APPENDIX B

Engineering Design Criteria Technical Memorandum

Cocoa Station Engineering Design Criteria Technical Memorandum

12 September 2024

Introduction

The purpose of this document is to provide base design criteria for the railway and railway-related elements of the proposed Cocoa Intermodal Station and Station Area. Non-railway related elements shall follow published guidelines and criteria related to the relevant scope of work (e.g. roadway items shall follow the FDOT Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways ["Florida Greenbook"]). This document is intended to articulate design considerations for planning work completed to date and inform subsequent design efforts. Detailed project-specific design criteria for final design shall be developed by the design team in coordination with Brightline, Florida East Coast Railway (FECR), and other stakeholders.

Design Standards and Guidelines

- American Railway Engineering and Maintenance-of-Way Association (AREMA)
  - Manual for Railway Engineering
  - Communications and Signals Manual
  - Portfolio of Track Work Plans
- Amtrak Station Planning and Development Guidelines
- Florida Department of Transportation (FDOT)
  - FDOT Design Manual
  - FDOT Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways ("Florida Greenbook")
  - FDOT Transit Facilities Guidelines
  - Accessing Transit: Design Handbook for Florida Bus Passenger Facilities
  - State Park-and-Ride Guide
- National Fire Protection Association (NFPA)
  - NFPA 1, Fire Code
  - NFPA 70, National Electric Code
  - NFPA 72, National Fire Alarm and Signaling Code
  - NFPA 101, Life Safety Code
  - NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems
- United States Department of Transportation (USDOT) – Federal Railroad Administration (FRA)
  - Americans with Disabilities Act of 1990 (ADA) Intercity and High-Speed Passenger Rail Platform Construction Guidance and Lessons Learned

Railroad Standards

General

The basis for all railroad geometric design and track work is to provide safe, economical, and efficient rail passenger transportation on an existing freight rail corridor. To accomplish the identified project directives, the design shall reflect adequate factors of safety with respect to overall operation, maintenance, and rolling stock stability. Improvements to the system shall accommodate the existing infrastructure without adversely affecting commuter operations and service.

The criteria presented herein relating to the design emphasizes safety and follows accepted engineering practices adopted by Brightline and as indicated in FRA track safety standards, and in the AREMA Manual for Railway Engineering (MRE).

Planning Considerations

All operations within the project corridor must be reviewed and approved by the host railroad. The basis of design shall consider the safety of operations as the highest priority. Railroad safety regulation is governed by FRA's Office of Railroad Safety, which includes FRA Track Safety Standards – CFR Part 213.

Definitions

All definitions used in this document are in accordance with those used in AREMA Manual for Railway Engineering.

Design Life

The design life for the new railroad related features and facilities are:

- Embankment: 50 years minimum
- Ballast and Subballast: 10 years minimum
- Track structure (rail, ties, and fasteners): 35 years minimum
- Structures: 100 years minimum

Temporary facilities used to accommodate construction of permanent systems shall be designed for a period up to five (5) years.

Design Loading

The design of track systems shall be based on a Cooper E-80 loading in accordance with AREMA MRE.

Design Speed

The design speed for main line track alignments shall be governed by FECR and Brightline with a goal of FRA Class 4 track. Maximum Authorized Speed (MAS) shall be the Brightline maximum timetable speed for the corridor for freight trains, and 79 miles per hour for passenger trains, and 60 miles per hour for freight. In locations where curves cannot be designed to MAS without significant impacts to cost, the MAS will be determined with the following equation:

$$\mathbf{V_{max}} = \sqrt{\frac{(\mathbf{E_a} + \mathbf{E_u})}{\mathbf{0.0007D_c}}}$$

Where: V_{max} = maximum allowable speed, in miles per hour

E_a = actual superelevation, in inches

E_u = unbalance, in inches

D_c = degree of curvature, in decimal degrees

Higher speeds for passenger trains as discussed above may be achieved through one of the following procedures:

- Elimination of selected curves
- Optimization of horizontal curve (reduce the degree of curvature)
- Implementation of higher actual superelevation in curved track with longer transition spirals
- Implementation of higher unbalance acceptable for use with passenger trains on a freight track

Curves should be designed to the highest speeds possible for mixed traffic based on the design criteria, train performance models, and local conditions and should not be limited to the maximum allowable operating speeds.

Subject to the identification of physical and environmental constraints or infeasibility, an MAS below 79 MPH for passenger and below 60 MPH for freight is anticipated at some locations along the corridor.

