Technical Monograph:
Transportation Planning
for the Richmond–Charlotte Railroad Corridor

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Appendix G
Descriptions of Individual Projects

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DESCRIPTION OF INDIVIDUAL PROJECTS

In response to the growth and expansion expected along the Richmond to Charlotte Corridor, analyses performed for the FRA identified improvements that would be required to support projected 2020 levels of intercity, freight, and commuter operations. These projects and improvements have been integrated into the Richmond to Charlotte CTP.

This appendix presents descriptions of the various projects and Corridor program improvements that have been initially evaluated and found to be necessary and sufficient to support safe and dependable rail passenger service between Richmond and Charlotte in less than 4 hours 20 minutes. The projects would accommodate the projected level of intercity passenger, commuter and freight service in the year 2020. Proposed projects are listed according to the categories outlined in the body of the report.

Each proposed project is described under the following headings:

- Needs assessment; and
- Project description.

Information on project location and priorities is presented, however, information on design and construction schedules, and construction impact on operations has not been developed.

Costs are discussed in Chapter 7.

The geographic locations of the projects and their interrelationships are shown in Appendix D.

Considerations for All Projects

The following considerations should be included, as appropriate, in the scope of each of these projects:

- Lengthen spans of overhead bridges as necessary.
- Provide independent structures at existing undergrade bridges where necessary to accommodate new tracks.
- Extend existing grade crossings to include improved approaches, maintenance of adequate site distances, and relocation of grade crossing signals.[1]

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[1] As part of a separate initiative, the potential for eliminating individual grade crossings would be analyzed.

- Provide adequate drainage facilities, including the extension of existing culverts under the railroad.
- Relocate wayside signals, as necessary, to accommodate the new track.
- Optimize spacing of signals approaching new interlockings as part of upgrading the signal system.
- Maximize the use of 45 mph main line crossovers and turnouts.
- Maintain access to existing sidings and local industries.

TRIP TIME-RELATED PROJECTS

Curve Realignments

The rail lines proposed to be utilized by high-speed rail service south of Richmond were built when railroad technology was in it infancy. Although numerous line relocations have been made over the years, it remains a railroad with a significant number of curves. At many locations the surrounding community has developed to the point where relocation of the alignment is unrealistic. Environmental concerns make relocation difficult elsewhere. Nevertheless, several types of fixed-plant improvements to reduce the speed constraints associated with curves in the Richmond to Charlotte Corridor should be implemented:

- Changing horizontal and vertical alignment, either within the existing right-of-way, or by acquiring land outside the existing right-of-way;
- Increasing superelevation to the maximum allowable for a particular track alignment;
- Increasing the amount of unbalanced superelevation used to calculate speeds through curves to minimize track shifts; and
- Modifying spirals (the length of track that provides a smooth transition from tangent track to curved track) to provide a smoother ride.

The alternative of changing horizontal and vertical alignment, either within the existing right-of-way, or by acquiring land outside the existing right-of-way, has been considered but deemed not necessary to meet the trip time goal of less than two hours between Washington and Richmond. However, the analysis of the requirements to meet the trip time goal of less than four hours and 20 minutes between Richmond and Charlotte lead to the conclusion that a judicious number of curve relocations would be required. The recommended alignment changes were selected to allow higher speeds that can be sustained for meaningful periods of time by eliminating or reducing the effect of slow-speed curves.

The initial analysis represents a "best case". Though listed here as two projects, the improvements would actually consist of a large number of separate "sub-projects" at individual curves or groups of curves. It is likely that detailed study will reveal local constraints that would limit the feasibility or practicality of implementing some specific sub-projects.

The curve realignment program will contribute significantly to the improvement in travel times in the corridor, thereby justifying the time and expense required to implement the program.

Analysis of Curves

Preliminary analysis of curves between Richmond and Charlotte used recent FRA track geometry car data, and NS and CSXT track chart data. The maximum lateral acceleration allowed in the body of the curve was kept below 0.15 g and maximum jerk rate was limited to 0.04 g per sec.[2] Spirals for increased speed were calculated in accordance with criteria previously used for the Northeast Corridor Improvement Project. Unbalanced superelevation was limited to 7 inches for tilt-bodied high-speed trains and 5 inches for commuter and conventional train operations, in conformance with criteria (based on ride comfort, maintenance, and spiral length concerns) utilized in the analysis of Northeast Corridor operations.

For the purpose of the analysis, it was assumed that superelevation, for the 157 miles between Richmond and Raleigh, would be increased (or similarly decreased) at linear rates specified by CSXT. For the 221 miles to the relocated Charlotte station the NS criteria were used.

The analyses identified curves that should be realigned to adjust spiral length, and, if need be, superelevation to optimize goal speeds and enable trip times to be decreased.

Determination Of Curves Or Segments Of Track To Be Relocated

Once the spiral analysis was completed, a series of Train Performance Calculator (TPC) runs were made to evaluate trip time performance and test alternatives to reduce trip times to meet the 4-hour 20-minute goal. Computerized and manual techniques were then utilized to determine the amount that individual curves or groups of curves would have to be relocated to increase speeds in slow-speed of restrictive locations identified by the TPC runs. The methodologies and results are documented in Appendix A.

Additional Requirements

Centralia to Norlina

It has been assumed that the restored S Line between Centralia and Norlina would be reconstructed to the optimal trip time, spiral, and comfort requirements. Additionally, it has been assumed the alignment would be graded to accommodate all of the proposed sidings, although certain of the sidings would not be built until the level of passenger and freight service dictated the need for them.

[2]Operations at 7 inches of unbalanced superelevation would require the installation of concrete ties on curves where unbalance would exceed 5 inches to provide for economical maintenance.

Surveying

As part of the project, the line needs to be surveyed to accurately record current conditions and enable final design to be completed. For the most part, the line has not been surveyed recently. Trip time sensitive realignments would be completed in conjunction with other improvements.

Safe Braking Distances

Safe braking distances at the increased speeds projected for the line would be established during the redesign of the signal system, which is described below.

Premium Ties and Fasteners

If tilt trains capable of operating at seven inches of unbalanced superelevation and a MAS of 110 mph are utilized in the corridor premium ties and fasteners would need to be installed on curves in which the trains would operate at greater than five inches of unbalanced superelevation. Preliminary analysis indicates that tilt trains would operate at greater than five inches of unbalanced superelevation on approximately 160 curves or approximately 90 track miles of curves. Allowing ten percent for the approaches to curves or for short stretches connecting adjacent curves, 100 miles of premium ties and fasteners would be required to safely and efficiently operate tilt trains in the Richmond to Charlotte Corridor.

The Benefits Of Curve Realignment Come In Small Increments

Many small sub-projects would be undertaken to implement the program. Even though the curve realignments would be within the right-of-way, implementation implies expenditures that would disrupt train operations, with only small benefits being derived for each curve realigned. Improvements of this nature are only warranted in the context of an overall program directed toward significant trip time reduction.

Curve Adjustment Program

Almost every curve in the corridor, that is not relocated, will require that individual curves be modified by either:

- Increasing superelevation to the maximum allowable for a particular track alignment;
- Increasing the amount of unbalanced superelevation used to calculate speeds through curves to minimize track shifts; and
- Modifying spirals (the length of track that provides a smooth transition from tangent track to curved track) to provide a smoother ride.

The work required to modify the curves was classified in accordance with four levels of shift:

- Less than six inches;
- Between six and 36 inches;
- Between 36 inches and 10 feet; and
- More than 10 feet.

For the most part these curves require shifts of less than three feet, which generally can be accommodated within the existing rail alignment. It is assumed that shifts of less than six inches can be achieved during planned surfacing and line maintenance activities.

Shifts greater than six inches are assumed to require specific scheduled work outside of the normal maintenance requirements.

In a limited number of instances the curves must be relocated in excess of 10 feet to obtain the desired spiral or superelevation modifications. In those instances it is assumed that significant levels of new roadbed will be constructed. USGS maps, photos of the right-of-way and other data were used to develop the estimates.

Curve Relocation Program

A description of recommended infrastructure and operating modifications is provided in Appendix A. This initial list of improvements represents a “best case” situation. It is likely that detailed study would reveal additional local constraints that might limit the feasibility or practicality of implementing some specific sub-projects. This curve realignment program would contribute significantly to travel time improvement in the Corridor thereby justifying the time and expense required to implement the program.

The curve relocations identified are as follows:

S Line – Modifications to Alignment that Existed Prior to Abandonment

- Dinwiddie Relocation (MP S37.1 – MP S39)
- MP S58.5 TO MP S60.1
- MP S62.6 TO MP S65.9
- MP S68.5 to MP S75.3
- MP S77 to MP S77.8 (Curves S77[3], S77.1 and S77.2)
- MP S86.1 to MP S87 (Curves S86, S86.1, S86.2), and
- MP S96.5 to MP S98.7.

Modifications to Active S Line – Norlina to Raleigh

- Manson Curve (S103), and
- Curves South of Wake Forest.

Modifications to H Line – Raleigh to Greensboro

- Curve H64
- MP H62.7 – MP H54.6 (Curves H55 to H60.1)

[3] Curves are numbered in ascending milepost order in relation to the mile of the line where the beginning of the curve is located; i.e., Curve S77 is the first curve south of MP S77 and Curve S77.1 is the second curve south of MP S77.

