NS RUTHERFORD INTERMODAL FACILITY EXPANSION

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ABSTRACT
The 200-acre Rutherford Intermodal Yard east of Harrisburg, PA is a critically important hub for Norfolk Southern’s mid-Atlantic intermodal rail operations. The 40-acre expansion was needed to support the rapid growth of regional intermodal freight traffic and is part of the railroad’s Crescent Corridor.

Major design and construction challenges included:
- Balancing earthwork and designing a level facility that parallels a mainline on a 0.6% grade
- Working in a narrow corridor within the existing facility while coordinating construction activities with active train and intermodal operations that included:
  - Minimizing impact to roughly 9 daily intermodal trains operating at Rutherford during construction.
  - Minimizing impact to the 220,000 plus yearly intermodal lifts of containers/trailers.

This project was completed in two phases extending over three years. Phase I included the relocation of Triple Crown Services a subsidiary of NSR where trailers are both a road trailer and rail car. Phase II was the IMF (Intermodal Facility) Expansion and involved 4 pad and 4 support tracks, concrete crane ways, 687 trailer parking spaces and maintenance facilities. There was 406,000 cubic yards of earthwork, drainage/storm water management, 84,000 square yards of roller compacted concrete, mechanically stabilized earth wall (MSE), cast-in-place retaining wall, reinforced soil slope wall (RSS), utility installations, high-mast lighting, security equipment, 37 switches, 46,000 feet of track and 47,000 tons of ballast.

NS’s Design & Construction Department oversaw the development of plans and construction of the project with the assistance of Michael Baker International. The project was funded by the Federal Highway Administration (FHWA) and NS for a total construction cost of $73.1 million.

The new facility opened October 1, 2015 on schedule.

INTRODUCTION
Norfolk Southern’s Rutherford Yard has a dynamic history. Originally constructed in 1906 as a classification yard for the Reading Railroad, the yard has transformed from a nearly abandoned classification yard in the 1980s to a Triple Crown terminal in 1992 and finally an intermodal yard. The initial intermodal conversion, completed in 2000, was constructed to handle the anticipated increased intermodal traffic between the South and the Northeast due to NS absorbing much of Conrail. As an intermodal facility, Rutherford Yard was ideally located to serve the Harrisburg market providing primarily north-south Intermodal service but also offered direct non-stop premium service to and from Chicago.

To meet the increased demand for rail intermodal capacity in the Harrisburg Region and the FHWA Freight Analysis Framework forecasting that the tons of freight transported in the US are expected to double from 2006 levels by the year 2035, NS proposed an expansion of the yard. The current facility was
operating near capacity and NS proposed an expansion that would increase annual lifts by 50% to roughly 350,000.

Norfolk Southern in partnership with the Common Wealth of Pennsylvania submitted the project to the U.S. Department of Transportation in 2011 for TIGER III funding. The project was awarded funding and design work began in late 2011.

EXISTING SITE

Due to the favorable terrain, the original classification yard was constructed five miles east of Harrisburg. Here the mainline tracks were on a summit with grades of 0.5% descending both east and west from a point about midway between the locations of the proposed humps (Proceedings of the 9th Annual Convention of the American Railway Engineering Association, 1908). This site was an ideal location for a classification yard but not an intermodal facility of today’s standards. The two existing mainlines running through the middle of the site were relocated to the outside freeing up room for the new yard and to allow room for future extensions of the yard. This decision in the 1900’s would later impact the design of the intermodal expansion in 2011. At the time, this work required up to five steam shovels moving 600,000 cubic yards of unclassified material, all of which was deposited on site (The Rutherford Gravity Yard of the Philadelphia & Reading Ry., 1907). In 2000, the initial intermodal facility construction required moving 300,000 cubic yards of the material again to the east and stockpiled as shown in Figure 1.

![Figure 1 - Eastern Stockpiled Material](image)

DESIGN ISSUES:

Grading

Norfolk Southern’s Design and Construction Department (D&C) started developing conceptual plans to expand the facility in 2011. The conceptual plans showed moving the existing Triple Crown facility and
entrance farther east and expanding the yard through the 300,000 cubic yards of stockpiled material from
the previous project. Once initial conceptual plans were approved by management including the
intermodal and transportation groups, Norfolk Southern’s D&C engineers partnered with Michael Baker
International to develop detailed construction plans. Under the direction of D&C, the first task was to
balance the cut and fill volumes while maintaining a flat, level facility running adjacent to a mainline on a
0.6% grade to the north and an industrial lead track and Grayson Road to the south. To meet these
demands, various types of walls and berms would need to be used. D&C and Michael Baker International
evaluated each section and determined which type of wall was best suited based on function and cost
while maximizing the footprint of the proposed expansion.