Horizontal Geometry

Curvature and superelevation of track alignment are related to design speed and to the acceleration and deceleration characteristics of the rail cars and locomotives. Where possible, track alignment shall be designed to maximize operating speed for mixed traffic.

The parameters for the design of horizontal alignments are established in accordance with Brightline Standards and the recommendations of the AREMA MRE.

Horizontal alignments for mainline tracks shall be stationed along the centerlines of the existing Brightline alignment. Where physically possible, all main tracks and passing sidings shall be designed for maximum speeds of 79 MPH for passenger operations and a maximum speed of 60 MPH for freight operations.

TRACK CENTERS

Track centers (distance between the centerlines of two adjacent tracks) for mainline, lead tracks, tangent tracks and tracks parallel to mainline tracks shall be a minimum of 14 feet between an existing track and a proposed track or between two or more proposed tracks. Existing track centers will vary and shall not be a factor in determining track realignments for existing tracks. Track centers greater than 14 feet may be required as an avoidance alternative for existing or proposed infrastructure, i.e., bridge piers. Similarly, track centers less than 14 feet may be required for an additional track between existing infrastructure elements as an avoidance alternative, i.e., existing headwalls where pipe extensions are disallowed. In no case shall track centers be less than 13 feet. In all cases where track centers are less than 14 feet between a proposed track and any track, the minimum separation between tracks and the locations where the track centers return to 14 feet of separation shall be clearly indicated and stationed.

Platform widths and offsets will control the distances between tracks approaching the platform, at the platform, and departing from the platform. Where an intra-track fence is proposed, proposed track centers are 18.5 feet.

TANGENT ALIGNMENT

The desired minimum tangent length (L) between mainline curves or spirals shall be determined by the following formula:

$$\mathbf{L = 3V}$$

Where: L = minimum tangent length, feet

V = design speed through the curve, feet per second

The formula for tangent length (L = 3V) for ride comfort is based on the rail car traveling at least two seconds on tangent track between two curves.

HORIZONTAL CURVE ALIGNMENT

All horizontal curvature will be circular curves defined by chord definition and will be expressed in degrees, minutes, seconds (X°XX'XX"). Curve radii shall be designed such that the degree of the curve does not include fractional seconds, as outlined in the formula below:

$$\mathbf{D_c = 2 * \sin^{-1}\left(\frac{50}{R}\right)}$$

Where: D_c = Degree of curvature, in degrees, minutes, seconds

R = radius of the curve, in feet

Compound curves and broken back curves shall be avoided and eliminated wherever possible. If elimination of such curves are not possible, compound curves shall be designed such that the underbalance is similar throughout the curve between the initial spiral curve point (SC) and the final curve spiral point (CS).

Any change in superelevation between different curves of differing radii shall be accomplished by a transition spiral in accordance with this criterion. In multiple track territory, adjacent mainline tracks shall have the same degree of curvature and superelevation. Station siding tracks may have different curvature and reduced superelevation. The maximum degree of curvature for all tracks shall be 12°30’00”.

ANGLE POINTS

Angle points between tangents may be used in some cases where it is not practical to design a horizontal curve. The maximum angle between two (2) tangents shall not exceed the values in the following table:

TABLE 1: Angle Between Tangents

Passenger MAS (MPH)	Maximum Angle
0-30	0º20’00”
31-60	0º05’00”
61-79	0º03’00”

Successive angle points shall be separated by the greater of 100’ or six (6) times the passenger MAS in miles per hour.

ELEMENT LENGTH

Tangents and constant radius sections shall have a minimum length of 100 feet, or three (3) times the passenger MAS, whichever is larger. For freight and mainline tracks, the minimum length of curvature shall be 62 feet, and the minimum length of tangent between curves shall be 100 feet. For freight and industrial tracks, the minimum length of curve and tangent between the curves shall be 25 feet.

TABLE 2: Element Length

Track Type	Minimum Length of Curve (ft)	Minimum Length of Tangent (ft)
Tangent & Constant Radius Sections	100 OR 3 X Passenger MAS*	
Freight & Mainline	62	100
Freight & Industrial	25	

**Whichever value is greater*

SUPERELEVATION

Superelevation is the vertical difference between the raised outside rail and the inside rail on a curve. Horizontal curves utilize superelevation to counteract the centrifugal force acting radially outward on a train when it is traveling along a curve. A state of equilibrium is reached when the centrifugal force acting on a train is equal to the counteracting force along the superelevated plane of the track. This equilibrium improves ride quality and reduces rail and equipment wear When superelevation is implemented as a tactic to reduce the effects of dynamic lateral forces, the inside rail must never be higher than the height of the outside rail. The following elements regarding superelevation are defined below:

- **Equilibrium Superelevation (E_e):** The superelevation required for the system to experience equilibrium while traversing the curve. Actual superelevation shall be based on the proposed MAS for freight trains.

