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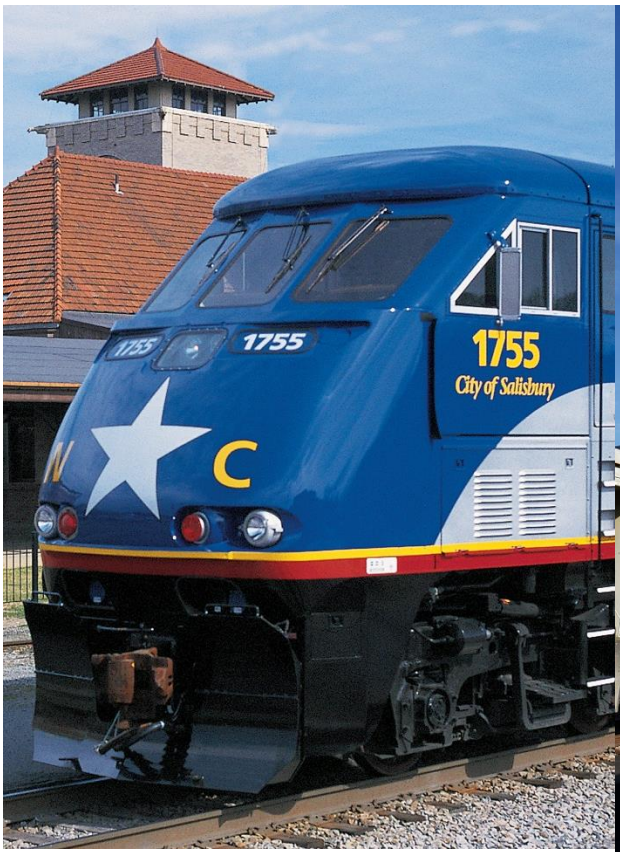

NCDOT Rail Equipment Overhaul

A REPORT PURSUANT TO S. L. 2019-231 SECTION 4.22.(A)

NCDOT RAIL DIVISION

Contents

Introduction

Report Objective

Pursuant to S. L. 2019-231 Section 4.22.(a) of the North Carolina General Assembly, signed on October 18, 2019, the North Carolina Department of Transportation (NCDOT) is pleased to present the information on its rail equipment overhaul program below. Of the funds appropriated to the Equipment Overhaul fund, $1,021,427 has been spent as of January 31, 2020.

Train Equipment

The NCDOT Rail Division manages a rail equipment fleet for daily service on the *Piedmont* route. The state's current fleet was acquired and refurbished between 1990 and 2016 to provide 3 daily round trips between Raleigh and Charlotte. The fleet is composed of 32 units of active equipment spread across 4 different classes. These include eight locomotives, fourteen coaches, five lounge/baggage cars, and 5 non-powered cab control units. The fleet was manufactured by 4 different firms over the period 1953-1998. Current railcars are 1950-1960 era original equipment, the oldest equipment fleet in the country used in regular intercity passenger rail service.

The Piedmont rail car and locomotive fleet was developed over time through the acquisition of second-hand equipment from many different former owners as the best method for incrementally adding small amounts of equipment to the fleet. Equipment was purchased as opportunities arose to acquire compatible equipment at low cost. The acquired equipment was stored until funding became available for refurbishment. The railcar fleet is original to the 1950's and 1960's and has an anticipated useful life in intercity service ending between the mid-2020's and 2040. To avoid the aging out of the entire fleet at one time, NCDOT is developing a fleet plan to determine phasing out of older equipment and buying new equipment.

The Rail Division's fleet requires individual customized maintenance programs based on manufacturer/remanufacturer and Federal requirements. For instance, the engine within the locomotive is maintained according to the manufacturer's requirements, similar to an automobile engine. The brake systems on locomotives and coaches are subject to Federal regulations for regular replacement based on daily service.

