Designation: F2960 – 23

Standard Practice for Permanent Amusement Railway Ride Tracks and Related Devices[1]

This standard is issued under the fixed designation F2960; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This standard applies to design, manufacture, installation, operation, maintenance, and inspection of permanent amusement railway ride(s) that have a track gauge greater than or equal to 12 in. (305 mm) measured between the heads of the rails and their related devices and facilities, for example, bridges, tunnels, and signal support structures, excluding rolling stock. This "track" specific standard provides requirements which are not covered in the "core" or "supporting" standards of the ASTM F24 committee.

1.2 This standard does not apply to track rides, such as roller coasters, that may resemble railways.

1.3 This standard does not apply to funiculars as defined in ANSI B77.2 (2020) or BS EN 1907 (2017).

1.4 This standard does not apply to Amusement Railway Rides and their associated track, devices and facilities that are manufactured and intended for use as a portable amusement ride or attraction.

1.5 This standard does not apply to permanently installed amusement railway rides and tourist railways, and their associated track, devices and facilities that are under the jurisdiction of the United States Federal Railroad Administration (FRA) in whole or part, or national equivalent.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F770 Practice for Ownership, Operation, Maintenance, and Inspection of Amusement Rides and Devices

F1193 Practice for Quality, Manufacture, and Construction of Amusement Rides and Devices

F2291 Practice for Design of Amusement Rides and Devices

2.2 *Industry Standards:*

ANSI B77.2 American National Standard for Funiculars – Safety Requirements (2020)

AREMA Manual for Railway Engineering (2020)

AWPA U1 (American Wood Preserver's Association Standard) The Use Category System (2013)

BS EN 1907 Safety Requirements for Cableway Installations Designed to Carry Persons—Terminology (Funiculars) (2017)

CDC Basic Body Measurements

CFR 49 Part 213 (DOT/FRA Track Standards) (2012)

ISO 7250 Basic Human Body Measurements for Technological Design

Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) (2009, incl Rev 1 and 2, May 2012)

SAE J833 Human Physical Dimensions

3. Terminology

3.1 *Definitions:*

3.1.1 *amusement railway ride, n*—an amusement ride that may have multiple vehicles (for example, locomotive(s), coach(es), etc.) linked together, at least one of which has on board mechanical propulsion that has an on board operator(s), utilizing flanged wheels on railroad type rails with a gauge of 12 in. or greater, that is insular to national regulations, which is designated by the Designer/Engineer as an amusement railway ride.

3.1.2 *Type AP-A track, n*—active main lines; any track where the operating speed exceeds walking speed.

[1] This practice is under the jurisdiction of ASTM Committee F24 on Amusement Rides and Devices and is the direct responsibility of Subcommittee F24.60 on Special Rides/Attractions.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.1.3 *Type AP-B track, n*—active passing tracks, loading tracks, classification yard tracks, and storage tracks; all other tracks (both active and inactive) that are not previously identified as Type AP-A track; tracks having an occasional use or a foreseeable need.

3.1.4 *Type AP-C track, n*—inactive track with no current operation requirements.

3.1.5 *walking speed, n*—less than 5 ft (1.5 m) per second.

4. Significance and Use

4.1 The user of this standard shall be required to review and comply with the referenced "core" ASTM F24 Committee standards in 2.1 of this standard. Modified or alternate requirements to those standards may be required in this standard.

4.1.1 Amusement railway sub-systems may be built to various scales, that is, rolling stock maybe to one scale and the track to another but have common gauge. The railroad's documentation or maintenance manuals shall identify the railroad standards of the respective subsystems/interfaces.

4.1.2 The Designer/Engineer's requirements shall consider the track equipment manufacturer's and rolling stock manufacturer's requirements and shall determine their appropriate interfaces.

5. Design

5.1 Design of roadway (track, ties, roadbed, and roadbed shoulder) shall be performed or overseen by the Designer/Engineer knowledgeable in Railway Engineering.

5.1.1 The Designer/Engineer shall specify the preparation of the road bed and ballast to support the rail system based upon expected loads.

5.1.2 *Drains:*

5.1.2.1 *Size and Design*—Ditches and other drainage structures (culverts, drains, and drop inlets) shall be of sufficient size and construction to handle the flow of water from rain, snow, and irrigation.

5.1.3 *Ballast:*

5.1.3.1 The Designer/Engineer shall specify if ballast shall be used.

5.1.3.2 If required, the Designer/Engineer shall specify the tamping of the ballast.

5.2 *Cross Ties:*

5.2.1 A cross tie is a structure placed transversely under both rails and secured to both rails.

5.2.2 Cross ties shall maintain track gauge.

5.2.3 Cross ties shall contribute to rail alignment.

5.2.4 Cross ties shall be made of a size and material to which rail can be securely fastened and support and distribute the load from the rails to the ballast or grade.

5.2.5 *Tie Selection:*

5.2.5.1 Ties shall possess the following attributes:

(1) Made of a size and material to which rail can be securely fastened.

(2) Provide sufficient compressive size and strength to withstand and distribute rail and train loading to the ballast or grade.

5.2.5.2 *Wood Ties*—Wood ties shall meet the requirements specified in industrially recognized standard, for example, AREMA Manual for Railway Engineering, or as specified by an Designer/Engineer.

5.2.5.3 Similar ties to wood (including plastic or composite ties) may be used provided they perform the functions above, for example, rails attached to concrete tie, steel or concrete in road crossings or in streets and are designed for the loads.