- **Actual Superelevation (E_a):** The difference in elevation between the high and low rails on a curved segment of track.
- **Underbalanced Superelevation (E_u):** The difference between the actual superelevation and the superelevation required for equilibrium.
- **Degree of Curvature (D_C):** Radius of curve based on chord definition.
- **Maximum Speed (V_{max}):** The maximum speed at which a train can safely traverse a curve of a defined length and degree of curvature.

$$\mathbf{E_e = 0.0007 \cdot D_c \cdot V_{max}{}^2}$$

Where: E_e = the equilibrium superelevation required, in inches

V = maximum allowable posted timetable operating speed through the curve, in miles per hour

D_c = degree of curvature, in decimal degrees

Note: the actual superelevation (E_a) must not exceed five (5) inches.

The total superelevation, E_e, is expressed as follows:

$$\mathbf{E_e = E_a + E_u}$$

Where: E_a = actual superelevation from the top of the low rail to the top of the high rail, in inches
E_u = underbalanced superelevation

The passenger train speed shall be maximized based on the actual superelevation for freight trains and the application of higher unbalance to the passenger train. The relationship between maximum allowable speed (V_{max}) and unbalanced superelevation (E_u) is expressed as follows:

$$\mathbf{V_{max} = \sqrt{\frac{(E_a + E_u)}{0.0007D_c}}}$$

Where: V_{max} = maximum allowable speed, in miles per hour

E_a = actual superelevation, in inches

E_u = unbalance, in inches

D_c = degree of curvature, in decimal degrees

A minimum superelevation of 0.25 inches may be accepted when the degree of curvature is under 0°10’00”.

Superelevation runoff shall be at a uniform rate and should be contained entirely within the transition spiral such that the superelevation does not change throughout the constant radius curves. The minimum superelevation runoff rate shall not be more than the following:

TABLE 3: Minimum Superelevation Runoff Rate

Passenger MAS (MPH)	Minimum Superelevation (Inch) Per 31 ft.
0-60	1/2
60-79	3/8

UNDERBALANCE

Superelevation and curvature should be designed such that the underbalance elevation (E_u) adhered to the following criteria.

TABLE 4: Equipment Underbalance Elevation Criteria

Equipment	Maximum Unbalanced Elevation
Brightline	5.0”
Any other passenger coach	4.0”
Freight	3.0”

Curves should be designed to avoid overbalanced (negative unbalanced elevation) at passenger operating speeds. Overbalance results in the premature wear of the low rail and shall be minimized wherever possible.

SPIRALS

Spiral curves (transition or easement curves) are defined as transition curves with a constantly decreasing or increasing radius proportional between either a tangent and a circular curve (simple spiral) or between two curves with different radii (compound/intermediate spiral). More specifically, the spiral is a curve whose degree-of-curve increases linearly with the distance along the curve from the point of spiral.

Spiral transition curves shall be used in mainline tracks to connect tangents to circular curves or to connect compound circular curves. The spiral to be used shall be the clothoid spiral.

Spirals are not required on a curve that is part of a turnout.

Spiral curve length and superelevation rate of change or runoff are directly related to passenger comfort. While passenger comfort is a major consideration, the rate of change in superelevation in a spiral also affects the rail car bodies in term of twisting, racking or diagonal warp. According to AREMA, the superelevation differential between rail car truck centers should not exceed one inch. Therefore, based on an 85-foot-long rail car with a truck center distance of 62 feet, the longitudinal slope of the outer (high) rail with respect to the inner (low) rail is limited to 1/744 or a rate of change of one inch per 62 feet in length in order to avoid wheel lift. The length of the spiral is based on passenger comfort and operational safety.

Spirals are required on all mainline tracks and shall be designed in accordance with AREMA guidelines in multiples of 31 feet. The clothoid spiral will be used in all track designs, and a spiral transition curve shall be utilized on the mainline tracks between the full body of the curve and tangent tracks. Compound curves with substantial differences in degrees of curvature shall also require a spiral transition curve.