- MP H50.3 – MP H43.8 (Curve H49 to Curve H44)
- MP H42.9 - MP H 41.8 (Curves H42.2, H42, and H41.1)
- MP H38.9 – MP H36.4 (Curves H36 to H38.2)
- MP H29.2 to MP H26.3 (Curves H28.4 to H26)
- H20.1 to h 21.3 (h20.5 to h22.3), and
- H 6 to H5.1 (MPH6.3 to MPH5.6).

Modifications to Washington to Atlanta Main – Greensboro to Charlotte Line

- Curve 296.

Restoration Of The S Line

Existing Amtrak Route – Richmond to Raleigh

The daily Carolinian between New York and Charlotte is routed from Staples Mill Road Station, Richmond, to Amtrak's Raleigh Station by means of the CSXT A Line via Petersburg, VA, Rocky Mount, NC, Wilson, NC, and Selma, NC and the NS H line between Selma and Richmond. The 197-mile trip takes 3 hours and 45 minutes (52 mph average speed) southbound and 3 hours and 34 minutes northbound. The route does not use Main Street Station, Richmond, and requires a slow move from the S to H Lines at Selma.

The A Line is the principal CSXT north-south, I-95, freight route; it is primarily single track with sidings. Achieving a two-hour Richmond to Raleigh trip time would require an average speed of almost 100 mph, which is not achieved on the NEC, and would require significant improvements to the A and H Lines. Therefore, NCDOT and VDRPT have selected the alternative of restoring the S Line.

The Proposed Restoration of the S Line – Richmond to Raleigh

The portion of the former Seaboard Line, (called the S Line), included in the Southeast Corridor extends from Richmond Main Street Station to Raleigh, a distance of 157 miles. The route between Centralia and Norlina, about 88 miles, has been abandoned and the tracks have been removed. Some bridges remain. The remainder of the tracks has been downgraded to a branch freight only Class II status. To restore passenger service the abandoned tracks would have to be restored, new passing sidings provided, bridges rebuilt or upgraded and the remainder of the tracks upgraded to passenger speeds. The discussion below outlines the facilities needed to restore passenger service between Centralia and Raleigh. The portion between Richmond and Centralia has been described in a previous report.

The restored line is planned to have four passenger trains each way between Charlotte and Washington or New York. In addition Amtrak proposes to reroute its Silver Star, now operating each way via the A Line and Selma and Raleigh, to the S Line. CSXT has stated that if the S Line is restored they would liked to operate four intermodal trains each way per day and one merchandise train each way. Description of these trains is discussed in a section covering Raleigh operations. Therefore the number of trains per day could be ten passenger trains and ten freight trains per day.

South of Norlina two local freight trains each way per weekday operate currently over a portion of the S Line in addition to the twenty trains mentioned above. The operation of these trains also would be covered in the section describing Raleigh's operations and configurations.

South from Richmond the current S Line ends at Centralia and joins the former Atlantic Coast Line (called the A Line) there. A connection to join the two lines was constructed when the S Line was abandoned south of Centralia.

Alternative routes are being studied in the Petersburg area as part of the Richmond to South Hampton Roads High-Speed Rail Feasibility Study. Three of the more promising options that might result in rerouting the Richmond, VA to Raleigh, NC corridor traffic include:

- Constructing a third main on the east side of the A line from Centralia to Dunlop in Colonial Heights, VA;
- Reinstalling track on the old ACL passenger main through Colonial Heights to the former N&W passenger station in downtown Petersburg where it would split into two routes, one route would connect to the NS line to Norfolk and the other route would go west on the NS line to new connections to the A line and former S line on the west end of Petersburg; and
- Constructing a third main on the east side of the A line from Centralia through Dunlop and the existing Ettrick (Petersburg) station, where it would split into two tracks before crossing the Appomattox River on a new bridge; one track would curve east and join the NS track through Petersburg to Norfolk; the second track would curve west to briefly join the NS route before connecting to the former S line on the west end of Petersburg. Access to the A line would be via an interlocking at Ettrick.

The Restored "S" Line

Where the S Line is restored starting at MP S10.9, a full universal interlocking would be required at Centralia to provide full connectivity between the A Line and The S Line in both directions. About ten northward CSXT freight trains would operate from the A Line to the S Line between Centralia and Main Street as well as the six-passenger trains to/from Florida. One Florida train and the four North Carolina trains would continue southward to Raleigh on the restored S Line. Because of clearances just south of Main Street Station, the Auto Train must operate on the A Line around Richmond.

South of Centralia the restored S Line would parallel the A Line for about two miles and would bridge over the A Line at the location (MP S12.5) where the S Line previously had crossed over the A Line on an overhead bridge.

South of Chester the restored S Line would be on the roadbed of the abandoned S Line to about MP S20. At that point rather than passing under the A Line as the S Line formerly did, crossing the Appomattox River on a major bridge now removed and then passing under the A Line again just south of the A Line Appomattox bridge, the restored S Line would curve to become parallel to the A Line through Petersburg. The parallel lines would serve one passenger station in Petersburg, which would be at Ettrick (about MP S 22). A universal interlocking is planned between the A Line and The S Line one mile north of the passenger station. This interlocking, named Pete for this study, would allow passenger trains to operate on either the A Line or the S Line between Centralia and Pete. Freight trains that operate on the S line may enter or leave the A Line at Pete. In short, CSXT would become a triple tracked between Centralia and Pete. Normally CSXT A Line freight trains would remain on the A Line to avoid conflicts with passenger trains; however, passenger trains operating on the A Line could use the restored S Line between Pete and Centralia, but that operation was not simulated.

At about MP S23 the A Line and the restored S Line separate again. The A Line curves onto its bridge over the Appomattox. River. This bridge is a 60-foot high single-track bridge about 1300 feet long in an otherwise double tracked line. It appears that the bridge has always been a single-track bridge. The elevation of the bridge according to the Petersburg USGS map is about 100 feet and the stream level is about 40 feet. The restored S Line would also require a new bridge of about the same length and height about a half mile upstream.

A complicating factor for the new S Line Bridge is a Norfolk Southern branch line (the original main line) that must either be bridged or gone under. The NS line has significant grade descending from west to east. The best alignment for the restored S Line would be about one half mile upstream from the A Line Bridge, and the elevation of the S Line would be about 85 feet at its intersection with the NS Line. The NS elevation at that point is also 85-90 feet, and that suggests an unwanted crossing at grade. Lowering the NS is a poor option because of their grade and raising the S Line is also a poor option because of the excessive downgrade that would create on the S Line south of the bridge. Going under the NS is not a good option either because the elevation of the S Line would have to be about 60-65 feet. That elevation would be near the water level of Cattail Run south of the under-crossing and only 10-15 feet above Appomattox River.

Having the bridge over the NS down stream to where the NS elevation is about 75 feet gives a better vertical separation. The S Line can cross over the NS at an elevation of about 100 feet because the elevation of the escarpment on the north side of the river is 110 feet and the elevation on the south side is about 90 feet. The restored S Line rejoins the former line on the south side of the river at new MP S23.5. The milepost of the former line is about MP S24.05 so paralleling the A Line through Petersburg is about one-half mile shorter than the original Seaboard alignment. Further references to the mileposts would be for the original mileposts.

A second complicating factor in the Petersburg area is at Secoast (MP S26.5) where the NS Belt Line passes over the former S Line. The access road to a new Chaparral Steel plant occupies a portion of the alignment of the former S Line south of that location. Given this, a new S Line alignment could possibly be located west of the former line, but it would require a new bridge under the NS. The new line would eliminate a 2-degree reverse curve that existed on the former alignment. It is also possible that a connection may be constructed from the S Line to the NS Belt Line to provide passenger train access to Norfolk. A separate study sponsored by VDRPT is evaluating the potential for high-speed rail service to Norfolk. The potential Norfolk trains have not been included in any train simulations.

Sidings

All proposed sidings on the restored S Line are planned to be 3.5 to 4 miles long. All end-of-siding turnouts are No. 20 installed on straight track. The rationale for 4-mile sidings is to minimize signal delay for trains entering the siding and to increase the probability of making moving meets. The long siding would permit an intermediate signal to be placed about mid-siding. If the signal at the opposite end of the siding displays a stop aspect, as one would expect when a train is entering the siding, the intermediate signal would display an approach aspect. That means the train is to begin braking at the approach signal and be prepared to stop at the signal at the leaving end of the siding. Enough braking distance must be provided between the intermediate signal and the stop signal so that a freight train can be stopped.

When the intermediate signal displays an approach aspect the signal at the entering end of the siding would display a limited clear aspect good for 45 mph if the end of the siding has a No. 20 turnout. That aspect tells the engineer that the train may operate at 45 mph until the entire train has entered the siding or the train has passed the intermediate signal, whichever occurs first. If the train is short enough, as passenger trains would be, the train may actually accelerate to the intermediate signal if the allowable siding speed is greater than 45 mph. By arranging the signals in this way the long freight train would clear the single track in the least possible time.

If the siding is so short that the intermediate signal could not provide sufficient braking distance to a stop signal, the intermediate signal may serve little or no purpose because the signal at the entering end of the siding would have to provide the safe braking distance needed. In a case like that the entering aspect would display a limited approach aspect (CSXT Signal Rule 281-D). The engineer may enter the siding at 45 mph but must immediately begin to brake so the train can be stopped at the opposite end of the siding. Thus the rear of the train could be crawling into the siding at fifteen mph or less depending upon the siding length, thereby occupying the single track for a longer than necessary period of time[4].

