\$5,402,118	\$4,591,800		\$12,867.74	\$12,199.17	\$14,524.22		376.40
6	50% Contract & 50% Force	\$6,153,510	\$5,230,484	\$18,951.20	\$12,268.90	\$12,199.17	\$14,524.22	351.16	394.44
7	Contract	\$5,549,290	\$4,716,897	\$14,074.34	\$14,120.44	\$12,199.17	\$14,524.22	335.14	386.66
8	75% Contract & 25% Force	\$8,258,070	\$7,019,360	\$16,810.82	\$12,651.88	\$12,199.17	\$14,524.22	451.86	552.37
9	Contract	\$7,867,077	\$6,687,015	\$18,129.71	\$10,989.99	\$12,199.17	\$14,524.22	368.84	548.15
10	Contract	\$7,199,430	\$6,119,516	\$16,539.16	\$11,636.22	\$12,199.17	\$14,524.22	370.00	501.63
11	Contract	\$12,375,353	\$10,519,050	\$14,778.45	\$10,684.54	\$12,199.17	\$14,524.22	711.78	862.28
12	80% Contract & 20% Force	\$7,325,051	\$6,226,293	\$15,935.94	\$8,872.85	\$12,199.17	\$14,524.22	452.91	494.05
13	65% Contract & 35% Force	\$5,945,384	\$5,053,576	\$25,098.34	\$11,702.07	\$12,199.17	\$14,524.22	282.03	391.05
14	30% Contract & 70% Force	\$7,810,295	\$6,638,751	\$24,316.16	\$12,443.75	\$12,199.17	\$14,524.22	455.36	483.22

* It is estimated that approximately 85% of the PP allocation will be used for chip seals.

Appendix C – Bridge Replacement Division Data

Bridge - Division Baseline (\$/SF)		
Division	Division Managed	Express Design Build
1	\$117.61	
2	\$90.78	
3	\$112.95	
4	\$106.48	
5	\$90.64	
6		\$92.21
7	\$89.84	\$155.13
8	\$106.17	
9	\$102.93	\$87.49
10	\$114.75	
11	\$96.52	
12	\$194.48	
13	\$171.44	\$195.71
14	\$148.71	\$265.81
Statewide	\$117.42	\$153.40

Appendix D – Maintenance Regional Data

Maintenance - Coastal/Sandhills Baseline			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$226.45	\$277.10	per ton
2900-Grass Mowing	\$68.80	\$43.16	per shoulder mile
2912-Mechanical Brush and Tree Control	\$561.08	\$478.52	per shoulder mile
3104-Litter Removal	\$328.93	\$447.40	per shoulder mile
3108-Drainage Ditch Maintenance	\$11,054.46	\$7,500.24	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$4,904.22	\$4,478.01	per shoulder mile
3126-Install Pipes (48" or Less)	\$205.10	\$165.24	per linear foot
3222-Long Line Painted Pavement Markings	\$0.17	\$0.08	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators	\$20.22	\$2.32	Each
3300-Install Non NBIS >48" Up To NBIS Structures	\$1,820.22	\$2,055.85	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Piedmont Baseline			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$194.52	\$189.08	per ton
2900-Grass Mowing	\$55.47	\$37.41	per shoulder mile
2912-Mechanical Brush and Tree Control	\$795.03	\$785.85	per shoulder mile
3104-Litter Removal	\$178.77	\$294.13	per shoulder mile
3108-Drainage Ditch Maintenance	\$12,695.07	\$10,920.46	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$6,902.83	\$3,208.20	per shoulder mile
3126-Install Pipes (48" or Less)	\$170.19	\$154.11	per linear foot
3222-Long Line Painted Pavement Markings	\$0.18	\$0.09	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators	\$244.18	\$81.19	Each
3300-Install Non NBIS >48" Up To NBIS Structures	\$91.81	\$1,683.14	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Mountain Baseline			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$513.50	\$235.49	per ton
2900-Grass Mowing	\$60.32	\$149.59	per shoulder mile
2912-Mechanical Brush and Tree Control	\$1,019.51	\$822.88	per shoulder mile
3104-Litter Removal	\$325.74	\$302.70	per shoulder mile
3108-Drainage Ditch Maintenance	\$18,332.80	\$13,986.23	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$10,651.69	\$4,709.28	per shoulder mile
3126-Install Pipes (48" or Less)	\$183.70	\$122.61	per linear foot
3222-Long Line Painted Pavement Markings	\$0.08	\$0.06	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators	\$1,889.30	\$30.85	Each
3300-Install Non NBIS >48" Up To NBIS Structures	\$604.25	\$596.72	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Appendix E – Maintenance Division Data