The following formulas shall be used to calculate the minimum length of spiral:

$$\mathbf{L_s = 1.63E_uV}$$

Preferred.

$$\mathbf{L_s = 1.22E_uV}$$

Acceptable on select curves with Brightline approval.

$$\mathbf{L_s = 62E_a}$$

For track speeds 0 – 60 miles per hour.

$$\mathbf{L_s = 82.66E_a}$$

For track speeds 61 – 125 miles per hour.

$$\mathbf{L_s = 62'}$$

Where: E_u = unbalanced superelevation, in inches

E_a = actual superelevation, in inches

L_s = minimum length of spiral, in feet

V = curve design speed, in miles per hour

In instances where a compound spiral is used to connect compound curves, the minimum compound spiral length shall be the greater of:

$$\mathbf{L_s = 1.63(\Delta E_u)V}$$

Preferred.

$$\mathbf{L_s = 1.22(\Delta E_u)V}$$

Acceptable on select curves with Brightline approval.

$$\mathbf{L_s = 62(\Delta E_a)}$$

For track speeds 0 – 60 miles per hour.

$$\mathbf{L_s = 82.66(\Delta E_a)}$$

For track speeds 61 – 79 miles per hour.

$$\mathbf{L_s = 93'}$$

Slower speed tracks, such as yard and non-revenue tracks, and curves within special trackwork shall not be superelevated unless there are special circumstances requiring superelevation. Curves within station and grade crossings shall be avoided where possible.

Where there are two or more superelevated tracks in a grade crossing, consideration shall be made to minimize the effect on the roadway surface. It may be feasible to change the profile of one (or two) of the tracks to better match the roadway profile to help minimize the sawtooth effect, or the same result may be achieved by lowering the actual superelevation.

After the actual and unbalanced superelevations are balanced, the spiral lengths will be established, and the longest spiral will be used.

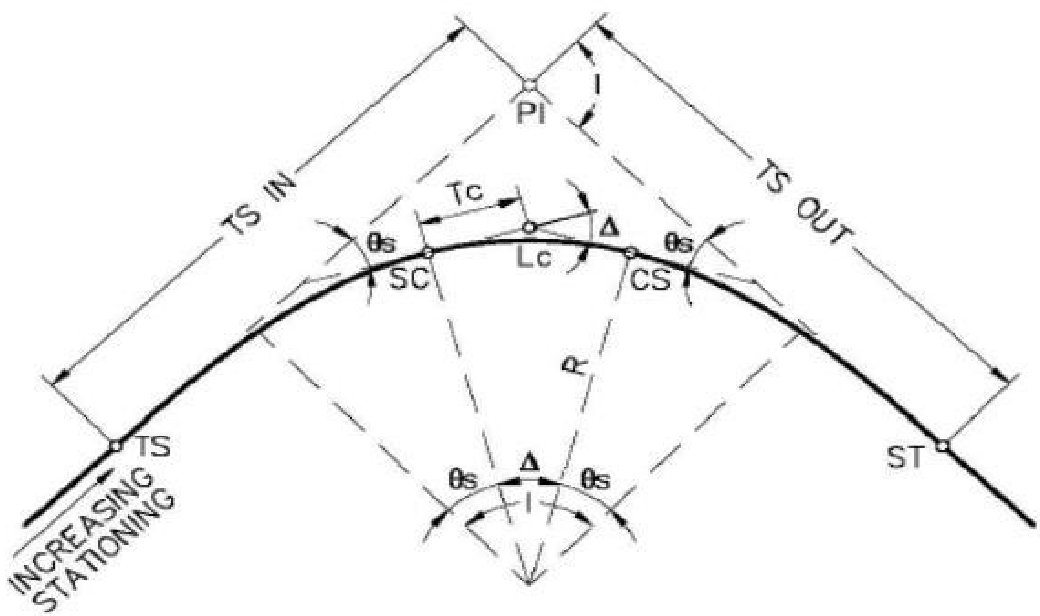

FIGURE 1: Track Spiral

TABLE 5: Track Curvature Abbreviations

DC	Degree of Curvature
I	Total Intersection Angle
ΘS	Spiral Angle = (Ls Dc) / 200
Δ	Central Angle of Circular Curve = I - 2 Θs
R	Radius of Circular Curve
TC	Tangent Length of Circular Curve = R Tan (Δ/ 2)
LC	Length of Circular Curve = (Δ/ 180) R
LS	Length of Spiral
TS	Tangent to Spiral
SC	Spiral to Curve
CS	Curve to Spiral
ST	Spiral to Tangent

JERK RATE

The minimum Jerk Rate (JR) on mainline passenger tracks will be 1.63, where:

$$\mathbf{JR} = \frac{\mathbf{L_s}}{\mathbf{VE_u}}$$

CIRCULAR CURVES

Circular curves shall be defined by the chord definition of curvature and specified by their degree of curvature. Lower degrees of curvature allow higher speeds. Higher degrees of curvature require lower speeds.