Adjacent to Grayson Road, the Industrial Lead Track needed to be raised about 23 feet while staying
within the existing NS right-of-way. NS decided that a reinforced soil slope wall would be the most cost-
effective solution at this location while maximizing the amount of material used on-site. The 2,000 foot
reinforced soil slope wall incorporated wire mesh baskets and geotextile fabric so that the fill slope could
be increased to a 1:1 ratio while still providing support of the Industrial Lead and support yard tracks.

The north side of the project had two walls back-to-back. The topmost wall would support trailer parking
and the bottommost wall would support a crossover track between the northern half of the yard and the
southern half of the yard. The topmost wall was designed using an MSE wall. The MSE wall included
precast facing panels supported by 19 foot straps with a precast barrier on top. The precast barrier would
also prevent trailers backing over the wall onto the crossover track. The MSE wall was elevated 13 feet
higher than the beginning of the crossover track. The crossover track came off the lead to the existing
facility and had to raise 13 feet to meet the proposed facility elevation. NS proposed using a concrete
cantilever wall to support that crossover track as it rose in elevation from the second lead track to the
proposed facility elevation. The 2.5 foot thick footing varied in width from 16 feet wide up to 19 feet.

Drainage

The areas surrounding Rutherford yard have grown and new development has replaced once empty lots.
The yard has unfortunately been on the downstream side of much of the development. The current yard
was receiving the upstream flow from areas north and south through an enclosed culvert system under
the yard that eventually drained to an existing 42” corrugated metal pipe (CMP). Due to various
commercial development and other infrastructure related projects, the railyard outlet and existing 42”
CMP had been negatively impacted causing flooding in various areas surrounding the yard. Upon further
investigation, it was believed that the invert of the 42” CMP culvert had been raised roughly 10 feet and a
“reverse manhole” installed. This created major impacts to the 42” CMP that was already functioning with
a limited hydraulic capacity compared to the 580 acre drainage tributary to it. It was calculated that the
existing 42” CMP had a 60 cubic feet per second capacity while the 10 year peak flow was 490 cubic feet
per second. This was a significant chokepoint for the drainage in the surrounding areas although it was
not the only drainage restriction. Crossing the railroad near 72nd Street was a 2’ x 3’ box culvert. The
culvert’s flow had been restricted for quite some time for unknown reasons. The 2’x 3’ box culvert
collected much of the water from the development south of yard and later ran along a swale/drainage
ditch to north eventually draining to the 42” CMP. These restrictions often had frequent and significant
impacts to the community. When drainage could not be conveyed through the existing drainage system
under the yard and along the ditch it would start ponding in Grayson Road. The road would eventually
flood and result in frequent roadway closures.

NS and Michael Baker International started looking at installing a new detention basin for the existing and
proposed drainage. The first task was to clean the “reverse manhole” to allow free flow of the drainage.
Secondly, the current drainage would ultimately be diverted to a new detention basin. This would reduce
the peak flows of the current system. NS additionally added debris collection systems to ensure the flow
of the system was maintained by intercepting grit and sedimentation. To alleviate flooding along Grayson
Road a relief channel was installed between Grayson Road and the industrial track. As construction
began, the facility experienced a significant storm event during the expansion, even with the
improvements only partially constructed; it outperformed the prior drainage system.
CONSTRUCTION:

Grading & Drainage

The project in itself was complicated but made even more difficult by the active rail operations ongoing at the facility. The existing intermodal facility to the west was operating at full-capacity handling over 225,000 lifts per year while Triple Crown Services operated their own facility to the east. Additionally, a mainline track ran through the middle of the expansion area.

Construction of the facility started on October 9, 2013 and proved to be a challenging time to start grading and drainage work due to the severe winter weather of the Northeast. As previously stated, 406,000 cubic yards of material needed to be excavated with a majority of that earthwork being the 300,000 cubic yards of existing stockpiled material. The stockpiled and excavated material had to remain onsite and was used to construct the table top surface of the facility as shown in Figure 2. This was accomplished by raising the elevation at the east end of the facility by twenty-four feet at the highest point.

Prior to performing the grading, there was a series of deep pipe runs that needed to be installed to connect and redirect the existing drainage structures that would be impacted as part of the construction of the facility. There was also a new pipe run that was installed down through the center of the expansion area and then crossed under the NS mainline and discharged into the newly constructed detention pond.

