Greater Triangle Commuter Rail (GTCR)
Phase II Feasibility Study

Client: GoTriangle

STV Project Number: 4020151

Appendix P
Evaluation of Norfolk Southern Infrastructure Recommendations

FINAL
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ABBREVIATIONS / ACRONYMS

CEM – Crash Energy Management
CFR – Code of Federal Regulations
CSX – CSX Transportation
DMU – Diesel Multiple Unit
EMU – Electric Multiple Unit
FRA – Federal Railroad Administration
GTCR – Greater Triangle Commuter Rail
MOW – Maintenance of Way
NCRR – North Carolina Railroad
NS – Norfolk Southern Railroad
NTD – National Transit Database
ROW – Right-of-Way
RTC – Rail Traffic Controller

Revision History

Version	Date	Description	Checked By
V1.0	6/14/22	Draft for Go Triangle Review	M. Barrow
V2.0	6/20/22	Final for Review	M. Barrow
V3.0	7/1/2022	Responds to GoTriangle Review	M. Barrow
FINAL	7/14/2022		M. Barrow

1. Introduction

1.1. Project Background

The Greater Triangle Commuter Rail (GTCR) study aims to develop a feasible plan for implementing commuter rail service on the NCRR H-Line corridor between West Durham and Auburn in Garner, NC with a potential extension to Clayton, NC. One of the the goals of early project development in Phase 2 of the GTCR study is to obtain proof of concept via rail network simulation. Norfolk Southern (NS) performed that analysis (under contract to GoTriangle and North Carolina Railroad Company) and identified a need for additional infrastructure beyond the double-track concept initially put forward. This memorandum presents STV's evaluation of the physical feasibility, costs, and risks of those additional infrastructure recommendations.

1.2. NS Modeling of the GTCR Study

Norfolk Southern and their consultants completed a network simulation analysis of the proposed GTCR project at the request of GoTriangle. This effort was conducted using the Rail Traffic Controller (RTC) simulation program to study the performance of freight, intercity, and commuter rail traffic in the corridor.

The purpose of simulation analysis, as conducted by NS, is to document that a proposed new project (a combination of new rail service supported by additional rail infrastructure) would not degrade the existing operations (freight and intercity) in the corridor. When an initial analysis shows that operational performance would be degraded by a proposed project, in terms of an increase in total delay minutes per mile experienced by each type of rail traffic, then the modeling team (NS) would propose additional infrastructure investments to return the operational performance to a "break-even" state, with no additional minutes of delay after the implementation of the proposed project.

NS studied two scenarios of the GTCR project: service from West Durham to Auburn with an 8-2-8-2 Service Plan, and from West Durham to Clayton, with the 8-2-8-2 Service Plan from West Durham to Auburn and limited service to Clayton. The NS analysis modeled freight traffic in the corridor today, with a modest level of growth forecast into the future as specified by NS. The analysis also modeled intercity rail traffic – Amtrak and Piedmont service – according to the 6th Frequency Timetable provided by NCDOT.

Under both GTCR scenarios, the operational performance of both freight and intercity rail traffic was negatively impacted by the introduction of commuter rail service with an increase in delay minutes per mile. NS identified five general areas where additional infrastructure would address these delays. These areas are described in more detail in the following sections:

- Burlington, NC industrial customer (recycling plant)
- West of West Durham, between CP Funston and new West Durham Station
- East Durham, in the vicinity of the existing NS yard

- Cary, at CP Fetner
- East Clayton, siding between CP Powhatan and CP Neuse

2. Burlington

2.1. NS Proposed Infrastructure

In the RTC analysis, NS identified freight delays occurring in the vicinity of an industrial customer (recycling center) at Milepost 18, west of the GTCR project corridor. NS Local Train P07 was modeled as accruing delays in the GTCR corridor due to the increased level of service. This train would then arrive late to the Burlington siding, triggering further delays in the system due to train crew Hours-of-Service limitations. To reduce these delays, NS proposed a run-around track to be located between MP-18 and MP-18.5 to allow trains to serve the industrial customer off the mainline.

2.2. Evaluation

2.2.1. Physical Feasibility

Figure 1, shown below, depicts the addition of a 40-car length siding track suggested by the RTC analysis to serve CMC Recycling.