Horizontal curvature shall range from a minimum degree of curvature of 0° to a maximum degree of curvature of 12° 30". Existing curves above this maximum degree of curve for mainline tracks shall be realigned to reduce the degree of curvature. The minimum degree of curvature (maximum radius) that is feasible shall be used. No turnouts shall be located within a horizontal curve.

Compound circular curves and circular curves joined by a transitional spiral shall be avoided to the extent practical. Existing curves of these types shall be replaced with a single circular curve and transitional spiral curves whenever practical.

Vertical Geometry

The profile grade shall represent the elevation of the top of the low rail. Vertical alignment shall represent the existing profile grade to the extent attainable.

In areas of curved alignment where profile is given for one track only, the gradients of the second track shall be adjusted uniformly to accommodate the differences in lengths throughout the curves. Turnouts and switches shall not be placed within a vertical curve.

Limiting design elements for vertical geometry are summarized in **Table 6**.

TABLE 6: Vertical Geometry Design Elements

Design Elements	Major Limiting Factors
Vertical Tangent between Vertical Curves	• Passenger comfort • Turnout locations
Vertical Curve/Grade (Maximum Rate of Change)	• Passenger comfort • Turnout Locations • Slack action and train handling • Horizontal and vertical tangents

GRADES

Compensated gradients as defined by AREMA will be used to designate grades.

The ruling mainline grade along the corridor is 1 percent based on freight train requirements for the mixed-use freight/passenger rail operations between. The preferred design gradient for long continuous grade shall match the existing grade. Maximum design gradient, with curve compensation at 0.04 percent per degree of curve if applicable, for grades up to 2 percent may be implemented for new construction projects with approval in accordance with Section 12.

At station platforms, a level gradient is preferred with a maximum grade of up to 0.5 percent is permitted. For yard tracks, where cars are stored, a level gradient is preferred, but a maximum non-rolling track gradient of 0.2 percent is permitted. For mainline track, the desired length of constant profile grade between vertical curves shall be determined by the following formula (but not less than 100 feet):

$$\mathbf{L = 3V}$$

Where: L = minimum tangent length, feet

V = design speed through the curve, feet per second

VERTICAL CURVATURE

All changes in grade shall be connected by a parabolic vertical curve as defined by AREMA MRE. For main line tracks, the minimum length of vertical curve shall be determined by the following formula:

$$\mathbf{L = \frac{2.15DV^2}{A}}$$

Where: L = Length of vertical curve, in feet

D = The absolute value of the difference in rates of grades expressed in decimal grade/100)

A = Vertical acceleration, in feet per second squared

V = Velocity, in miles per hour

The recommended vertical accelerations (A) for passenger and freight trains for both sags and crests are as follows:

TABLE 7: Recommended Vertical Accelerations for Passenger & Freight Operations

Train Type	Recommended Vertical Acceleration (Ft/Sec^2)
Passenger Train	0.60
Freight Train	0.10

The minimum length of tangent (in feet) between vertical curves shall be 3 times the maximum allowable speed (in MPH). The longer vertical curve based on the above recommended accelerations shall be used. Under no circumstances shall the length of vertical curve be less than 100 feet.

Station platform and special trackwork shall not be located inside vertical curves. The end of platform and point of switch should be located at least 100 feet from beginning and end points of a vertical curve.

Locating vertical curves on bridges or at-grade crossings should be avoided to the extent practical.

In summit areas, locations of all signals shall be checked for visibility.

Complex profiles, such as those with more than three grade changes exceeding 1.0% each within a distance of 3,000 feet, may cause potential excessive dynamic forces and handling issues for long freight trains. In locations where complex profiles might occur the design shall be consistent with Brightline standard practices. See **Table 8** for vertical curve nomenclature.