The spacing of the sidings on a single-track system determines the capacity of the system and also the length of the delays when meets do occur. Since the S Line is being restored for passenger service, the latter consideration is most important. A maximum delay of ten minutes for a meet between two passenger trains is the worst-case that should be tolerated for reliability of service. A meet between two passenger trains would require that a passenger train would have to divert from one track to a second track to avoid slower moving trains, or divert to a siding in single-track segments to enable a passenger train in the opposing direction to pass. Each time this occurred a passenger train would be required to slow down, enter a siding, and wait for the passenger train coming in the opposite direction to go past, each train added an average of 9.5 minutes of delay to its performance. Therefore, to ensure the reliability of the passenger train operations, a maximum delay of ten minutes for a meet between

[4] Greystone, S109, at about 2.5 miles is the only recommended siding that this would apply to.

two passenger trains was the worst-case scenario that would be tolerated. Accordingly, the design criterion for siding spacing was expressed in time rather than miles[5]

While the maximum speed on the S Line would be 110 mph, the prevailing speed is more like 90 mph because of the many curves. Thus a train would travel a mile in about two-thirds of a minute. Dividing two-thirds into ten minutes gives a maximum center-to-center siding spacing of 15 miles. If the sidings are four miles long as explained earlier the length of single track between siding switches should not exceed 11 miles.

Spacing every siding at the ideal distance is often not possible. Major bridges, clusters of road crossings, and curves may make it too expensive or operationally infeasible to place sidings ideally. Therefore a location where no grade crossings or curves exist should be sought. Even then such a location may not be found. Sidings that require standing freight trains to cut crossings (uncoupling the train to let automobiles use a crossing and then re-coupling the train to depart) are unacceptable because many freight trains have only two crewpersons: an engineer and a conductor. Therefore constant communication between a dispatcher and the engineer is required so that the engineer may pace the train's arrival at a siding so that meets can be made without stopping the freight train. This is another reason for having long sidings.

Installing Number 32 Turnouts (80 mph) in Place of Number 20 Turnouts (45 mph) at the End of Sidings

A passenger train slowing from 100 mph to 80 mph to enter a passing siding would depart the single track one minute sooner than if it slowed to 45 mph. Whether the time saved in entering the siding at 80 mph actually results in an overall reduced transit time for the train entering the siding depends where the opposing train to be met is located when the siding is entered. If the siding spacing is fifteen miles the opposing train may be from a fraction of a minute to as much as nine minutes away from the exiting end of the siding being entered.

Siding With Number 20 Turnout

A passenger train traveling at 100 mph entering a siding to meet another train would be delayed a minimum of five-minutes due to: receiving a signal in advance of the turnout and decelerating to 45 mph, traversing the siding at 45 mph, and accelerating to 100 mph. For this to occur the opposing train can be no farther than three minutes (4 miles) from the exiting end of the siding when the initial passenger train entered the north end of the siding.

Siding With Number 32 Turnout

A passenger train traveling at 100 mph entering a siding to meet another train would be delayed a minimum of 1.5-minutes due to: receiving a signal in advance of the turnout and decelerating to 80 mph, traversing the siding at 80 mph, and accelerating to 100 mph. For this to occur the opposing train can be no farther than one minute (1.3

[5] In an operation where the train speeds are uniform, miles would be acceptable criteria.

miles) from the exiting end of the siding when the initial passenger train entered the siding. Consequently, it is highly likely that few, even any, trains would achieve a no-slowdown meet with the Number 32 turnout installed.

Reduction in Delay

The least delay time that can be saved is zero minutes (same as at 45 mph) and the most is 3.5 minutes (5 minutes less 1.5 minutes) but about three minutes is about the best that can be achieved.

Therefore, if only one or two meets occur at a siding each day the added cost for number 32 turnouts cannot be justified. However, when the number of passenger meets is five per day at a siding the increased reliability of operations might justify the cost.

Siding Location and Curve Relocations.

If the ideal location of a siding is where curve relocation may eventually be made, constructing the siding there prior to the line change would be wasted money. Therefore, if adequate siding spacing can be maintained sidings should be constructed where no line change is likely.

There would be locations discussed later where siding locations cannot be changed to avoid possible future relocations. In that case a choice should be made whether to either build a new main track with the current main track becoming the siding in its current position or to build a new siding concurrently to relocating the main track. These areas are identified in the following discussion.

SIDING-BY-SIDING DISCUSSION – Restored S Line, Centralia to Norlina

Chester Siding

Between Centralia and MP S13 at Chester a passing siding is provided so that northward trains entering the A Line from the restored S line can wait clear of the S Line or A Line if access to the A Line is not immediately available. Also southward trains entering the S Line at Centralia would have a place to wait clear of both the A Line and S Line if the S line is not immediately available.

Lynch Siding S16.4 to S20.2

Between Pete and Chester a 4-mile long passing siding at Lynch is proposed between about MP S16 to MP S 20. A siding previously existed at Lynch but it was much shorter than the one now being proposed.

Burgess Siding (MP S29.6 to MP S34.5)

The south end of the proposed siding at Lynch is at about MP S20, so the ideal location of the next siding would be about MP S31. The north end of a signaled Burgess Siding was formerly at MP S31.2 and much of the new siding can be built of the former siding roadbed. The limits of the new Burgess siding are from MP S29.6 to MP S34.5.

De Witt Siding (MP S41 to MP S44.5)

De Witt was the location of a former signaled passing siding that began at MP S41.2 and extended to MP S42.6. Reusing the roadbed of the former siding results in the spacing between the De Witt siding and the Burgess siding being about 7 miles or 3 miles less than the ideal 10 miles. The west end of the siding would be extended to MP S44.5 and would be located between curves 44 and 44.1.

Alberta Siding (MP S55.4 to MP S61)

Ideally, the north end of the next siding would be at about MP S55. Conveniently, a former signaled siding at Warfield began at MP S55.8 and extended to MP S57.3. A second un-signaled siding for Alberta began at MP S59.5 and extended to MP S61. It is proposed that the two former sidings would be connected into one 5.6 mile long Alberta siding. The former Warfield siding would be extended 0.4 miles northward to MP S55.4.

Skelton Siding (MP S71.2 to MP S 74.9)

Grandy was the next signaled siding south of Alberta; it extended between MP S66.9 and MP S68.3, but was only 5.9 miles from Alberta. The north end of the next siding should be about 10-11 miles south of Alberta or at MP S70-71, so clearly the former Grandy siding does not meet the required siding spacing.

A former mile-long non-signaled passing siding at Skelton (Skelton is the railroad name, Forksville is the name on USGS maps) was located between MP S73 and MP S74. This former siding is located in difficult terrain[6] and extending it to a 4-mile siding would be difficult. However, it is proposed that the new siding would be extended north to about MP S71.2 and south to the north end of the former 271-foot deck plate girder Taylor Creek Bridge at MP S74.9.

Associated Curve Relocation. Four curves (a right-hand 4-degree curve, a left-hand 4-degree curve, a right-hand 4-degree curve, and a left-hand 3.75-degree curve) are located south of MP 71. It is proposed that a 7,900-foot line change be made when the siding is built and the four curves replaced by one right-hand curve of 1.75 degrees and one left hand curve also of 1.75 degrees. The relocation would be about 400 feet shorter than the original alignment, but because of two small grade breaks in the original alignment the maximum grade could remain at one percent.

The southward portion of the siding includes two left-hand curves of 2.5 degrees and 3.75 degrees. It appears that the two curves could be rather easily combined into a single 1.5-degree curve with a 2900-foot relocation. Relocating these two curves would increase the amount of tangent distance north of the Taylor Creek Bridge to place the turnout to the south end of the siding.

Bracey Siding

The north end of the next siding should be located about 10-11 miles south of MP S75 or at MP S85-86. If the north end of the new Bracey siding were located at MP S84, as desired, the south end of the siding would be located at MP S88, which is about

[6] A major bridge crossing of the Meherrin River is about three miles north at MP S70.2 and the former S Line alignment is on a serpentine climb of one percent from that point to Skelton.

one-half mile north of a bridge over Roanoke River, which is more than one-half mile long. Locating the siding further south would overlap the bridge. A former signaled siding at Hagood extended from MP S83 to MP S84.5. While MP S83 is only eight miles from the Skelton siding the roadbed of the former siding might be reused and extended to MP S86.5 between two curves of 4.5 degrees and 4.0 degrees.

Associated Curve Relocations. Southward between MP S86 and MP S87 are three curves: a left-hand curve of 4.5 degrees, a right-hand curve of 4 degrees, and left-hand curve of 4 degrees. It is proposed relocations that these three curves be replaced with one 2-degree curve. This length of the relocation is approximately 4,200-feet.

The south end of the relocation would be approximately MP S87, so if the relocation was made at the time the siding was being built the new Bracey siding could extend from MP S83 to S87.

Signal System Upgrade

Signal system upgrades are necessary to efficiently handle increased train traffic on the Corridor and to permit improved intercity passenger service with greater safety. These improvements also would enable freight service, and any potential commuter service, to safely and efficiently operate on the same tracks. New block layout and signal aspects would accommodate speeds up to 110 miles per hour[7]. The signal system would use microprocessor-based track circuits and control/indication equipment. Block spacing would anticipate increased train speeds. Cab signals would be installed and all locomotives operating on the line would be equipped with Automatic Train Control (ATC). Reverse signaling would be installed throughout the corridor. Interlockings would be remotely controlled from Jacksonville, Florida on the S Line and from Greensboro, North Carolina for the H Line, and along the Washington to Atlanta Main Line.