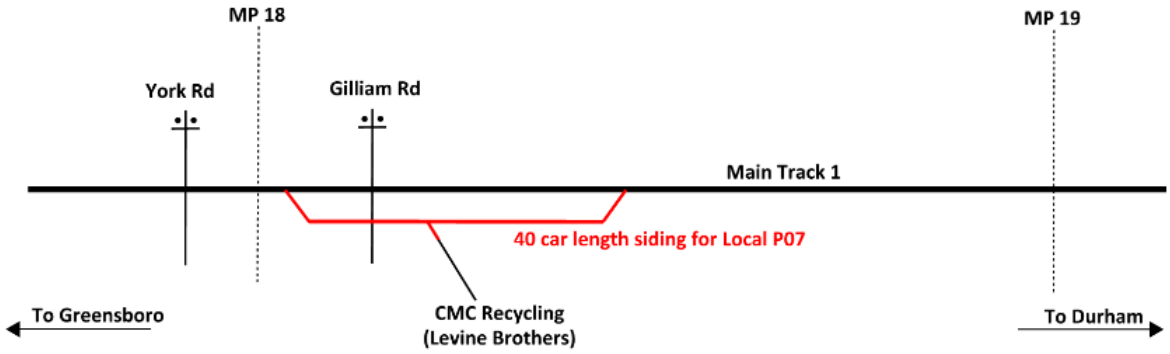


Figure 1: Suggested CMC Recycling Run-Around Track

An existing horizontal curve in the mainline does not allow for the siding to be located as shown in the RTC analysis. There is 1,500’ of available tangent if the industry lead is centered in the siding.

2.2.2. Cost

Because the suggestion is not feasible, there is not an associated cost estimate. Refer to Section 2.3. for the Counterproposal cost estimate.

2.2.3. Other Considerations/Risk

Another consideration with this suggestion is how far removed from the project limits, this infrastructure modification is located. This siding track would be located about 35 miles west of the westernmost commuter rail station. While it may be considered reasonable to include this improvement in the scope of the GTCR project as a mitigation of freight system impacts due to its relatively low cost and justification documented in the modeling study, it may not be considered reasonable to take on a long-term commitment for operations and maintenance costs for track that would not be used by commuter trains.

2.3. Counterproposal

Figure 2, shown below, depicts a feasible alternate that satisfies the intent of the RTC analysis suggestion in Burlington, operationally. This layout adds a siding in the space available and then extends a siding tail track to provide 2,000' of storage track for the P07 train.

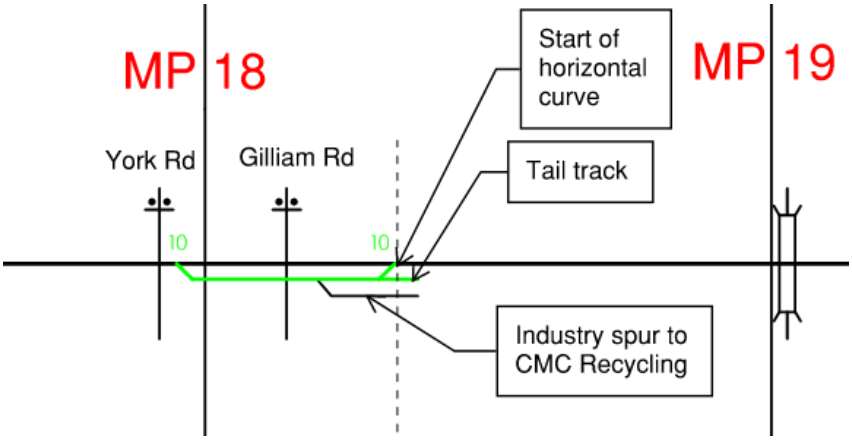


Figure 2: Burlington Siding with Tail Track

This counterproposal is estimated to cost $8.5 million (2020$).

3. West Durham

3.1. NS Proposed Infrastructure

In the RTC analysis, NS identified significant freight delay related to the operation of NS Train 350 and 351 in the vicinity of Durham. These trains today service the NS yard in East Durham, conducting long duration switching moves for traffic to and from Greensboro. These trains are quite long, at times longer than 10,000 feet, and require substantial lengths of track to complete their work. Today, at times, the trains will occupy D&S Junction, and occupy the mainline, while completing their work.

The initial GTCR proposal converted the existing controlled yard track to become a second mainline track. However, when NS 350 & 351 are operating, typically in the late morning peak

period (8-10am), this second mainline would be unavailable to passenger traffic requiring all intercity and commuter traffic to operate over a single track. Additionally, when 350 & 351 are particularly long and/or conducting operations west of the yard, D&S Junction would be occupied, lengthening the segment of the alignment with single track passenger operations. These conditions, as modeled, create significant delays for both freight and intercity traffic.