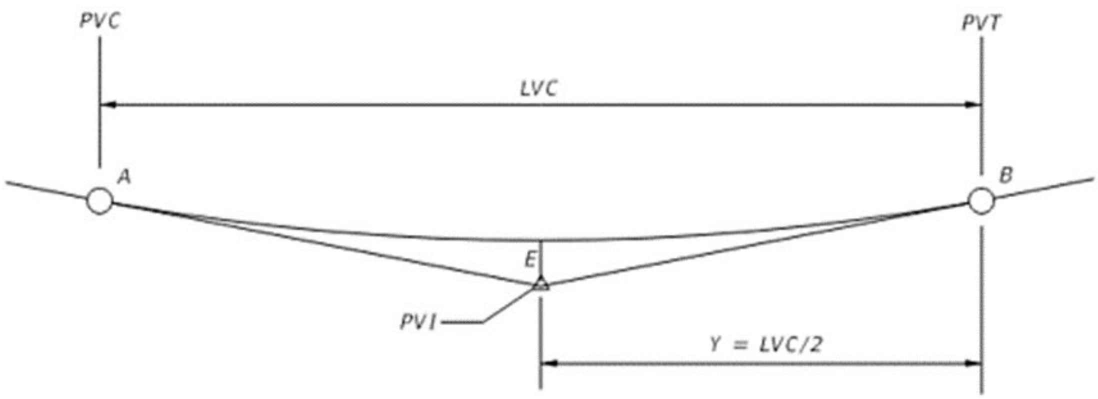

FIGURE 2: Rail Vertical Curve

TABLE 8: Rail Vertical Curve Nomenclature

PVC	Point of Vertical Curvature
PVT	Point of Vertical Tangency
PVI	Point of Vertical Intersection
G1	Grade of Entering Tangent in Percent
G2	Grade of Exiting Tangent in Percent
LVC	Length of Vertical Curve
E	Vertical Distance Between PVI and Vertical Curve
EL	Elevation

Clearances
The minimum railroad clearance standards shall be met or exceeded for all new construction or design and for all temporary construction or design.

All horizontal clearances shall be measured from center of track to the outermost obstruction.

All vertical clearances shall be measured from top of rail (T/R). At clearance locations where superelevation is present, vertical clearances shall be measured from the high rail.

In general, horizontal clearance from the centerline of the nearest track to any obstruction shall not be less than 8'-0" in tangent track. Additional distance shall be added to account for curvature in accordance with Brightline Clearance Diagrams for plate clearances. Whenever possible, clearances should be designed to be 10' or more depending on site conditions and type of obstruction. 5'-1" from center of track shall be used for clearances to platforms adjacent to mixed-use tracks.

In general, vertical clearance from a horizontal plane at the top of the high rail to the nearest overhead obstruction shall be at least 23'-6". Vertical clearance to utility lines shall meet FECR and National Electric Safety Code requirements.

BRIDGES

Brightline has minimum requirements for outside parties constructing, rehabilitating, or replacing bridges over FECR railroad tracks.

Where the horizontal clearance from the centerline of the track to the face of a pier or abutment is greater than 25 feet, no crash wall will be required. Where this clearance is 25 feet or less, a crash wall shall be required in accordance with AREMA MRE Chapter 8, Part 2, Section 2.1.5 and with FDOT.

Both Brightline and the agency or authority having jurisdiction for the structure shall approve the structure and clearances.

Roadbed Section

Brightline criterion shall apply to the Roadbed Section and shall be in accordance with ARMEA MRE. Additionally, the following criteria shall apply to the track's roadbed section.

BALLAST DEPTH

For concrete ties the ballast depth shall extend not less than 12 inches below bottom of tie for the full length of the tie and shoulders. Ballast material shall be in accordance with AREMA Grade granite 3 ballast material specifications. Ballast material shall meet the requirements of FECR in all track areas and shall be from a FECR approved quarry.

SUBBALLAST DEPTH

Subballast depth shall be a minimum of 6 inches below ballast on mainline tracks and sidings. Subballast shall conform to AREMA Chapter 1 – Roadway and Ballast; Part 2- Ballast; Section-211, subballast specifications for site specific calculation of total/subballast thickness.

SHOULDER WIDTH

Ballast shoulder width shall be 12" beyond the end of the tie in accordance with Brightline standards.

Special Trackwork

Special trackwork refers to trackwork units that are used for tracks to converge, diverge, or cross each other. Special trackwork includes turnouts, crossovers, and track crossings. All special trackwork design shall be based on Brightline Standard Drawings or approved vendor drawings and shall be manufactured from Head Hardened (HH) Rail.

TURNOUTS AND CROSSOVERS

All turnouts shall be sized either Nos. 15, 20 or 24 using Brightline standard plans. No other sizes shall be used unless approved by Brightline.

All new turnouts shall be constructed of new 136-RE CWR and wood ties. All new crossovers shall be constructed of new 136-RE CWR and wood ties.