The new signal system would improve the reliability of train operations for all services, contribute to maintenance-related operating costs, and would be a component critical to enabling higher speed train operations.

High-Speed Intercity Trainsets

High-Speed Rail planning by Virginia Department of Rail and Public Transportation (VDRPT) and North Carolina DOT assumes an increased number of trains operating between New York City and points south of Washington. Their objective is to offer the public a reliable, high-quality, cost-effective, competitive high-speed intercity passenger rail service. Neither state has selected the trainsets (locomotive plus coaches) that will be used to provide this improved intercity rail service. Diesels and Amtrak Amfleet coaches are presently operated south of Washington.

A variety of train set alternatives are being evaluated nationwide and will provide state planners with numerous options. Among the alternatives, the FRA’s Next Generation High-Speed Rail Technology Program has initiated a program to develop

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[7] The braking distance for a 110 mph passenger train is essentially equal to that of a 60 mph freight train.

and demonstrate a high-speed turbine-electric locomotive that would approach the speed and acceleration capability of electric trains without the cost of railroad electrification. Upon successful completion of a demonstration program, the non-electric locomotive would be a viable option to high-speed intercity passenger operators. Tilt-train equipment to enable trains to operate at increased speed safely and comfortably though curves is being operated in the Pacific Northwest and will be introduced in the Northeast Corridor in late 1999.

The train set selected by the state planners will have to be compatible with NEC operating requirements and facilitate timely engine changes (between diesel and electric) in Washington.

The trainsets that would be operated south of Washington to provide improved high-speed rail service have not been identified. Once a determination has been made, the cost of acquiring the trainsets would be evaluated. It is essential that rolling stock compatible with Amtrak's Northeast Corridor train service be selected.

Capacity Related Improvements

Route Realignment/Augmentation – Richmond Main Street Station to Centralia

Main Street Station

A single track and platform on the west side of Main Street Station would be insufficient to reliably operate the volume of freight trains, through passenger trains, and terminating/originating passenger trains projected for 2020.Two tracks would be constructed on the west side of Main Street station. Thus, northward freight trains can be passing through the station on Track 2 while southward passenger trains and/or northward originating trains are routed to or loading/unloading in the station on Track 1. Similarly, northward and southward passenger trains may routed to or load/unload simultaneously.

Richmond to Centralia

High-speed rail services proposed by the states of Virginia and North Carolina would utilize Main Street Station, which the City of Richmond is in the process of upgrading as a multi-modal transportation center.

The existing track configuration between Richmond and Centralia is inadequate to support the proposed level of 2020 train operations.

The most significant constraint between Main Street Station and Centralia would be the single-tracked James River Bridge. It is assumed that passenger trains would have preference over freight trains for the use of the bridge. Therefore, northward freight trains require sequencing to enable them to follow a northward passenger train at Rocketts (located at the south end of the James River bridge). Northward freight trains would be held at Dale Avenue, just south of Dale Interlocking, to avoid blocking highway crossings. Freight trains would not be released from Dale Avenue unless they could clear Main Street station before a southward passenger train operating to Centralia was scheduled to depart Main Street Station (Main St Interlocking, at the south end of the

Station, is the north end of the single track on the bridge). A northward freight train released from Dale Avenue must be assured non-stop access to the James River Bridge.

Southward freight trains would not be released to enter Main Street Station if a northward freight train has been released from Dale Avenue. The numerous highway crossings between Dale and Rocketts cause a de facto single-track operation for freight trains between Brown Street and Dale, even though two tracks actually exist on both sides of the James River Bridge[3]. Any train that must be held, must be stopped clear of these crossings.

Restoration of passenger rail operations from Staples Mill Road Station, through Main Street Station, to Centralia would require that:

- Rocketts Interlocking be reconfigured to accommodate the proposed Richmond to Bristol TransDominion Express rail service;
- The existing crossovers in the vicinity of MP S1.5 would be relocated to Deepwater Junction (MP S-1.8) to facilitate the movement of the Acca-Deepwater turn from South Yard (located west of the railroad) to Deepwater (located east of the railroad). The new crossovers would be positioned so that a progressive move, from north to south, can be made from the siding (Sixth Street lead);
- The existing interlocking at Marlboro (S4.5) be replaced with an universal interlocking (with two No. 20 crossovers to enable 45 mph moves) at Dale (S4.8);
- The existing Falling Creek interlocking (S-7.3) would be removed and a universal interlocking (with two No. 20 crossovers) constructed north of MP S-7 to replace it. The interlocking would be located on the tangent track between the north end of the 2-degree curve, at MP S-7.0, and the Falling Creek Bridge; and
- The double track south of Rocketts would be extended from MP S8.9 to Centralia (approximately S10.7).

The principal conclusions relative to the re-institution of passenger train operations in Main Street Station and the results of the recent simulation of proposed 2020 freight and passenger trains between Staples Mill Road Station, Centralia, and Fulton Yard are:

- Terminating, and originating trains, at Main Street Station is not possible without storage and turning facilities located in close proximity to the station, and
- Full reverse signaling and universal interlockings at Dale and Falling Creek are essential to provide the operating flexibility and capacity to enable the train dispatcher to manipulate trains through the available windows between Rocketts and Main Street, over the James River Bridge.

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[3]Stopping a freight train between Dale and Rocketts would result in crossings being blocked, thereby, delaying cross-street traffic.

Route Realignment/Augmentation - Norlina to Raleigh

Norlina Siding

The north end of the next siding south of Bracey should be about 10-11 miles south of MP S87 or at MP S97-98. Norlina is at MP S98, which is where a stretch of double track previously began.

The route from Portsmouth, VA to Raleigh, NC was apparently constructed before the route from Richmond to Norlina, and the original route had no curves through Norlina. When the railroad was built from Richmond it was connected to the original line with a 5 plus-degree curve (60 mph) at Norlina Station. A 3-degree curve (75 mph) was located one and a half miles north of Norlina at MP S96.5. A 1.6-mile relocation using a 7000-foot long one-degree curve to tie the two routes together would create an eleven-mile long stretch between Paschall and Manson where trains could operate at a constant 110 mph. This would be the longest continuous high-speed length between Richmond and Raleigh. This relocation was used in the trip time analysis.

While the former double track extended to MP S103.6, the new Norlina siding is proposed to end at MP S102.

Greystone Siding

The north end of the next siding south of Norlina should begin in the vicinity of MP S112-113. A former signaled siding began at MP S112.5; that location would be ideal except the new siding would extend through Henderson with its many highway crossings. A non-signaled Greystone siding exists between MP S109.5 and MP S110.9.

Because of the closeness to the Norlina siding, it is proposed that only a 2.4-mile Greystone siding be installed between MP S108.9 to MP S111.3 mostly using the current siding. This siding would take place of the one that should be at Henderson.

Kittrell Siding

The north end of the next siding south of Greystone should begin in the vicinity of MP S121-122, 10-11 miles from Greystone. A formerly signaled siding at Kittrell extends from MP S121.9 to MP S123.5. It is proposed to reuse the current siding but extend it its limits to cover the area between MP S121 to MP S124.8.

Youngsville Siding

The north end of the next siding should begin in the vicinity of about MP S134-135. A formerly signaled siding at Franklinton extended from MP S129 to MP S130.5, but that siding is too close to Kittrell. However a non-signaled siding at Youngsville extended from MP S135.3 to MP 136.6. It is proposed to reuse the Youngsville siding and extend its limits from MP S133.9 to MP S 137.9.

Neuse – Crabtree Siding

The north end of the next siding should begin in the vicinity of about MP148. The north end of a former double track, now removed, was at Neuse (MP S147.6). The double track extended for six miles to MP S153.9 at Crabtree. It is proposed that this double track be rebuilt.

Edgeton to Southern Jct

The single track between Crabtree and Edgeton on the S Line north of Raleigh Yard would remain because a major bridge over Crabtree Creek can accommodate only a single-track. However, double track would be restored between Edgeton (actually south of the Edgeton curve (Curve S154.1) and Southern Junction. The restoration of this double-track would be essential to provide for efficient train movements throughout Raleigh. The south entrance to CSXT Raleigh Yard, located south of MP S156, would have hand-operated switches but the lead to the NCDOT Yard off S Line Track 1, located at Peace Street, would be interlocked to facilitate Richmond to Charlotte passenger train movement. Northward trains to both CSXT Raleigh Yard and the NCDOT Yard would operate on Track 1 between Southern Junction and the switches leading to the CSXT Raleigh and NCDOT yards.

Triangle Transit Authority has developed a phased plan that involves the development of a Regional Rail system supported by shuttle and local bus service. This service, planned to be operational by 2007, would use self-propelled, bi-directional, diesel rail cars using a separate rail line constructed within the existing railroad rights-of-way to connect Durham, RTP, Morrisville, Cary, Raleigh and North Raleigh. The joint utilization of the freight rail corridor will require ongoing coordination between freight, intercity rail, and transit personnel.