NS proposed several additional pieces of infrastructure to mitigate these delays. In West Durham, these proposals included:

- Double track between CP Funston and the new CP West Durham, just west of the GTCR corridor; and,
- Universal crossovers at both CP Funston and CP West Durham

This infrastructure would allow freight and intercity traffic to exit the GTCR corridor more quickly, able to proceed all the way west to CP King without blocking eastbound traffic. The siding between CP King and CP Funston is only 9,600 feet long today and extending the length of double track would allow long trains like NS 350 & 351 to proceed all the way to CP King.

3.2. Evaluation

3.2.1. Physical Feasibility

Figure 3, shown below, depicts the extension of the siding track that currently exists between CP King and CP Funston to CP W Durham.

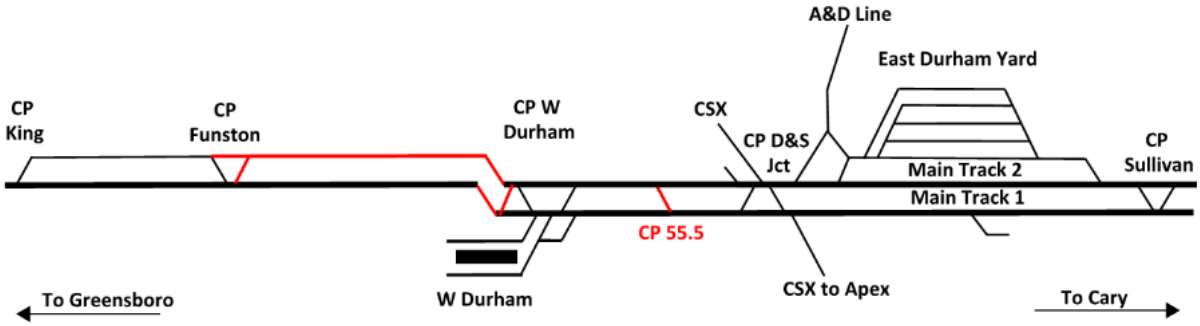


Figure 3: Suggested Double Track Configuration West of West Durham Station

The suggested extension is about three miles long and includes two overhead roadway and three railroad bridges that would require reconstruction, along with three at-grade crossing modifications, and one industry spur modification. Much of the existing single track would potentially need to be modified, as well, to shift the single track to tie to the two mainline tracks at W Durham.

3.2.2. Cost

The cost of the siding track suggested in West Durham is estimated at $85 million (2020$).

3.2.3. Other Considerations/Risk

There are several industries located in close proximity to the rail corridor between Funston and W Durham, potentially resulting in significant right-of-way impact if the siding is extended. Similar to the Burlington siding, this siding extension is west of West Durham Station and falls outside of the conceptualized project limits. However, unlike the Burlington siding, the capital cost of this item is significant, the physical impacts are potentially significant, and the underlying issue of NS Trains 350 and 351 occupying the mainline exists today. Therefore, it may be difficult to justify the full cost of this improvement as a GTCR project expense. Further, it may not be considered reasonable to take on a long-term commitment for operations and maintenance costs for track that would not be used by commuter trains.

3.3. Counterproposal

Figure 4, shown below, depicts the counterproposal, in which the extension of the siding at CP Funston is shortened to be long enough to accommodate the 350/351 trains (approximately 1.9 miles) but not extending it all the way to W Durham. This counterproposal is estimated to cost $29 million (2020$).