![Figure 2 - Proposed Intermodal Expansion](image)

CONSTRUCTION OF THE WALLS:

The excavation and grade differences necessitated three walls to be constructed to maximize the space due to the confined area controlled by Grayson Road on the south and the NS mainline to the north. These walls consisted of:
• **Cast-In-Place Wall**: This wall was constructed to address the elevation change needed to have the lead track off the existing Thoroughfare track to provide rail access to the active Triple Crown tracks. This wall was 414 feet long, 18 feet high at the highest point, 2 feet thick at the base and 1 foot thick at the top with a handrail along the entire length.

• **Mechanically Stabilized Earth Wall**: This wall was required to provide the elevation required for the truck parking lot above the Triple Crown Lead adjacent to the cast-in-place wall. This wall was 615 feet long, 17 feet high, and included a single face barrier cap along the top to provide protection to the track below so that the trailer parking operation along the top would not back over the wall.

• **Reinforced Soil Slope Wall (RSS)**: This wall was constructed along Grayson Road again to provide the required space to build the intermodal expansion. Originally, this wall was to be constructed at a length of 2,028 feet, and 23 feet high at the highest point. The RSS wall is constructed utilizing an 18 inch by 18 inch galvanized wire face, geo-grid material, and suitable fill material. One key component to the success of construction of this wall is the backfill material. With the on-site material being susceptible to frost and high moisture contents from the weather, NS had a difficult time obtaining the required compaction for the RSS wall. NS chose to incorporate dense graded aggregate in the backfill material to improve the constructability of the RSS wall and achieve compaction. In addition, due to the excessive amount of rock (16,000 cy) that was generated out of the 300,000 cubic yards of fill material, the length of the RSS wall was reduced by 750 feet and a rock buttress was constructed. The buttress was 750 feet long, 25 feet deep and 23 feet high.

![Figure 3 - Location of Walls](image-url)
Pavement of the Facility:

The paving of this facility incorporated two different types of pavement. In the main body of the facility, roller compacted concrete (RCC) was utilized for its structural integrity. It was chosen to meet the high demands of truck traffic and the demands of lift machinery including straddle cranes and the possibility of packers. The RCC was placed at various thicknesses ranging from 6 inches utilized in the light weight vehicle parking areas, 12 inches utilized in the truck drive lanes, and 17 inches for heavy tonnage areas such as container stacking and packer unloading areas. Asphalt was also utilized at the east end of the facility for trailer parking, which included cast-in-place dolly pads.

![Placement of Roller Compacted Concrete (RCC)](image-url)

Figure 4 - Placement of Roller Compacted Concrete (RCC)
Track Construction:

As part of the expansion of this project, 46,000 feet of new track was constructed including the installation of 37 number 10 turnouts. A majority of the tracks were built utilizing steel ties; this included the four new pad tracks, the four new storage tracks, and the reconstructed siding leading into the south side of the facility along the top of the RSS wall. All the turnouts and the leads into the new facility were assembled out of wood ties. Coordination was key to the construction of the new leads due to the need to work in close proximity of the active tracks serving both the existing intermodal and Triple Crown facilities.

CONCLUSION:

Almost two years to the day, the expansion of the Rutherford Intermodal facility was opened on October 1, 2015. The expansion transformed an underutilized parcel of land to a major piece of the Norfolk Southern Intermodal network. The expansion proved once again that hard-work of individuals in design, construction and those involved with the public-private partnership can successfully accomplish meaningful projects that benefit local freight demands, as well as, the national freight network. The team members who worked on this project stayed focused on working safely, within budget, on-schedule and without negatively impacting existing operations. The facility was an overall success and will continue to enhance the Norfolk Southern network.
ACKNOWLEDGEMENTS

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Rutherford Intermodal Expansion

Norfolk Southern Railway Company

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Rutherford Intermodal

History

1906
Class Yard Built

1992
Triple Crown

2000
Intermodal

2015
Intermodal

1992 – Triple Crown Services

2000 – Intermodal Facility

Rutherford Yard

Location of Expansion

Proosed Location of Expansion

Stockpiled Material To Be Used On-site

Proposed Expansion Layout

50% Increase in 180,000+ Htfs/Year
Roller Compacted Concrete

Installation of the 48" Concrete Pipe to Replace Collapsed Brick Pipe (September 12, 2015)

Reinforced Soil Slope and Rock Buttress

Concrete Crane Ways (17")
Maintenance Facilities

Skeleton Track Constructed

Facility Opened October 1, 2015 - On Time and Under Budget

QUESTIONS?