Southern Jct to Ashe

A series of track and interlocking improvements to facilitate passenger and freight operations through the existing Boylan Interlocking and the new Raleigh Station to serve proposed intercity operations, which would be located west of the existing Boylan Interlocking, the crossing with the old Norfolk Southern Railway to Varina would be constructed. The improvements would include:

- Reconfiguration of the crossovers between Tracks 1 and 2 at Southern Junction, located on the S Line west of the entrance to Glenwood Yard;
- Construction of a new Track 4 between Boylan Interlocking and Southern Junction Interlocking;
    - Track 4 would predominantly serve freight trains, but also could be used for passenger trains;
- Removal of the rigid crossing frogs at Boylan Interlocking and installation of a new interlocking to facilitate train movements displaced by the removal of the crossing frogs;
    - The new interlocking would provide the same progressive route that the crossing currently provides from Glenwood Yard through Raleigh to Varina on the original NS Railway;
    - The revised configuration would enable adequate spirals and superelevation to be installed in the ten-degree curve between Boylan and Hargett Street on the S Line. Speed on the 10-degree curve would be raised from the current 10 mph to 30 mph on tracks 1 and 2;

- Construction of a new Track 4, a third track south of Boylan Interlocking, which would be configured to accommodate the proposed station; and
- Construction of a new interlocking, Ashe (for Ashe Avenue) to facilitate train operations south of the new station.
- The station would consist of: a low-level, 24-foot wide center-island platform located between Tracks 2 and 4, and a second platform located adjacent to Track 1.

Route Realignment/Augmentation - H-Line: Raleigh To Greensboro

The North Carolina Railroad owns the 81-mile corridor segment between Raleigh and Greensboro. The 12-mile portion of the line between Raleigh and Cary, Fetner Interlocking, consists of a pair of single-track lines operated by NS and CSXT. CSXT trains cross the NS at Fetner to access the Aberdeen Subdivision to Hamlet. The remainder of the H Line to Greensboro essentially is single-tracked with passing sidings.

The alignment has numerous sharp curves, steep grades, and grade crossings. The controlling grade is –1.16 percent, between mileposts H38 and H39. TPC simulations reveal that freight trains ascending this grade decelerate to as slow as 11 mph. The line passes through numerous cities and small towns, Durham being the principal city. Existing sidings are located at:

- Durham,
- Funston,
- Efland,
- Mebane, and
- McLeansville.

The sidings are short, normally less than two miles, and are accessed through hand-thrown switches whose use is authorized by the dispatcher.

Fifty-nine mph is the existing MAS for passenger trains and forty-nine mph is the maximum for freight trains. There are numerous slow speed areas as the result of curvature and grade crossings. The line would be upgraded to have a 110 mph MAS. However, although passenger trains speeds would be increased throughout the line, numerous restricted speed locations would remain.

Traffic on this portion of the line would increase greatly:

- The number of passenger trains is expected to increase from four passenger trains per day to eighteen passenger trains per day.
- The number of freight trains is expected to remain about the same - approximately six or seven freight trains per day.

Sidings spaced to minimize delays to passenger and freight trains would be located between Fetner and Greensboro to accommodate this traffic increase.

Fetner Sidings

A siding would be installed just south of Fetner on the CSXT Aberdeen Subdivision. The siding would serve as a location where trains to and from the Aberdeen Subdivision may meet. If, for example, an eastbound freight train was to meet a westbound freight train at Fetner, the eastbound train can be held on the siding allowing the westbound train to easily access the lines, minimizing main line delays. The siding would be located so that a freight train occupying the siding would not block any of the grade crossings located just south of Cary Station.

Reconfigure Fetner Interlocking

Located at the junction of the H Line and the CSXT Aberdeen Subdivision, the interlocking enables CSXT trains on the CSXT owned track between Raleigh and Fetner to access the Aberdeen Subdivision and NS trains on the H Line track to access the H Line south of Fetner. The existing interlocking would be reconfigured to facilitate these train movements. A 1000-foot tangent would provide room for the interlocking between the two curves at Fetner. The interlocking can be reconfigured independent of the work on the Fetner or Cary Sidings.

Cary Siding

The Cary passenger station is located between Henderson and Academy Streets at MP H72.6. A 3.6-mile siding would be located just west of the station and would extend between MP H72.6 and Crabtree Creek at MP H69. Two highway crossings, one public and one private, would be located within the limits of the siding. The public crossing, Morrisville Blvd would have to be grade separated because of superelevation in both the Main track and the siding. The siding would not extend into Fetner Interlocking. It was anticipated that the siding would be used primarily by freight trains. The sidings provide locations for slow moving southward freight – climbing the four miles of significant grade south of Boylan, to be overtaken by a passenger train. The siding also would provide capacity to store a northward freight train if the route between Fetner and Raleigh was congested because CSXT and NS freight trains were occupying the tracks.

Brassfield Siding

A 3.5-mile siding between a new Brassfield Interlocking and a reconfigured East Durham Interlocking would enable freight trains to set off or pick up from Durham Yard without blocking the main track of the H Line.

The new siding would be provided on the east side (geographically west) of the current main track between Brassfield and East Durham. The existing track would not be realigned to improve speed through several short two-degree curves but rather the new main track be built with three 110 mph 1.5-degree curves (H56, H57, and H58). It is proposed that the existing tracks not be realigned at all but rather the new main track be built with the three proposed 1.5-degree curves good for 110 mph. The siding tracks, -could be good for 90-mph, but that would serve no real purpose because of the 45 mph entry and exit speed to the siding tracks.

A siding does not exist to enable a freight train to set off or pick up from Durham Yard without blocking the main track of the H Line. The yard is heavily used and appears to have very little remaining capacity. Therefore, a new main track would be provided on the east side (geographically west) of the current main track, which would become a passing siding. The existing siding would be extended north to Brassfield to provide additional capacity and provide a location for freight trains to stand or work independently of passenger trains.

The current configuration requires that working trains occupy the Main track. The south siding switch, actually a crossover, would be located at MP H56.9, the location where the CSXT Apex Line crosses the H Line. An existing, apparently unused siding would be upgraded to provide a tail track to facilitate switching at the south end of the yard clear of the main track. One Main track (the new track) and two sidings would extend between Brassfield (MP H60) and South Durham MP H56.9). The largest segment of track in these sidings without highway crossings would only be approximately one mile.

Durham Siding

Durham passenger station would be relocated to MP H54.8. A siding to enable passenger trains to meet would be installed between East Durham and West Durham Interlockings. The simulated schedule does not have passenger trains normally meeting at Durham; however, future schedules may include this meet. This siding would have numerous highway crossings located within its limits.

Funston-Glenn Siding

The north end of the next siding should begin in the vicinity of MP H50. The north end of the existing Funston-Glenn Siding would be at MP H49.7; the north end of the siding would be located at the south end of the Curve H49, a two-degree curve. The current south end of the existing Funston siding is at MP S48.5 and the siding would be extended southward to MP H44.1 to South Glenn and would include the short siding at Glenn MP H46.3, which is where the branch to Carrboro (Chapel Hill) joins the H Line. Wye tracks connect this siding to the branch track. The Funston end of the siding approximately has a two-mile stretch free of highway crossings.

The south end of the siding coincides with the south end of the recommended solution to reduce the curvature of Curve H44.1; an 11,000-foot relocation that would increase MAS to 100 mph or greater. The relocation would begin near the NC10 underpass west of the current west end of Curve H44.1 and would cut directly across Stony Creek valley on a 50-foot fill. It is estimated that about 800 feet in distance would be saved. The existing main track would remain in place as the siding and the newly constructed track would be the main track. The new track would bridge over the branch to Chapel Hill and an existing highway intersection would pass over the relocated track. There would be no connection between the new Main track and the Chapel Hill Branch.

Efland-South Mebane Siding

It is recommended that the existing Mebane siding, located between MP H31.6 and MP H32.4, be extended northward to include the existing siding at Efland (MP H36.7 to MP H37.5). A curve reduction at Efland would allow the existing Main track to become the new siding at that location. The extension would result in a 5.9-mile long siding between MP H31.6 and MP H37.5. However the south end of the Mebane siding would be closer to the north end of the proposed Burlington Siding than ideal. The north portion of the siding has a stretch over two miles without a highway crossing.

Mebane Interlocking would be constructed at MP H34 and would serve to facilitate the meeting of three trains within the siding.

Route Realignment/Augmentation – Haw River Siding

Applying the 10-11 mile spacing between siding switches criterion, indicates that the south end of the next siding from McCleansville (to be described next) should be at MP H22-23. That places the switch south of the Burlington passenger station. A siding does not exist at this location; therefore, a totally new siding called Haw River would be placed between MP H21.7 and MP H25.4. This siding cannot extend further north because it would involve reconstruction of the bridge over the Haw River. Besides, the north end of this siding would be only 6 miles from the south end of the proposed Mebane siding. Simulations show that numerous passenger trains would meet at this siding during each day. Approximately a two-mile stretch in the north portion of the siding and a 1.5-mile stretch at the south end of the siding would be free of crossings.

Pomeroy Street crossing is located in **Curve H23** and the turnout to Cannon Mills, an active industry, comes off the high side of this curve, it is recommended that the current main track become the siding. This would enable the industrial switch to come off the siding with less superelevation than the main track and the new main track would be constructed north of the current main track with appropriate spirals.

McLeansville Siding

An existing siding at McLeansville extends between MP H9.8 and MP8. It is recommended that the siding be extended northward to MP H11.8 and southward to MP H 7.8 to create a four-mile long siding. This siding would have an interval of about 1.6 miles where a freight train can stand without blocking any highway crossings.