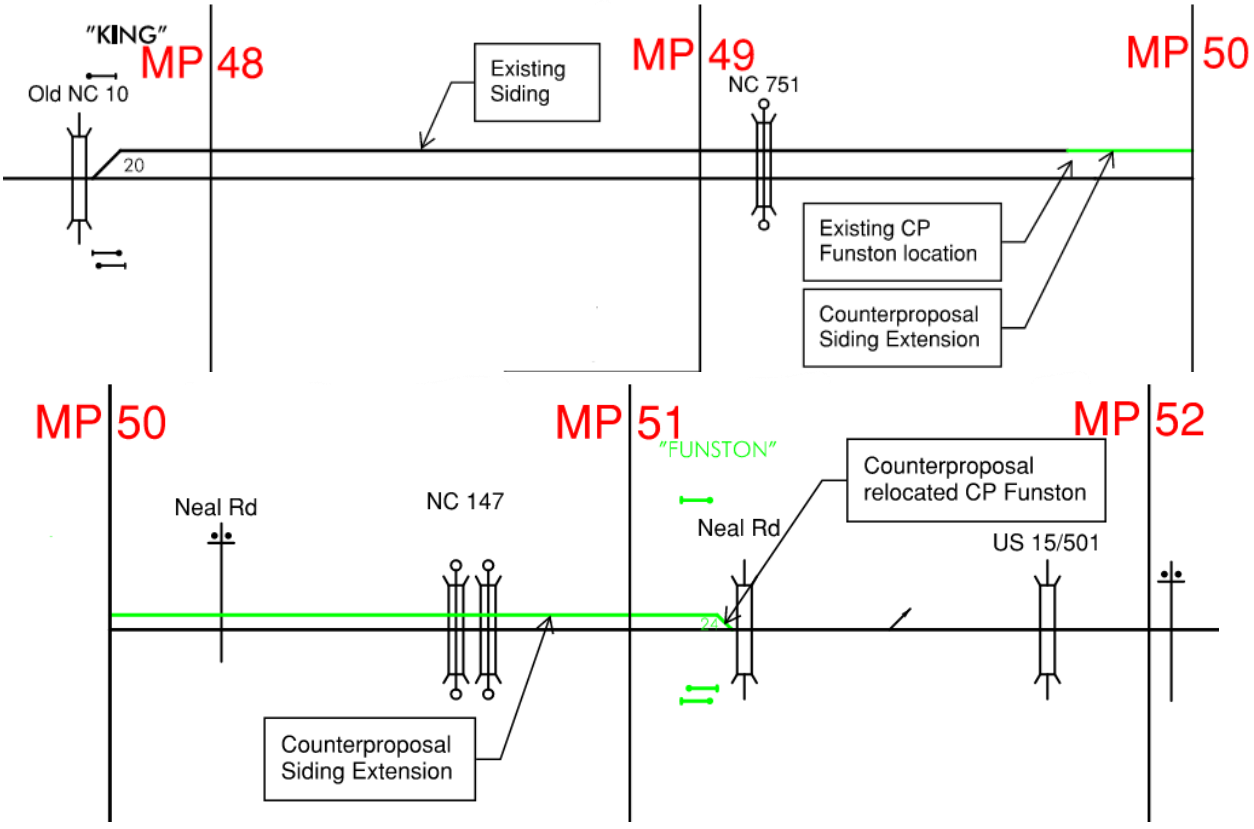


Figure 4: Counterproposal for CP Funston siding extension

4. East Durham

4.1. NS Proposed Infrastructure

As discussed in Section 3.1 above, the area of the East Durham yard is the site of significant modeled delays to intercity and freight traffic. NS proposed additional infrastructure in this area to mitigate the modeled delays:

- New crossover at CP 55.5.
- Construction of a third track between D&S Junction and CP Sullivan. This new track would act as the second mainline, allowing the existing controlled yard siding to remain for freight traffic only. While NS analysis indicated that this piece of infrastructure was not necessary to achieving zero additional delay minutes, without it the system would remain operationally fragile and sensitive to delays.

4.2. Evaluation

4.2.1. Physical Feasibility

The inclusion of a third track between D&S Junction and CP Sullivan is fraught with difficulties. This is a highly complex, two-mile-long area on the railroad corridor within which multiple rail lines meet, multiple roadways cross at-grade, multiple industry spurs and two large rail yards are active. Adding a third track through D&S Junction would detrimentally affect the mainline because multiple diamond crossings would be needed to allow CSX to cross the mainline from the SDS Line to access the D&S Junction yard. NCDOT Rail strongly discourages the use of diamond crossings due to difficult maintenance and speed reduction. They have removed several with recent projects. A third track would also likely force the closure of the at-grade crossing at Driver St due to roadway profile grades and safety concerns with a longer at-grade crossing of more tracks. The commuter rail station concept is already expected to require closure of Plum St, and closure of Driver St would not likely be acceptable. Along the East Durham Yard frontage and eastward toward CP Sullivan, the suggestion to shift the two mainline tracks to avoid impacting the siding track and the additional CP 55.5 crossover can be accommodated with minimal physical constraints.