STANDARD TURNOUTS AND CROSSOVERS

Turnouts and crossovers shall be located to allow suitable placement of switch machines and/or switch stands, with consideration of the placement and visibility of control signals, and with easy access for operation and maintenance. Turnouts and crossovers shall be located on tangent tracks and shall meet the following requirements:

- Switch points, stock rails, closure rails, guard rails, and frog wing rails and all associated components shall be fabricated from new, high strength (head hardened) rail.
- 100 feet minimum from point of switch (PS) to horizontal or vertical curves
- Less than 100 feet from horizontal or vertical curves with approval from Brightline.
- 50 feet minimum from PS to the edge of road crossings (including sidewalks)
- 50 feet minimum from PS to Insulated Joint
- 50 feet minimum from PS to opposing point of switch
- Crossovers shall be located in parallel tracks only
- Standard crossovers shall be on minimum of 14-feet track centers

END OF TRACK PROTECTION

Stub-ended passenger tracks shall have a bumping post.

Track Guage

The standard track gauge shall be 4’-8.5”. Track gauge shall be measured between the gauge sides of the heads of rails 5/8” below the top of rails. Gauges for special trackwork shall be as recommended in the AREMA portfolio of trackwork plans except as modified to reflect the physical and operational characteristics of the system as approved by Brightline.

Continuously Welded Rail

The standard rail section shall be new Premium 136 RE Continuous Welded Rail (CWR). Premium rail standards are outlined in FECR/All Aboard Florida Engineering Publication 1004.

Ties

Track construction shall utilize concrete ties for mainline track. The following criteria shall apply for concrete ties:

- Concrete ties shall be spaced at 24 inches, center to center.
- Concrete ties shall be of the type as specified by Brightline and shall conform to the Brightline material specifications.

Grade crossings and Special Trackwork shall be constructed on wood ties. All grade crossings shall be on 10’ wood ties spaced at 19.5” centers.

Station & Station Platform Design Standards

Station Concept – Proposed Platform & Station Conditions

- Double sided Station Platform
  - Length: 1,000 feet
  - Width: 30 feet
- Station Building:
  - Similar in design to similar to Boca Raton Station. L-shaped configuration, 9,000-9,500 sf footprint, 30 ft depth, 2-3 stories
  - Amenities include restroom, ticket area, waiting area, small café/shop, access to station platform/pedestrian bridge, and plaza/parking areas
- Station Plaza: approx. 1 acre
- Pedestrian Overpass Bridge
  - 2 elevators at 3 locations – west of tracks at station plaza, at platform, and east of tracks at transit transfer center on US 1
  - Stair case at 3 locations
  - Or ramp
  - Crossing from west of station to platform
  - Crossing from west of station to west side of US 1
  - Crossing from west of station to east side of US 1
-

General

The station design criteria introduced in this section discusses the guidelines, practices, procedures, and policies which reflect current regulations, proven and accepted technological developments, and best available rail industry practices.

The station design shall provide a safe and efficient transit experience that promotes ridership growth, multimodal integration, and encourages economic development opportunities in the surrounding community.

The station design shall reflect the requirements of the site and surrounding community to safely support operations to effectively service a wide range of potential users. Key design considerations and criteria used to develop the station design for this project are summarized in the proceeding sections.

Station architecture, layout, landscaping, and streetscaping shall be designed to meet applicable county, city, district, or neighborhood guidelines and requirements.

PASSENGER CAR TYPES

Typical passenger cars consist of a single-level design, with a high-level entry floor height with a nominal floor height of 48 inches.

LOCOMOTIVE TYPE

The design of the platform shall consider the type of locomotive used, as the platform must provide safe and reliable access to the locomotive cab for crew changes to take place. For the current intent of the project design, diesel locomotives are to be used.

PLATFORMS

Platform Configuration

Station platforms shall be designed with two (2) side platforms located on opposing sides of the tracks or a single center island platform to service trains in each direction. Consideration will be given to future track additions, maintenance, platform extensions, security, signage, utility access, amenities, and boarding requirements. In multi-track territory, all tracks shall have direct access to a platform for the safe boarding and alighting. Anticipated design items required for the function and operation of the platform will be included in the preliminary engineering opinions of probable construction cost where possible.

For side platform configurations, the minimum allowable track centers are 18.5 feet to allow for inter-track fence between the tracks to prevent pedestrians from crossing between platforms at grade. For center island platforms fencing should be considered in areas where pedestrians may cross the tracks to access the platform. Fence design shall adhere to Brightline clearance requirements. Platform widths should consider space required for canopies and overhead crossing or under-grade structures. The center platform width shall be sized to accommodate for an overhead crossing tower with stairs and an elevator. To the extent practical, platforms should be clear of any obstructions and provide for access by baggage and service vehicles.