English Siding

A new passing siding, English, would be installed from English Street at MP H1.7 to an upgraded Piedmont Line Track 3 at MP H0 in Greensboro. Two highway at-grade crossings would be located in the siding, and they may have to be modified to accommodate the siding, closed, or separated. The siding would be configured to accommodate the relocated Greensboro Station. The main H Line track would be relocated and connected to Piedmont Main Track 1 with a Number 20 Turnout. The siding track would connect to Track 3.

Route Realignment/Augmentation – Charlotte To Greensboro

Elm to Cox

Elm Interlocking would be reconfigured and all crossovers would be Number 20s. Parallel routes would be provided so that trains to and from the H Line can make simultaneous moves.

It is assumed that reinstalling the double track between Cox and Hoskins Interlockings, the following project, would be completed prior to this improvement. Therefore, the Elm to Cox improvements only would include the addition of a right-hand Number 20 Turnout that would provide access to Track 3,which would be extended southward from the Rail Street grade crossing. Track 3 formerly extended further south than it does today, therefore the extended track would be constructed where a track once existed. The new turnout at Cox would provide northward freight trains interlocked access to Track 3 at 40-45 mph. Signaling on Track 3 would extend northward to the Intermodal Terminal at MP 287.2. From that point to Aycock Street, MP 285.5, Track 3 would not be signaled; it would be operated under yard rules under control of a yardmaster. Signaling Track 3 as a main track between these points is not recommended.

The new number 10 crossovers and turnouts at Pomona Interlocking would be located on tangent track. The configuration should fit between existing signals. Signaling would indicate whether the number 20 crossover or the number 10 crossover between Track 1 and Track 2 is set to provide the diverging movement. Diverging clear or diverging approach aspects would be displayed only when the 45 mph crossover is reversed. Most likely, a restricting aspect would be used to indicate when the route containing a number 10 turnout or crossover is to be used.

The hand-operated number 10 crossover between Tracks 3 and Track 1 near the Intermodal Terminal would be relocated northward into the interlocking in the vicinity of Holden Road. The low signals in Track 3 would normally display restricting for yard moves. The train dispatcher would require the permission of the yardmaster to take control of these low signals adjacent to Track 3. Thus, the dispatcher would not be concerned with movements on Track 3 until he/she needs to use the crossover.

Cox to Hoskins

Presently Cox (MP 289.3) is the north end of a single-track segment extending to Hoskins (MP 298). It is recommended that double track be restored between Cox and Hoskins. Cox Interlocking would be relocated and reconfigured. Because of the large number of trains (about six a day) that would be diverting from Track 1 to Track 2 at Cox to use Track 2 between Cox and Elm, a left-hand Number 32 crossover good for 80 mph would be installed in Cox Interlocking. Hoskins would be made universal with two number twenty crossovers.

Thomas (MP 307) to Lake (MP 314)

The double track from south of Hoskins presently extends southward to Bowers (MP 309.8. The five-mile segment between Bowers and Lake (MP 314) presently is single tracked. The double-track segment between Bowers and Lake would be reinstalled.

The north end of one of the three high-speed passing sidings between Greensboro and Charlotte would be installed between MP 307, south of Thomasville, and Bowers. Bowers Interlocking would be relocated to MP 311.4, north of a two-degree curve. Bowers would be configured to provide universal move capabilities with number twenty crossovers. Lake, located three miles south of MP 311, would be eliminated. The high-speed passing siding would be located between both main tracks. Forty-five mph crossovers would provide access for northward and southward trains to the center siding. The north end of the siding would be called Thomas. In addition to the number twenty turnouts to/from the siding, the new Bowers interlocking would also have a pair of number twenty crossovers between the main tracks. The new center siding would enable faster passenger trains to overtake slower moving freight trains without having to divert to the opposite track and then back again in the face of opposing traffic.

Yad (MP 328.6) To Salisbury (MP 333)

The second of the three high-speed passing sidings between Greensboro and Charlotte would be installed between Yad (MP 328.6) and Salisbury (MP 333).

Yad Interlocking, a new interlocking, would be located south of Curve 329, the north end of which abuts the Yadkin River Bridge.

The existing crossovers in the current Saljct interlocking are sandwiched between curves. Therefore a portion of the interlocking would be relocated northward about 1500 feet to ensure that turnouts and crossovers are on straight track. However, because several curves in Salisbury have highway crossings in them, it is proposed to maintain the current superelevation and alignment and restrict the speed to 70 mph through the city of Salisbury.

Saljct Interlocking

Reverse curves on Tracks 1 and 2 At Saljct appear to off set the two main tracks one-track center space. Therefore, the yard track adjacent to the present Track 2 would be aligned into the existing Track 2 creating a nearly straight track north of MP 333, eliminating the reverse curve in Track 2. Most of the current Saljct interlocking is located on a short tangent south of MP 333.

Saljct Interlocking would be reconfigured to locate the interlocking north of the reverse curve. The Asheville Line tracks would be extended northward and parallel 30 mph routes would be provided to enable northbound and southbound Asheville Line freight trains to operate simultaneously. The primary southbound Asheville Line route would consist of

- A right-hand number 15 crossover between the center siding and Track 2, and
- A right-hand number 15 turnout leading to Asheville Line.

A left-hand turnout from the southbound Asheville Line track would provide a connection to the northbound Asheville Line track.

A right-hand number 20 crossover from Track 1 to the center siding would be located immediately north of the number 15 crossover.

The primary northbound Asheville Line route would consist of:

- A right-hand number 15 crossover between the northbound Asheville Line track and Track 2, and
- A number 20 crossover between Track 2 and the center siding.

The parallel connections to the Asheville Line would enable a northbound Asheville Line freight train to access the center siding[8] while a southbound Asheville Line freight train access the southbound Asheville Line from Track 2.

A left-hand number 20 would provide access from Track 1 to the center siding. A left-hand number 20 crossover would provide access from the center siding to Track 1

Connections to the yard would be a number ten turnout and a number ten crossover.

South Salisbury and Salisbury Station Configurations

The speed on the south Wye at Salisbury is only ten mph. A number 10 Turnout connects the south leg of the Salisbury Wye[9] to Track 2 of the Piedmont Main Line at Kerr Street (MP 333.5). Currently one passenger platform exists along Track 2 between Kerr Street and Council Street, therefore every northward passenger trains stopping at Salisbury would have to operate left-handed on Track 2 between Sumner (MP 339.3), a new Interlocking described in a subsequent project and at least Saljct (MP 333). That practice would be unsatisfactory for future operations. Therefore platforms would be located adjacent to both Tracks 1 and 2. The current left-hand crossover between Tracks 1 and 2 would be moved southward out of the station area to south of Innes Street (MP 334.9). It would be a number twenty crossover good for 45 mph.

Provisions would be made to add new Tracks 4 and 6 in the station area to accommodate future commuter trains or Asheville trains, these tracks would not be built until such service is implemented.

Yadkin Junction at MP 334.5, which is about one mile south of Salisbury Station, consists of a run around track adjacent to Track 1 and a hand operated turnout to the former Yadkin Railroad now the NS N Line. One train per day has been assumed to operate to and from the branch. No change is proposed for this location.

Reid (MP 337.3) to North Kannapolis (MP 347.4)

Salisbury to Reid, MP 337.3, presently is double tracked. Reid to North Kannapolis, MP 347.4, presently is single tracked. A number of active industries are located on the single track. Most likely local freight trains either have difficulty obtaining track time to do their work or freight trains are held to give local trains time to work, double track would be necessary if this problem is to be minimized. It is recommended that the double track between Reid and North Kannapolis be restored to minimize the local service freight problem, when passenger service is increased. This segment of double track construction would have a high priority.

Saljct (MP 333) and Reid (MP337.3) are four miles apart, while Reid and North Kannapolis are located ten miles apart. Consequently, Reid is too close to Saljct and

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[8] The right-hand number 20 crossover would enable the northbound train to crossover to Track 1, if necessary.

[9] The south Wye apparently is quite sharp; according to the employees' timetable the use of dynamic brakes is prohibited.

too far from North Kannapolis. Therefore it is recommended that Reid interlocking be relocated to a point about midway between Saljct and North Kannapolis, approximately MP 339.5. The new interlocking would be called Sumner.

Kannapolis (MP349.5) to Adams (MP 354.1

North Kannapolis (MP347.4) to Haydock (MP360.1) currently is double tracked. Kannapolis and Concord are located in this segment. Interlocked crossovers at Adams (MP 354) are located approximately midway between North Kannapolis and Haydock. It is recommended that the third of the three center sidings between Charlotte and Greensboro begin at MP 349.5, at the north end of the long one-degree curve (East C Street), and end at Winecoff School Road at MP 352.9. C Street, formerly the southernmost grade crossing in Kannapolis, has been removed. The siding is much shorter than desired, however, the 317-foot bridge over I-85 prevents the end of the siding from being extended farther south to Adams.

Adams is located exactly where the siding should end, but rather than having an interlocking at MP 353 and another at MP 354, Adams would be relocated northward one mile to MP 352.9. Placement of the interlocking at MP 352.9 would not be easy. The left-hand crossover between Tracks 1 and 2 would be placed north of the bridge over I-85 and the crossovers and turnout providing access to the center siding would be located north of Winecoff School Crossing. The widening of the two main tracks to make room for the center siding would be accommodated by a redesign of Curve 306, a one-degree curve south of the crossing. The left-hand crossover providing access to the center siding from Track 1 and the right-hand turnout providing access to Track 2 from the center siding would be installed adjacent to the Winecoff School crossing. A right-hand crossover between the center siding and Track 1 would be installed north of these turnouts. Despite the short length of the siding a clear space of nearly two miles would exist so that a freight train can be held without blocking any highway crossings.