4.2.2. Cost

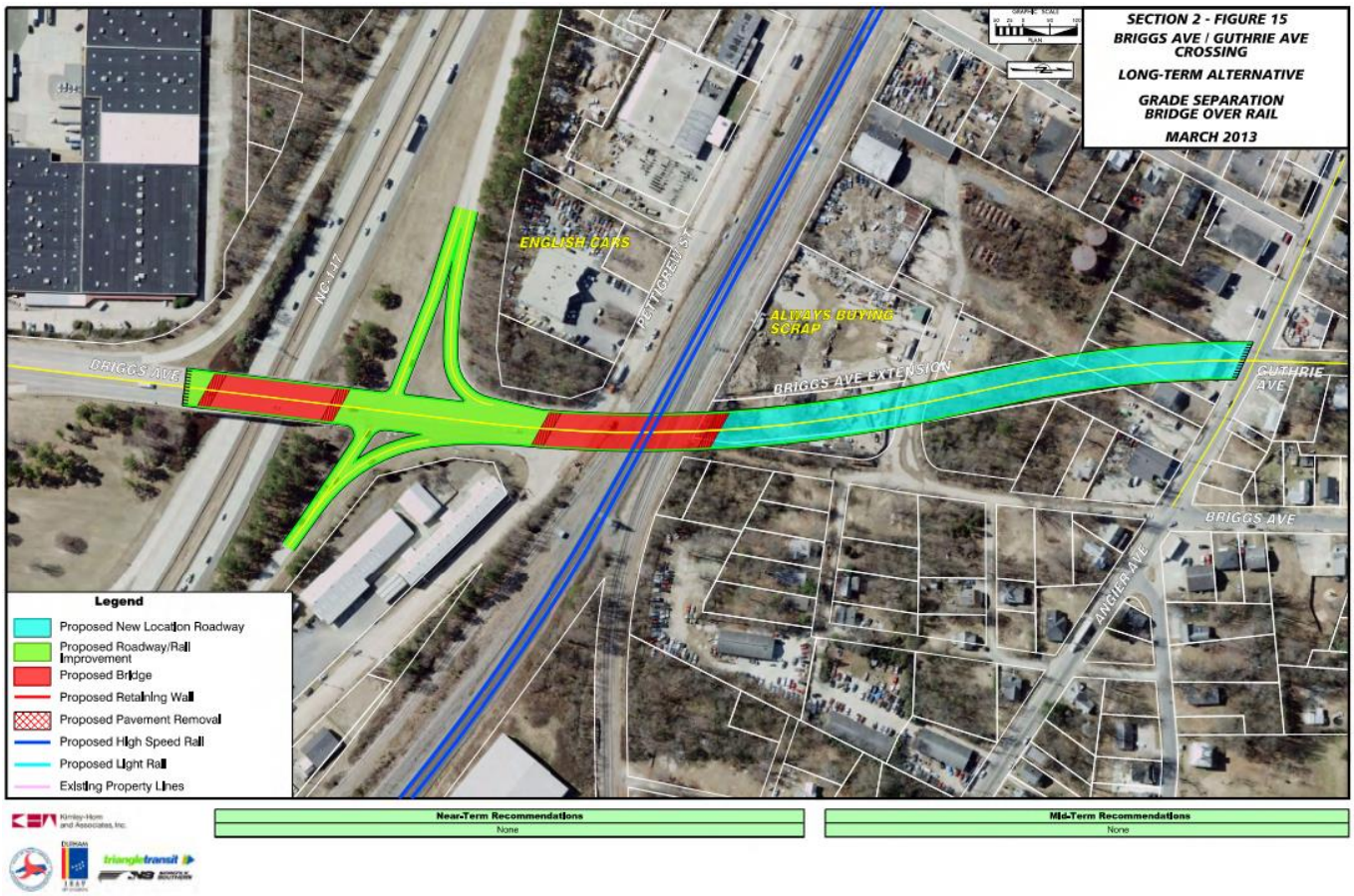
The cost of adding a third mainline track as suggested in East Durham is estimated at $80 million (2020$).

4.2.3. Other Considerations/Risk

The East Durham area includes historically disadvantaged neighborhoods that have been repeatedly adversely affected by infrastructure projects in the past. The potential closure of crossings could impose additional impact to this neighborhood, further reducing access and

increasing isolation. One of the goals of GTCR is to avoid adversely impacting cultural resources, while providing access to alternative transportation to low-income households.

If it is determined that Driver Street must be closed, Briggs Ave could potentially be grade-separated over the railroad to provide an alternate connection. A similar concept was explored in the City of Durham Traffic Separation Study (2014) as shown below. In 2014, the cost was estimated to be $21.5M (close to $30M today). The physical impacts are potentially significant, the improvement is not explicitly justified by the modeling study, and the underlying issue of NS Trains 350 and 351 occupying the mainline exists today. Therefore, it may be difficult to justify the full cost of this improvement as a GTCR project expense.