Table 1. Piedmont Service Equipment

Unit Type	Type	Quantity	Years in Service	Year of Manufacture
Locomotives	EMD F59PH/F59PHI	8	4-22	1988-1998
Cab Control Units	EMD F59PH with cab/no engine	5	0	1988-1990
Coaches	St. Louis Car/Pullman Standard	14	6-25	1964-1966
Lounge/Baggage Cars	American Car & Foundry	5	7-24	1953

Overhaul Program

Locomotive Overhaul Requirements

When long-lived components and sub-components on locomotives fail, they must be exchanged or repaired. Some components are changed out on a schedule, such as brake systems, while others are maintained in place until failure, similar to a private automobile. When components are changed out during day to day servicing, there are often required changes made to the physical layout and

orientation of the locomotive, such that, over time, a locomotive's systems may deviate from the arrangement prescribed in the original system design and specifications. Safety and performance-critical systems are generally straightforward to maintain to specifications, but some systems and components require more elaborate repairs than can be made in a small yard and shop, such as NCDOT's Capital Yard.

NCDOT's large Diesel engines (50 times the size of an automobile engine) used in the locomotives are recommended to be removed, inspected, and have major subcomponents replaced after every 8-10 years. NCDOT's typical annual mileage per engine is generally over 60,000 miles, so the resulting service interval is more than one-half million miles. As this time period is very long compared to repair parts 'on the shelf' life cycle, components that may be replaced every ten years can become discontinued and/or unavailable. The result of this process is that mismatch and inventory create challenges for management of Capital Yard's inventory and maintenance process.

This day to day routine necessitates a 'reset' of each unit periodically to allow for a redesign of systems and components to validate them against a new or improved specification and component supply chain. In some cases, major systems can fail before an overhaul, and so individual units receive varying degrees of work based on the age of their components and systems and the attendant requirement to update or replace systems and components.

Locomotive Overhaul Schedule

NCDOT's locomotive fleet consists of Electro-Motive Diesel model F59PH or F59PHI locomotives. These units are very similar in construction, components, and arrangement to each other; however, different sets of the units were acquired and placed in service at different times. The last major overhaul cycle of locomotives was funded in the Piedmont Improvement Program. As a part of that program, six of the locomotives were returned to service between 2010 and 2014 with moderate updates to their systems from their original specification. Of these six, two were NCDOT's original F59PHIs ordered in 1998 and four F59PH units purchased second hand from a former operator in Canada. Two additional F59PH units were separately bid and rebuilt with more elaborate updates in 2016. NCDOT has planned to update all 6 F59PHs to one specification as soon as possible, as some of the components are not interchangeable between the 2 newest units and the older ones. In addition, NCDOT has planned to replace its F59PHIs with additional rebuilt F59PHs if funding permits, to achieve one uniform fleet of locomotives.

An outline of locomotive overhaul and desirable dates for overhaul is shown below:

Unit	Last Overhaul	Next Overhaul	Source of Funds	Estimated Cost (Year of Expenditure)
1810	2010	As soon as CCU's are placed in service	Appropriated Funds (20-21)	$1,600,000
1869	2010	As soon as CCU's are placed in service	Appropriated Funds (20-21)	$1,600,000
1859	2010	As soon as CCU's are placed in service	Appropriated Funds (20-21)	$1,100,000
1893	2014	2021	Funding to be identified	$1,650,000
1984	2016	2023-2025	Funding to be identified	$1,100,000
1871	2016	2023-2025	Funding to be identified	$1,100,000
1755	2009	2020	Federal CMAQ	CMAQ funded
1797	2009	2020	Federal CMAQ	CMAQ funded

Total Locomotive Overhaul	**$8,150,000**

Table 2: Overhaul Schedule

Rail Car Overhaul Program

NCDOT's rail car fleet consists of 14 coaches and 5 baggage/lounge cars. The coaches and baggage/lounge cars were last refurbished or overhauled between 2009 and 2014. The first refurbishments for service occurred in the early 1990s before start of the *Piedmont* service in 1995. Unlike locomotives, there are fewer critical components that require costly repair if not overhauled. Important components include brake systems and wheels, air conditioners, and restroom systems. Each of these may be repaired on a more limited basis relative to major repairs to a locomotive.