Haydock (MP360.1) to Junker (Existing at MP 371.2)

Haydock to Junker (MP 372.2), a distance of about twelve miles, currently is single tracked. It is proposed that double track be restored between Haydock and Junker. The segment between Adams and Junker is about eighteen miles therefore it is recommended that an interlocking **Shamrock**, consisting of a double crossovers, be located about half way between those locations, at about MP 363, just north of Shamrock Road. It is proposed that Haydock interlocking be removed when double track is restored.

Junker (Proposed new at MP 372.2) to AT&O Jct (MP 375.3

A third track, new Track 3, would be installed between Junker Interlocking (MP 372.4) and A.T. &O Jct (MP 375.3). Junker Interlocking would be configured to enable southward freight trains to enter Track 3 at 45 mph. Track 3 also would provide a holding location for a southward freight train to wait short of the yard without blocking Track 2. This is essential to facilitate the operation of 17 daily southward intercity and commuter passenger trains.

AT&O Jct (MP 375.3) to North End Charlotte Station (MP377.5)

Northward Freight Track

The yard track adjacent to Main Track 1, called Track 3, would be upgraded to serve as the northward freight-working track. Northward trains would enter Track 3 at a new interlocking (named Stadium because of its location next to Erickson Stadium, described in a subsequent project) immediately south of the proposed new passenger station. Northward freight trains then proceed to their working location near MP 375.5 without interference from or interfering with other NS freight trains or passenger trains. However, they would have to cross the CSXT tracks at grade, at Graham Interlocking. The northward freight train working location is about 7,500 feet from the CSXT crossing; so nearly all trains should be able to work with the rear of the train clear of the CSXT at-grade crossing. However, Lidell Street may be blocked. The potential of closing or eliminating this crossing should be evaluated. Northward working freight trains that arrive before the previous working train departs would wait south of the CSXT crossing, leaving the crossing clear for CSXT trains. Over 25 CSXT moves per day, including yard moves, would use the crossing.

A.T. & O Jct would be reconfigured to enable freight trains to access Track 1 at 30 mph upon completing work. A new interlocked crossover from Track 3 to Track 1 would replace an existing hand operated crossover between the yard and Track 1. Two right-hand crossovers between Tracks 3 and 1 and Tracks 1 and the yard track adjacent to Track 3 would be removed. Since northward working freight trains would no longer occupy the Main Tracks, these crossovers would no longer be needed. A pair of crossovers, located between Tryon Street and Lidell Street, between the same tracks would remain for emergency use.

Southward Freight Track

A new connecting track leading southward out of AT&O Jct. would parallel the switching ladder at the north end of the yard so that standing or arriving working freight trains would not block switching operations.

The new connecting track would tie into the existing easternmost track in the yard, which is adjacent to the Intermodal Terminal, and would be upgraded to become a new running Track 4 between A.T. &O Jct. and Tryon Street.

The rear of a long southward freight train working at Charlotte Yard would be at, or north of, A.T. &O Jct; which is the reason that Track 4 would be isolated from the switching lead. Track 4 would become Track 1 at Stadium Interlocking, south of the proposed Charlotte passenger station.

The configurations described would enable northward and southward freight trains to set-off and pick-up at Charlotte, without conflicting with each other. The goal of enabling passenger trains and non-working freight trains to have their own tracks would be achieved.

Tracks 3 and 4 would be signaled between Stadium Interlocking and Tryon Street. Track 3 would have a 30 mph maximum speed between Stadium Interlocking and A.T. &O Junction. The hand-operated crossovers south of Tryon Street would be electrically locked. All switches on Northward Freight Track 3, between Tryon Street and A.T. &O, Jct would have switch locks installed to enable the 30 mph MAS to be established between Tryon Street and A.T. &O Jct. Eliminating the yard speed on Track 3 and increasing MAS to 30 mph would enable long trains that have finished their work to accelerate to 30 mph prior to accessing the Washington to Atlanta Main Line.

Charlotte Station, 6th Street Interlocking to Stadium Interlocking

Charlotte Passenger Tracks And Passenger Station

Charlotte Station, located at MP 377.9, would consist of three tracks west of Track 3. Tracks 1 and 2 between A.T. &O Junction and Stadium would be the passenger tracks through Charlotte.

At this time, only three station tracks are planned. Two additional station tracks may later be placed east of Track 4 for a possible commuter service entering from the CSXT. A second at-grade crossing over the CSXT, at Graham, may be restored to provide access to the former O Line to Monroe, for additional commuter service. Freight trains that pick up or set off at Charlotte would not use the passenger tracks.

Stadium interlocking, just south of Charlotte Station, would be arranged so that freight trains can move in parallel to and from Tracks 3 and 4. It is assumed that most southward freight trains going to Columbia would operate left handed between Stadium and Charlotte Junction (3.5 miles).

Charlotte Station to Charlotte Airport

Extending high-speed trains from Charlotte Station to the Airport Station would provide access to Charlotte Airport. The Airport Station would be located adjacent to the Airport Freeway. Just south of Little Rock Road a loop track for turning trains terminating at Charlotte would diverge westward from the southbound main track, passing over both main tracks and rejoining the northbound main track. The Airport Station would consist of platforms adjacent to Tracks 1 and 2.

Two Washington to Atlanta trains entered/departed the SEC at Greensboro; these trains also stopped at the Airport Station.

A left hand Number 15 turnout at North Advance will be upgraded to a Number 20 Turnout to improve access to the NS line to Columbia, SC from the Piedmont Main Line.

Commuter Rail Service to the Airport Station

Three of the seven commuter trains from Concord each morning turned back to Concord for a second trip. Thirty-minute headways from Concord for this service were assumed. If these trains operated to the Airport they would not be able to return to Concord for a second trip and additional equipment sets would be required. Layover facilities in Charlotte for day storage of commuter trains have not yet been identified. It was assumed that over night facilities will be provide somewhere near Adams Interlocking.

Maintenance and Layover Facilities

NCDOT Raleigh Storage Yard and Servicing Facility

The existing facilities, located adjacent to the S Line between Southern Jct and Edgeton, would be expanded and upgraded to accommodate the increased level of daily passenger service, five round trips instead of the one presently operated, between Raleigh and Charlotte.

Charlotte Storage Yard and Servicing Facility

An efficient storage yard and maintenance facility in the vicinity of Charlotte Airport Station to store trains both during the day and overnight, enable various equipment cleaning functions to be performed, and accomplish assigned maintenance functions. The facilities would ensure that passengers traveling northward from Charlotte are provided safe, reliable, and clean trains. The new passenger storage and servicing tracks would be just south of Little Rock Road east of the northbound main track. Three equipment sets are projected to layover at night at the Airport.

The storage yard would provide sufficient yard storage capacity to handle overnight layovers for trains scheduled to depart Charlotte the next day, and to store equipment scheduled for maintenance. Additional space should be preserved for future Charlotte to Atlanta service.

Station Improvement Projects

The provision of marketable (and potentially profitable) station facilities, parking, and amenities will merit careful attention and focused investment in the preparation of a development plan for the Southeast Corridor. Stations represent the beginning and end of each passenger's experience with the railroad and as such will play a significant role in providing improved passenger service in the Southeast Corridor. Stations will serve as the focus for local participation and investment, as an image-builder for train service, and as an enhancement to passenger comfort and convenience.

This study has emphasized train operations and related facilities, and therefore has confined itself to identifying only a few of the many issues related to stations; cost estimates for all station improvements have not been developed. The corridor partners will, however, need to devote significant resources to this topic if rail service in the corridor is to be optimized.

Stations

Although several stations have benefited from recent refurbishment efforts, certain of the stations in the corridor would have to be upgraded to conform to track alignment enhancements and to properly attract and accommodate the increase in traffic made possible by the high-speed service. Marketing studies would be needed to properly direct station investments and train schedules at these locations.

Upgrade Petersburg Station

The present station has one platform, on the north or eastbound track. The construction of a new S Line track on the west side of the existing tracks through the station would require that a second platform, adjacent to the S Line track, be constructed[10].

Restore Henderson Passenger Station

Passenger service to Henderson ceased when Amtrak discontinued limited service on the S Line in the late 1980s. Restoration of passenger service would require construction of station and platform facilities.

Raleigh Station

Neither the present Raleigh station nor the old Seaboard station, located in North Raleigh on the S Line, would be used. A new multi-modal terminal (serving bus, TTA, long distance bus, taxi, auto, etc) would be located west of existing Boylan Interlocking, the crossing with the old Norfolk Southern Railway, to Varina. A new interlocking, Ashe (for Ashe Avenue), would facilitate train operations south of the new station. A low-level, 24-foot-wide center-island platform would be located between Tracks 2 and 4; and a second platform would be located adjacent to Track 1. The simulation revealed that the platform configuration and the adjacent interlocking were shown to have important capacity implications.