4.3. Counterproposal

Most of the physical constraints in East Durham are directly at D&S Junction, and therefore the counterproposal, shown in Figure 5 below, is to avoid as much track work as possible in that area.

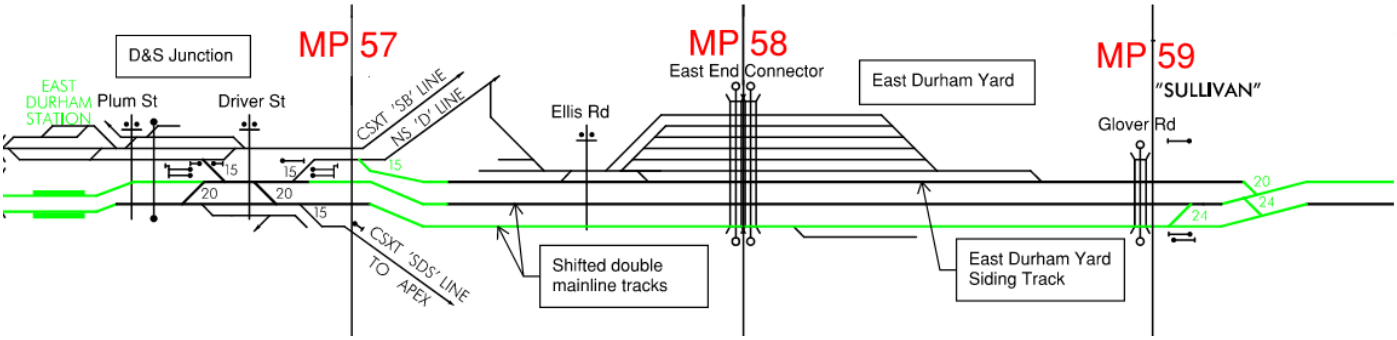


Figure 5: East Durham counterproposal

The East Durham counterproposal shifts the double mainline tracks to avoid impacts to the siding track, but rather than taking a third mainline through D&S Junction, this layout ties the siding track directly to the NS 'D' line, which then rejoins the mainline track, allowing the siding track to remain separate from the double mainline tracks, and thus providing room for the 350/351 trains to build at East Durham Yard with minimal impact to mainline traffic. This configuration will reduce the operational fragility and delay risk identified by the RTC analysis, avoid the use of diamond track crossings, and allow Driver St to remain open. This counterproposal is estimated to cost $65 million (2020$).

5. Cary

5.1. NS Proposed Infrastructure

In the NS analysis, it was observed that the proposed configuration of CP Fetner in Cary would potentially be inflexible in the event of a track outage, requiring long distances of single-track operations. To mitigate this, NS proposed the inclusion of an additional right-hand crossover just east of the proposed CP Fetner crossovers.

5.2. Evaluation

5.2.1. Physical Feasibility

Figure 6, shown below, depicts the location of a suggested additional turnout to provide a way for trains to access both Cary platforms in the event of a track outage.

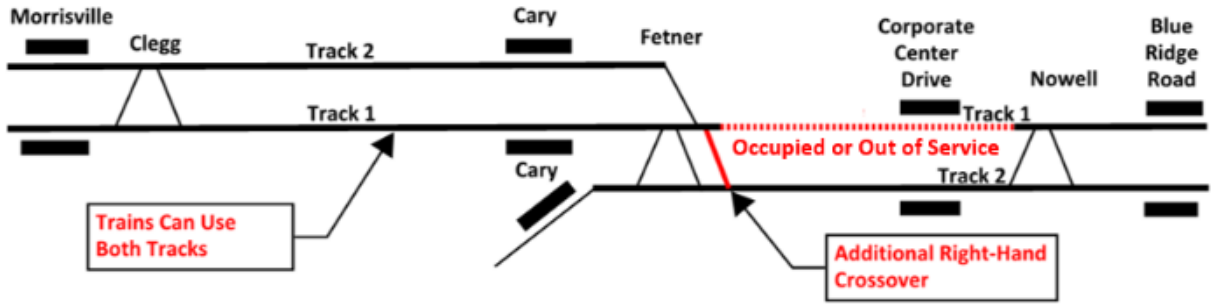


Figure 6: Suggested CP Fetner Configuration

Existing horizontal curvature in the mainline does not allow for this turnout to be located exactly as proposed by NS, because the curve begins immediately east of CP Fetner.

5.2.2. Cost

The location of the crossover as suggested is not feasible because the vicinity of E. Durham Rd. bridge and subsequent curvature do not allow enough tangent for a crossover. Because the suggestion is not feasible, a cost was not developed.