Maintenance - Division 1			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$222.00	\$265.80	per ton
2900-Grass Mowing	\$73.65	\$48.13	per shoulder mile
2912-Mechanical Brush and Tree Control	\$487.80	\$395.26	per shoulder mile
3104-Litter Removal	\$395.03	\$561.70	per shoulder mile
3108-Drainage Ditch Maintenance	\$6,675.08	\$4,708.68	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$5,526.19	\$5,240.46	per shoulder mile
3126-Install Pipes (48" or Less)	\$273.76	\$160.25	per linear foot
3222-Long Line Painted Pavement Markings	\$0.07	\$0.07	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators			Each
3300-Install Non NBIS >48" Up To NBIS Structures		\$840.56	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 2			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$153.82	\$406.14	per ton
2900-Grass Mowing	\$116.39	\$74.60	per shoulder mile
2912-Mechanical Brush and Tree Control	\$478.66	\$413.40	per shoulder mile
3104-Litter Removal	\$346.20	\$577.97	per shoulder mile
3108-Drainage Ditch Maintenance	\$8,667.96	\$11,584.76	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$10,648.73	\$7,736.18	per shoulder mile
3126-Install Pipes (48" or Less)	\$234.32	\$189.00	per linear foot
3222-Long Line Painted Pavement Markings	\$0.19	\$0.88	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators			Each
3300-Install Non NBIS >48" Up To NBIS Structures		\$2,807.71	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 3			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$239.56	\$397.43	per ton
2900-Grass Mowing	\$66.90	\$36.94	per shoulder mile
2912-Mechanical Brush and Tree Control	\$387.81	\$490.36	per shoulder mile
3104-Litter Removal	\$635.17	\$287.76	per shoulder mile
3108-Drainage Ditch Maintenance	\$17,527.23	\$18,362.53	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$4,663.19	\$7,449.18	per shoulder mile
3126-Install Pipes (48" or Less)	\$88.49	\$212.44	per linear foot
3222-Long Line Painted Pavement Markings	\$0.40	\$0.06	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators	\$2.92		Each
3300-Install Non NBIS >48" Up To NBIS Structures	\$280.60	\$2,874.67	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 4			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching		\$331.04	per ton
2900-Grass Mowing	\$8,179.52	\$536.45	per shoulder mile
2912-Mechanical Brush and Tree Control	\$395.26	\$505.22	per shoulder mile
3104-Litter Removal	\$464.77	\$778.34	per shoulder mile
3108-Drainage Ditch Maintenance	\$18,115.71	\$35,406.23	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$6,809.40	\$3,868.76	per shoulder mile
3126-Install Pipes (48" or Less)	\$506.16	\$284.29	per linear foot
3222-Long Line Painted Pavement Markings	\$0.17	\$0.24	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators			Each
3300-Install Non NBIS >48" Up To NBIS Structures		\$2,116.59	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 5			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$268.67	\$250.75	per ton
2900-Grass Mowing	\$57.31	\$610.21	per shoulder mile
2912-Mechanical Brush and Tree Control	\$1,472.01	\$1,432.79	per shoulder mile
3104-Litter Removal	\$578.08	\$263.91	per shoulder mile
3108-Drainage Ditch Maintenance	\$22,878.23	\$22,320.12	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$16,565.43	\$5,167.34	per shoulder mile
3126-Install Pipes (48" or Less)	\$167.89	\$217.53	per linear foot
3222-Long Line Painted Pavement Markings			per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators	\$465.53	\$114.51	Each
3300-Install Non NBIS >48" Up To NBIS Structures		\$95,561.91	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 6			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$301.57	\$211.98	per ton