All side platforms should slope away from the track a minimum of 1% and no more than 2% in accordance with ADA Standards Chapter 4, Section 403, Article 403.3. At center island platforms, the slope shall be away from the centerline of the platform, with area drains for discharge to the municipal storm drain system. The entire station site and contiguous railroad right-of-way shall be properly drained.

Low level side or center island platforms shall be at an elevation 8” above the top of the adjacent rail. The platform edge shall be 5’-1” inch from the centerline of track. Platforms shall have a solid surface on a firm foundation. A full summary of the dimensional station criteria is referenced below:

- Minimum low platform width for side platforms is 17’-0” (Brightline Standard)
- Minimum width of center island platform is 24’-6” (Brightline Standard)
- Length of new platforms is 1000’
- Centerline of nearest track to edge of commuter platform is 5’-1”
- Height of platform above top of rail is 8” (Brightline Standard)
- Edge of canopy set back from the edge of platform is 4’-5” (Brightline Standard)
- Height of the canopy’s leading edge above the top of platform – 9’-2” (Brightline Standard)

Preliminary engineering plans shall indicate typical, full length passenger trains at the platform, the gap between the train and the platform at each boarding location, taper of platform approaching a curve, and the maximum lateral deflection of a typical passenger railcar at the midpoint and both ends of a railcar in a curve.

Stairs, Ramps, and Walkways

When grade separated access is provided at a platform, the placement of stairs, ramps, or elevators shall be placed in a way that is convenient for passengers and clear of freight or railroad operations. Stairways shall be a minimum of 48” wide, using a maximum tread riser of 7”. Ramps with slopes greater than 5% must have handrails per ADA Chapter 5, Section 505, Article 505.1.

Accessibility

The U.S. Department of Transportation “Level Boarding Final Rule”, issued on September 9, 2011, requires passenger railroads to ensure, at new and altered station platforms, that passengers with disabilities can board and alight any passenger rail car of the train. Where level-entry boarding cannot be provided due to freight-clearance requirements or mixed equipment, the passenger railroad operator must submit to the FTA a narrative that shows how they intend to meet the performance standard.

Level boarding for the mobility-impaired transit users shall be provided by one or more of the following methods:

- Railcar-equipped wheelchair lifts. Railcars equipped with mechanical lifts provide handicap access to all railcars.
- Fixed Mini-Highs. ADA access will also be accommodated by the use of a mini-high platform and ramp as a redundant access option, in the event that a railcar-equipped wheelchair lift is non-functional. Fixed mini-high platforms and ramps must conform to ADA requirements and must be 8’-0” clear of the nearest track centerline. The train’s conductors will be required to employ an onboard bridge plate to span the gap between the train car and the mini-high platform. Final location and configuration of the mini-high platforms and ramps will be determined by the selection of an operator, the train manufacture, and both ADA and FECR standards and requirements.
- Portable Wheelchair Lifts. At low-level platforms without level boarding, portable wheelchair lifts can be utilized to provide ADA access. The wheelchair lift should be kept on or very near the platform, where it can be retrieved by the conductor and taken to the rail car. The lift is manually operated and does not require any batteries or power. It should be kept in an enclosed protective shed, which is accessible to the train crew when needed. Wheelchair lifts are not recommended for stations with annual total ridership greater than 7,500 “ons and offs” in accordance with Brightline policy adopted in May 2012. Stations that exceed this threshold will be evaluated on a case-by-case basis.

Platform Amenities

Amenities should consist of:

- Ticket Zone w/ at Least Two Ticket Vending Machines
- Unisex Employee Restroom
- Janitor Closet
- Electrical Room/IT Room
- Vending Area
- Drinking Fountain/Bottle Filler Pedestal

- Information and Wayfinding Signage
- CCTV (Operator Specific)
- Wi-Fi access
- Public-Address System
- Emergency Call Boxes
- Charging Stanchions
- Passenger Benches
- Trash receptacles

PEDESTRIAN CROSSINGS

The station shall be designed to allow the travelling public to safely traverse between platforms at designated locations. To deter patrons from illegal crossings, inner-track fencing will be used. Pedestrian access to side loaded platforms at the new stations is via sidewalk, connecting the facility a grade crossing. At the center island stations, there is no grade crossing and no direct sidewalk to platform access. To accommodate this constraint, pedestrian access shall be achieved by an overhead pedestrian bridge.