5.2.3. Other Considerations/Risk

The Town of Cary has begun planning for a new Multimodal Center in the southwest quadrant of the intersection of the railroad with N Harrison St. This facility would interface with several intercity trains (Piedmont, Carolinian, and Silver Star), as well as commuter trains, existing regional and local bus, and planned bus rapid transit. The stakeholder coordination in the Town of Cary was completed prior to the results of the RTC analysis. Conceptual designs shown to stakeholders did not include this additional crossover. Adding this turnout between the Harrison Ave crossing and the station will shift the low-level platform ~300’ west, which may extend pedestrian paths between the new Multimodal Center and the commuter station platforms.

5.3. Counterproposal

Figure 7, shown below, depicts an alternate location for this crossover, just east of the proposed Cary Station, allowing the same flexibility suggested by the RTC analysis, but at a location with sufficient tangent length. This location could push the proposed Cary Station west ~300’. Further stakeholder engagement is recommended to inform the Town of Cary and coordinate with the Multimodal Center project. The cost for this counterproposal is $3.5 million (2020$)

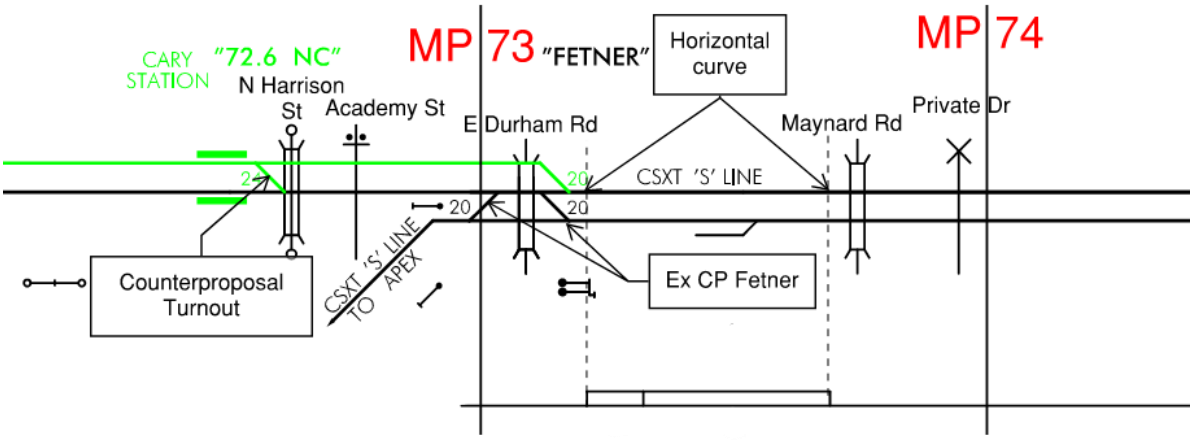


Figure 7: Cary Turnout Counterproposal

6. Clayton

6.1. NS Proposed Infrastructure

In the eastern end of the corridor, the NS analysis observed that the proposed configuration of the Auburn Station would eliminate the ability of freight traffic to use the existing siding between CP Auburn and CP Wake which would become the second mainline track. NS unit trains today stage in this siding as well as the CP Powhatan-CP Neuse siding to the east. To mitigate the "loss" of the Auburn-Wake siding, NS suggests lengthening the Powhatan-Neuse siding to the east to a length able to accommodate two unit trains. This extended siding would have a universal crossover in the center.

Additionally, NS suggests the inclusion of a signal between CP Wake and CP Clayton to facilitate the operation of commuter trains eastbound into Clayton. Under the modeled configuration, commuter trains would receive a restricted speed signal from CP Wake to Clayton Station, 3.76 miles in distance. The inclusion of the signal would reduce the distance of restricted speed operations.

6.2. Evaluation

6.2.1. Physical Feasibility

Figure 8, shown below, depicts the suggestion from the RTC analysis to mitigate the impacts to the Auburn-Wake siding. The extension of this siding appears to be feasible within the limits between the existing siding and the existing industry spur. The inclusion of a signal between CP Wake CP Clayton appears to be feasible as suggested (only applies to Scenario 2). This signal would not be needed at this location if the Clayton Station is moved east to Powhatan Road.