New Amtrak Station - Durham

In July 1996 the City of Durham and the NCDOT opened a new interim station downtown. The station replaced a small bus-type shelter that served the City for six years. A new multi-modal center, with an island platform for intercity passenger service, is planned for Durham in the vicinity of the old Liggett & Myers Tobacco Company. The site is located alongside the longest section of track unbroken by city streets in downtown. The multi-modal center will be adjacent to several other historic buildings that are being refurbished for residential, entertainment and office use.

Relocated Greensboro Station

The relocated Greensboro passenger station would be placed where the former Southern Railway station is situated in Greensboro, just east of Elm Interlocking. Two low-level island platforms would be provided. One platform would between the NS Main tracks and the other would be between the H Line and English Siding, described in the discussion of the H Line. A walkway under the main tracks would connect the two platforms. Once the station is reactivated and the new platforms and pedestrian access structures constructed, passenger trains would no longer stop in Pomona. The English Siding would be configured to access the H Line platform.

I-485 Station – North of Charlotte

The Richmond to Charlotte corridor study identified the need for a beltway station to be located north of Charlotte in the vicinity of MP P367 where I-485 passes over the rail line. University City Boulevard parallels the rail line at this location. The station would be used by intercity and commuter passengers. The benefit to both modes of the

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[10] Alternative routes through Petersburg are presently under evaluation as part of a study to extend high-speed rail service to Norfolk.

interface of rail passenger service and major regional highways has been successfully demonstrated at New Carrollton station located north Washington. The rail station constructed in the early 1980s has proven to be an effective traffic generator.

Convenient access to I-485 would be provided. The station would serve the rapidly developing area north of Charlotte. It was assumed that all Richmond to Charlotte and Raleigh to Charlotte trains would stop at the station. Proposed Concord to Charlotte commuter trains also served the station.

Charlotte Airport Station

The benefit to both modes of the intermodal interface of high-speed rail and regional air service has been effectively demonstrated at Baltimore Washington International (BWI) Airport, located between Baltimore and Washington. The BWI Airport Rail Station, constructed in the early 1980s, has proven to be an effective traffic generator of air-to-rail and rail-to-air transfers.

The success of the BWI connection has resulted in the planning for a similar connection at Greene Airport in Providence, RI, and led to the recommendation that an intermodal rail-air station be constructed adjacent to Charlotte Airport. The airport is located approximately six miles southwest of downtown Charlotte, adjacent to the NS Washington to Atlanta Main Line.

Extending high-speed trains from Charlotte Station to the Airport Station would provide this interface. The extension requires that a servicing and storage yard be constructed south of the Airport Station, which would be located adjacent to the Airport Freeway. Just south of Little Rock Road, a loop track for turning trains terminating at Charlotte would diverge westward from the southbound main track, passing over both main tracks and becoming parallel to the northbound main track. The new passenger storage and servicing tracks would be just south of Little Rock Road, east of the northbound main track.

Other Stations: Burlington, High Point, Kannapolis, and Cary Stations

Various improvements to accommodate the projected intercity service levels may be necessary at each of these stations.

Americans with Disabilities Act (ADA) Issues

The ADA requires reasonable accommodation of the needs of the disabled. To implement the transportation provisions of ADA, the U.S. Department of Transportation has issued rules that require all Amtrak stations to meet ADA standards by 2010, with the exception of flag stops. These standards include: accessible routes, signage to include Braille, full accessibility to both north- and southbound platforms, new platforms with tactile edging and striping, modified ticket counters, updated public address and telephone systems, and accessible restrooms.

To meet these standards, various improvements would be implemented at Amtrak stations, including but not limited to: new platforms, new lighting and canopies, and improved public address systems. These actions would make all Amtrak stations, fully accessible to disabled passengers.

While assuming that Amtrak, NCDOT, and VDRPT will accomplish the ADA modifications, this study has not identified the related costs.

Station Platforms

Low-level platforms are assumed to be constructed or to be upgraded at all stations, which generally handle lower volumes of intercity passengers. Provision for future high-level platforms, when justified by ridership, should be included. The installation of audio and visual warnings of approaching trains is recommended at locations where non-stopping train speeds would exceed 45 mph.

The cost of the platforms is included in the projects identified for Petersburg, Henderson, Raleigh, Greensboro, Salisbury, I-485, Charlotte Station, and Charlotte Airport Station. Requirements at other stations were not evaluated as part of this study.

Parking

Enhanced train service would necessitate expanded parking facilities at existing intercity stations along the Corridor. Parking at existing stations most likely would not accommodate the projected passenger volumes. Follow-on planning and design work would project the number of spaces needed at each.

New stations serving intercity traffic (for instance, Charlotte I-485) would, of course, need parking facilities, which the design phase for these facilities would identify.

Station/Parking Access

Automobile access to existing and proposed station facilities also will have to be evaluated as part of the follow-on planning and design work.

Grade Crossing Improvements

Increasing speeds and the frequency of trains raises concern for safety at the numerous public and private at-grade highway crossings on the rail lines between Richmond and Charlotte. All of the public crossings are protected, at a minimum, by crossbucks, flashing lights, gates, and ringing bells.

Protection and Elimination

The VDRPT has an on-going program to identify crossings that can either be:

- Eliminated, through closing them:
- Separated, through construction of a bridge on underpass; or
- Improved, through the installation of more extensive and move highly visible protection devices.

Decreasing grade crossing hazards is an essential element of ensuring safety in implementing HSGT on existing lines. Virginia received about $4 million under Section 1010 of ISTEA for high-speed rail grade crossing improvements, and is eligible for additional funding under TEA 21 section 1103(c). Completed and planned grade crossing improvements north of Richmond to date include construction of a pedestrian bridge and new roadway bridge at Featherstone in Prince William County, and the provision of Constant Warning Time systems at crossings.

In conjunction with development of the Southeast Corridor, NCDOT has instituted an innovative highway/rail crossing hazard elimination program known as the Sealed Corridor Initiative. Aided by Federal funding under the ISTEA and TEA-21 specialized high-speed rail grade crossing programs and the Next Generation High-Speed Rail Program, the Sealed Corridor Initiative aims at improving or closing every crossing along the North Carolina portion of the Southeast Corridor, thus helping to ensure safe high speed operation along the line. NCDOT has developed a comprehensive strategy for treating the different types of crossings across the route, with solutions including four-quadrant gates, longer gate arms, inexpensive median barriers, and video enforcement. Video surveillance at specific unimproved and improved crossings has provided incontrovertible proof that advanced highway-rail crossing protection systems, such as four-quadrant gates and median barriers, reduce driver "run-around" violations dramatically and thus significantly reduce the risk of train/auto collisions.

The Sealed Corridor Initiative serves as a model for grade crossing hazard elimination. With its program of technology installation, testing, and assessment, the Initiative is a prime example of a cost-effective, comprehensive, corridor-wide grade crossing treatment. This experiment has provided useful information to the FRA, the FHWA, and the other States as they work to enhance grade crossing safety on other emerging corridors.

Safety is a primary concern when raising speeds between Richmond and Charlotte. Higher speeds will require, at minimum, that the actuating circuits be lengthened to initiate warnings sufficiently in advance of the arrival of the faster trains. Faster trains take less time to traverse the length of the circuit, and reach the crossing sooner than slower trains. At crossings with fixed circuits, warning time must be set for the fastest possible train. This creates a potential problem, in that when a slow train approaches the crossing, the gates are held down for an inordinate amount of time. Some motorists loose patience with the situation, and drive around the gate at the risk of a collision.

Constant Warning Time circuits can offset this problem by automatically adjusting the length of the warning to a time appropriate to the speed of each individual oncoming train. The system has the ability to determine the speed of an approaching train, and initiate the crossing warning cycle so that a predetermined period of warning will have transpired when the train reaches the crossing, regardless of the train speed

A new innovation, which could be applied at selected crossings, is a system of four-quadrant gates, wherein four gates, instead of two, are lowered across the traffic lanes, blocking both directions on both sides, and barriers are placed down the center of the roadway. This system prevents a motor vehicle from driving around the gates after they are lowered. The possibility of closing additional crossings must also constantly be re-examined.

Effect on Speed on Crossings Located on Curves

Speed is a significant concern when considering increased speed on crossings that are located on curves. In numerous instances, an increase in superelevation would be necessary to attain the projected increase in speed planned over the crossings and reduce lateral “G” forces felt by the passengers.

With superelevation, the outside rail on each track on the curve is raised as much as six inches above the level of the inside rail. With a multiple-track crossing, which many crossings are and will be after the improvements, this means that there is a series of inclines to be crossed, one between the rails of each track, and a dip from the slope of one track to the next. There is also likely to be a slope upward to the tracks on each side, the one on the outside of the curve being significantly greater than the one on the inside of the curve. This is not practical on a heavily traveled road, and may require that these crossings be closed, or grade-separated. Analysis will be required to develop a recommendation for each crossing.

Grade Crossing Summary

With the introduction of more trains, many of which would be traveling at higher speeds, it is imperative that the effort be continued to eliminate as many crossings as possible, and increase protection on those that remain. Efforts to eliminate lightly used crossings, by finding alternatives, or other means, should continue. Separation of traffic at as many high-density crossings as possible must be achieved. Improved crossing protection should be installed at crossings for which separation cannot be justified.

Improvements Evaluated By Others

The Main Street Station Improvement project previously was evaluated by others and is incorporated in this report to ensure that projects impacting train operations or facility considerations are included. The cost of the track and interlocking improvements required to provide the capacity and achieve the desired operational flexibility are listed in a previous project.