2900-Grass Mowing	\$59.56	\$36.33	per shoulder mile
2912-Mechanical Brush and Tree Control	\$273.93	\$222.65	per shoulder mile
3104-Litter Removal	\$108.20	\$14,690.17	per shoulder mile
3108-Drainage Ditch Maintenance	\$8,005.25	\$16,905.21	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$6,300.35	\$3,606.41	per shoulder mile
3126-Install Pipes (48" or Less)	\$244.61	\$214.12	per linear foot
3222-Long Line Painted Pavement Markings	\$0.18	\$0.09	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators	\$2.30	\$2.32	Each
3300-Install Non NBIS >48" Up To NBIS Structures	\$3,359.85	\$2,115.43	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 7			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$206.18	\$181.76	per ton
2900-Grass Mowing	\$81.04	\$56.92	per shoulder mile
2912-Mechanical Brush and Tree Control	\$795.19	\$464.92	per shoulder mile
3104-Litter Removal	\$230.10	\$112.40	per shoulder mile
3108-Drainage Ditch Maintenance	\$11,627.78	\$9,907.23	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$3,304.97	\$3,068.56	per shoulder mile
3126-Install Pipes (48" or Less)	\$111.68	\$117.98	per linear foot
3222-Long Line Painted Pavement Markings	\$0.09	\$0.11	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators			Each
3300-Install Non NBIS >48" Up To NBIS Structures		\$1,099.55	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 8			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$824.70	\$228.24	per ton
2900-Grass Mowing	\$58.99	\$61.16	per shoulder mile
2912-Mechanical Brush and Tree Control	\$1,012.92	\$959.50	per shoulder mile
3104-Litter Removal	\$122.90	\$154.13	per shoulder mile
3108-Drainage Ditch Maintenance	\$8,961.04	\$3,232.56	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$2,221.55	\$2,566.43	per shoulder mile
3126-Install Pipes (48" or Less)	\$188.32	\$104.04	per linear foot
3222-Long Line Painted Pavement Markings	\$0.56	\$0.07	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators	\$56.31		Each
3300-Install Non NBIS >48" Up To NBIS Structures		\$2,933,164.43	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 9			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$238.02	\$157.15	per ton
2900-Grass Mowing	\$40.69	\$15.82	per shoulder mile
2912-Mechanical Brush and Tree Control	\$182.91	\$159.61	per shoulder mile
3104-Litter Removal	\$90.65	\$64.47	per shoulder mile
3108-Drainage Ditch Maintenance	\$6,377.46	\$5,140.57	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$3,812.67	\$2,343.00	per shoulder mile
3126-Install Pipes (48" or Less)	\$64.75	\$138.08	per linear foot
3222-Long Line Painted Pavement Markings	\$0.17	\$0.05	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators	\$22.83	\$14.55	Each
3300-Install Non NBIS >48" Up To NBIS Structures		\$1,181.13	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 10			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$79.26	\$145.62	per ton
2900-Grass Mowing	\$75.28	\$45.79	per shoulder mile
2912-Mechanical Brush and Tree Control	\$733.56	\$851.65	per shoulder mile
3104-Litter Removal	\$187.69	\$360.31	per shoulder mile
3108-Drainage Ditch Maintenance	\$15,442.06	\$11,965.17	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$5,234.49	\$3,786.04	per shoulder mile
3126-Install Pipes (48" or Less)	\$323.91	\$108.73	per linear foot
3222-Long Line Painted Pavement Markings	\$0.40	\$0.09	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators			Each
3300-Install Non NBIS >48" Up To NBIS Structures		\$1,229.58	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 11			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$569.35	\$198.47	per ton