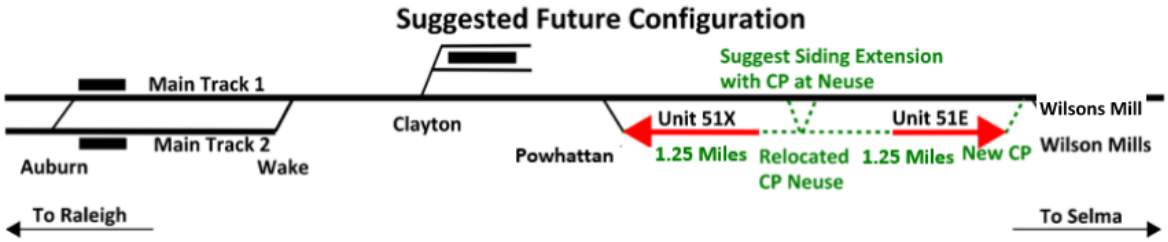


Figure 8: Suggested Powhatan-Neuse Siding Extension

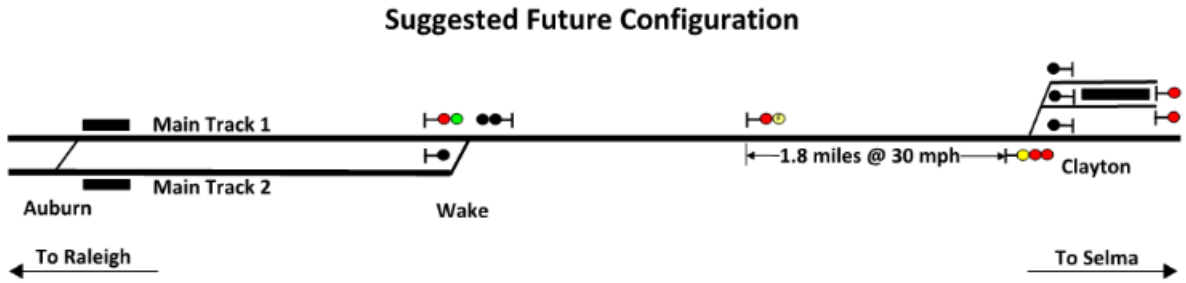


Figure 9: Suggested Additional Signal between CP Wake and CP Clayton

6.2.2. Other Considerations/Risk

The RTC analysis shows that the siding extension would be suggested regardless of whether the GTCR terminal station is at Auburn or at Clayton (in either Scenario 1 or Scenario 2).

6.2.3. Cost

The cost of extending the Powhatan-Neuse siding is estimated to be $20 million, plus $1.5 million for an additional signal, for a total of $21.5 million (all 2020$).

6.3. Counterproposal

The RTC analysis suggestion for this siding extension was found to be feasible, so no counter is being proposed, however the station locations under evaluation have been modified since RTC modelling began. Therefore, the layout for Scenario 2 will be updated as shown in Figure 10 below. The additional signal will be needed at the tail track of the revised Clayton Station location.

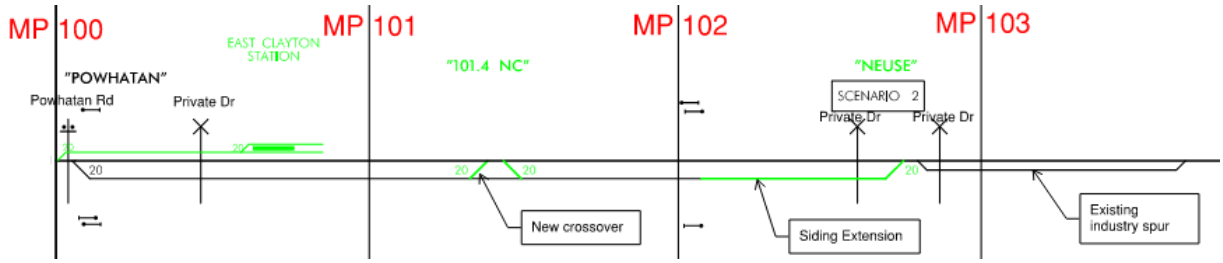


Figure 10: Powhatan Siding Extension Updated configuration for Scenario 2

7. Next Steps

GoTriangle, NCRR, and NCDOT plan to coordinate with NS to review the counterproposal and determine if the alternate solutions improve the operational risk identified in the RTC analysis sufficiently. The need for additional modelling may be required to make that assessment, which may take time beyond that anticipated.

The analysis also included additional concerns that were identified regarding the reduced Maintenance-of-Way (MOW) work windows for NS and CSX MOW forces to complete inspections and maintenance. Though not a daily occurrence, NS may need to take one or more tracks out of service which may impact commuter train schedules. Additional discussion and planning with NS to address these concerns are needed before a commuter train schedule can be finalized.