Nevertheless, overhaul of the existing rail cars will be required in the near future. The current fleet does not include certain amenities that would be included in the next generation of coaches for train service, including larger restrooms, visual train messaging systems, and automated end and side doors. Inclusion of these items in the next round of overhaul increases the scope of fleet overhaul and requires more detailed examination of the costs and benefits of continuing to maintain the current fleet.

NCDOT is performing an analysis of the ongoing costs of the current fleet and those of a new fleet. This analysis will consider the capital cost of introducing new cars as well as the cost to maintain them. In some cases, manufacturers are willing to sign long term fixed price agreements for parts and/or maintenance, which can offset the initial costs of introducing new cars. The analysis will consider the availability of equipment for service expansions.

Future Schedule Intention

NCDOT intended to overhaul of some combination of the first three units in the table above at its earliest opportunity; however, the fleet's availability requirement has been constrained by a lengthy process for Federal Railroad Administration new equipment approval and Positive Train Control (PTC) certification by Amtrak for introduction of the new Cab Control Units (CCUs). These CCUs provide another cab on the non-powered end of the train. The inability to include these units in revenue service has required extended use of all available fleet locomotives, delaying the overhaul activities for the first three locomotives in the table above.

Figure 1: Locomotive Turbocharger

In 2015, NCDOT transitioned its operations to 'push-pull' design where the train no longer must turn around at each endpoint. This design is more efficient as there used to be additional train crews employed in Charlotte to turn the trains around as the 'road' crew that brings the train to/from Charlotte does not have sufficient time in its 12 hour shift to run the train to/from Charlotte and turn the train around twice. To ensure the train can operate without turning requires operator's cabs at each end of the train.

NCDOT anticipates that the cab control units will be commissioned for service in spring of this year. As the Cab Control Units will be brand new to operating in service, it is anticipated that over the next 2-4 months there will be issues to discover and resolve to maintain and optimize their operation. After that initial time period, fully operational cab control units should allow for locomotives to be available for overhaul by the end of the summer. This summer, NCDOT anticipates issuing a Request for Proposals to overhaul as many as 3 existing locomotives and 3 new locomotives created from older shells.

Use of Funds Appropriated for SFY 2020

NCDOT has allocated the $3,350,000 that was appropriated for state fiscal year 2020 to two projects for locomotive overhaul and coach overhaul. Expenditures so far on these projects consist of durable goods purchased for and installed on the locomotives and coaches and engineering services to create the procurement documents for the locomotive rebuild contract. Some of these components may be re-manufactured, while others are new components and systems. If possible, components removed and replaced are sent out to be remanufactured for credit or for use as spare components for future needs. Examples of high cost items that have been charged to these projects this year include traction motor re-manufacturing (the electric motors that turn the axles), turbocharger replacement (on the main diesel engine), and brake assembly replacement.

On the coach railcars, the funding has been focused on mandatory or time sensitive repair of critical components. This includes brake system inspection and replacement, as mandated by the Federal Railroad Administration, and repairs to doors, couplers, restrooms, and other critical systems.

Overhaul Expenditure	
Locomotive Overhaul	$714,167
Coach Overhaul	$307,260
Total to date	$1,021,427

Table 3: Overhaul Program Funds as of 1/31/2020

NCDOT expects funding from FY 2018-2021 to support the overhaul of three existing locomotives based on current cost estimates. In addition, the Rail Division has sought and received federal Congestion Mitigation Air Quality (CMAQ) awards to refurbish 2 F59PH shells into rebuilt units compliant with modern air quality standards, which would replace the current F59PHI units in operation today, which are nearing the end of their service life.

Conclusion

The NCDOT Rail Division is pleased to present this report and summary on its overhaul program for train equipment. The *Piedmont* service maintains one of the highest customer satisfaction scores in the country for intercity rail service. The Rail Division is committed to providing quality equipment to ensure safe and reliable service and to contribute to our customers' on-board experience, including comfortable seats and fast Wi-Fi. Maintaining this experience will allow the service to grow as new riders use North Carolina trains between the new Raleigh Union Station, the future Charlotte Gateway Station, and intermediate stations along the route. Continually adding passengers to our service allows the Rail Division to deliver a more cost-effective service while ensuring the current quality of service on the route and serving more citizens of the State of North Carolina.