2900-Grass Mowing	\$44.60	\$36.12	per shoulder mile
2912-Mechanical Brush and Tree Control	\$1,297.11	\$723.62	per shoulder mile
3104-Litter Removal	\$302.66	\$240.38	per shoulder mile
3108-Drainage Ditch Maintenance	\$19,730.29	\$6,354.06	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$8,091.15	\$3,245.02	per shoulder mile
3126-Install Pipes (48" or Less)	\$221.95	\$98.93	per linear foot
3222-Long Line Painted Pavement Markings	\$0.06	\$0.05	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators			Each
3300-Install Non NBIS >48" Up To NBIS Structures	\$604.25	\$669.89	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 12			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$209.23	\$142.30	per ton
2900-Grass Mowing	\$37.99	\$26.64	per shoulder mile
2912-Mechanical Brush and Tree Control	\$1,794.06	\$723.02	per shoulder mile
3104-Litter Removal	\$375.07	\$466.79	per shoulder mile
3108-Drainage Ditch Maintenance	\$5,222.53	\$6,980.03	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$6,127.93	\$2,273.68	per shoulder mile
3126-Install Pipes (48" or Less)	\$248.33	\$231.09	per linear foot
3222-Long Line Painted Pavement Markings	\$0.19	\$0.08	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators			Each
3300-Install Non NBIS >48" Up To NBIS Structures	\$91.81	\$2,108.09	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 13			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$274.75	\$185.53	per ton
2900-Grass Mowing	\$188.57	\$169.40	per shoulder mile
2912-Mechanical Brush and Tree Control	\$397.13	\$793.67	per shoulder mile
3104-Litter Removal	\$269.63	\$175.06	per shoulder mile
3108-Drainage Ditch Maintenance	\$9,016.86	\$10,679.38	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$3,034.29	\$5,188.90	per shoulder mile
3126-Install Pipes (48" or Less)	\$131.72	\$124.45	per linear foot
3222-Long Line Painted Pavement Markings	\$0.10	\$0.09	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators	\$1,889.30		Each
3300-Install Non NBIS >48" Up To NBIS Structures		\$1,668.70	per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Maintenance - Division 14			
	Primary	Secondary	Unit of Measure
2817-Mechanical Asphalt Patching	\$846.38	\$394.81	per ton
2900-Grass Mowing	\$2.35	\$666.99	per shoulder mile
2912-Mechanical Brush and Tree Control	\$1,419.83	\$961.35	per shoulder mile
3104-Litter Removal	\$393.60	\$436.25	per shoulder mile
3108-Drainage Ditch Maintenance	\$36,085.43	\$30,925.01	per shoulder mile
3112-Shoulder Maintenance / Reconstruction	\$13,961.15	\$10,309.92	per shoulder mile
3126-Install Pipes (48" or Less)	\$207.71	\$302.09	per linear foot
3222-Long Line Painted Pavement Markings	\$0.08	\$0.06	per linear foot
3232-Install / Replace Pavement Markers and Vertical Delineators		\$30.85	Each
3300-Install Non NBIS >48" Up To NBIS Structures			per linear foot

As noted in the SAS Analysis section due to the presence of outliers in a particularly small data set, regional and division level baselines may be inaccurate.

Appendix F – FOB Goods Division Data

Division	CRS-2L (\$/gal)	S9.5A & S9.5B (\$/ton)	ABC (\$/ton)	No. 78M Stone (\$/ton)
1	\$2.19	\$89.09	\$17.59	\$26.63
2	\$2.24	\$74.85	\$17.54	
3	\$2.06	\$80.06	\$19.34	\$27.14
4	\$2.14	\$75.36	\$14.43	\$20.33
5	\$2.14	\$68.61	\$12.97	\$19.16
6		\$78.71	\$14.94	
7	\$2.15	\$69.28	\$17.90	\$22.45
8	\$2.14	\$70.80	\$15.94	\$24.87
9	\$2.42	\$65.98	\$18.52	\$23.18
10	\$2.15	\$61.17	\$19.66	\$28.42
11	\$2.20	\$71.68	\$12.64	\$17.33
12		\$63.97	\$17.81	\$25.14
13	\$2.18	\$79.99	\$11.41	\$16.59
14		\$84.15	\$14.12	\$20.02