5.2.5.4 The rails shall be attached to ties or the similar systems with fasteners such that the rails are adequately supported. Drilling of the rail flange is not allowed.

5.2.5.5 *Used Ties*—Ties may be reused provided they are not considered defective as described in 9.8.5.1 but may contain holes from prior use. Ties maybe flipped over to provide new spiking surfaces.

5.2.6 *Tie Spacing*—Nominal tie spacing shall be established by the Designer/Engineer and be based upon the expected load. Also, see X5.2.6 on thematic ties.

5.3 *Tie Plates*—Tie plates are not a requirement of this standard.

5.3.1 If canted tie plates are used, each shall incline the top of the rail towards the centerline of the track. If tie plates are used, flat and canted tie plates shall not be mixed in the same rail section.

5.4 *Spikes (or fasteners):*

5.4.1 Rails shall be secured at every tie. The rail shall have a sufficient number and strength of spikes (fasteners) to effectively maintain gauge and provide sufficient rail restraint.

5.4.2 *Spiking Pattern*—Reserved.

5.5 *Joints:*

5.5.1 *Joint Bars*—Joint bars, if used, shall join rail sections together and shall match the rail size.

5.5.1.1 Only metal joint bars are allowed. At insulated joints, an insulated metal bar with insulated bolt holes shall be used.

5.5.1.2 *Compromise Joints*—Rails of different size or section shall be joined with properly designed and constructed compromise bars, taper rails, or offset welds.

5.5.1.3 Welded joints are acceptable when appropriately designed for the railway installation and specific processes (for example, annealing) are specified. Aluminum rail which has been welded shall not be used.

5.5.1.4 As a minimum, the threaded end of the bolt shall be flush with or proud of the nut.

5.5.2 *Joint Gap*—A gap between rail ends shall be installed to provide for thermal expansion resulting from maximum and minimum temperature difference within the year or other means approved by the Designer/Engineer.

5.6 *Rail Anchors*—Rail anchors shall not be used on open deck bridges. An open deck bridge is a bridge with no floor.

5.7 *Gauge Rods:*

5.7.1 A gauge rod is a device threaded at its ends with features at its end that attach to opposing rails for the purpose of maintaining the gauge distance between those rails (See Fig. 1).

5.7.2 *Application*—If used, gauge rods shall be installed at right angles to the rail with the jaws firmly gripping the base of the rail.

FIG. 1 Gauge Rods (installed on rails, ties and tie plates not shown)

5.8 *Rail*—Rail shall meet the requirements of the Designer/Engineer.

5.8.1 *Short Rail*—Short rails and joint gap fillers shall provide wheel guidance to mitigate a derailment at the maximum speed stipulated by the Operator.

5.9 *Track Geometry*—One rail shall be designated as the line rail. The alignment of the track is established by this rail. Either rail may be used as the line rail on tangent track so long as the same rail is used for the entire length of the tangent.

5.9.1 In curves, the inside rail is designated as the grade rail. The grade rail is the reference from which super-elevation is applied to the outside rail of the curve.

5.9.2 The following figures define track geometry for all gauges that shall be used by the Designer/Engineer to establish the requirements for the track. These figures will be referenced in subsequent sections.

5.9.3 *Gauge*—Gauge is the distance between a point one-half the depth of the rail head below the top surface of the two rails measured at right angles to the rail or, for standard gauge, ⅝ in. (15.9 mm) below the railhead as shown in Fig. 9. The minimum and maximum gauges shall be determined using Fig. 3 and Fig. 4 respectively.

5.9.3.1 *Gauge less than standard or if the rails are canted*—Gauge is the minimum distance between the rail heads, measured at right angles to the rails at the rail head. Canted rail is the inclination of both rails towards the center line of the track, typically by the use of inclined tie plates, usually at an incline of 1 in 20. See Fig. 10.

5.9.3.2 In curves the gauge, as defined in 5.9.3, shall be adjusted for the degree of curvature, the tread width and wheel base of the rolling stock but shall not exceed the values of Fig. 4. (See X5.9.3.2 for definition of degree of curvature.)

5.10 *Cross Level:*

5.10.1 *Definition*—Cross level is the difference in elevation between the top surfaces of the two rails measured at right angles to the track, as shown in Fig. 11

5.10.2 *Designated Cross Level*—On tangent track, the cross level shall be zero ± tolerance specified by the Designer/Engineer. On curved track, the designated cross level is equal to the designated super elevation (see 5.11). Between the tangent and curved track is the transition track. Super elevation in the transition varies from level at the tangent to full super elevation at the curve.

5.11 *Super Elevation*—Super elevation is the banking of track by raising of the outside rail or lowering of the inside rail in a curve. The amount of super elevation is a function of the degree of curvature, proposed speed of the train and the location of the center of gravity of the train vehicles. The super elevation shall be designed so that the combined force vectors from the weight of the train and the centripetal forces due to the trains speed in a curve shall act as a combined force vector intersecting the tie surface between the rails (stable) versus outside the rails (unstable). The design shall use a train speed from zero to the maximum speed, including over speed conditions, to ensure overturning stability is provided.

5.12 *Turnouts:*

5.12.1 *Turnout*—The section of rail from the tip of switch points (point of switch) to the heel of the frog shall be considered the turnout.

5.12.2 General requirements for turnouts.

5.12.3 *Materials*—All materials used within the limits of a turnout shall be specified by an Designer/Engineer and not be flame cut after manufacture.

5.12.4 *Rail*—All rail used within a turnout shall be of the same weight and section. Compromise joints are not permitted within a turnout.

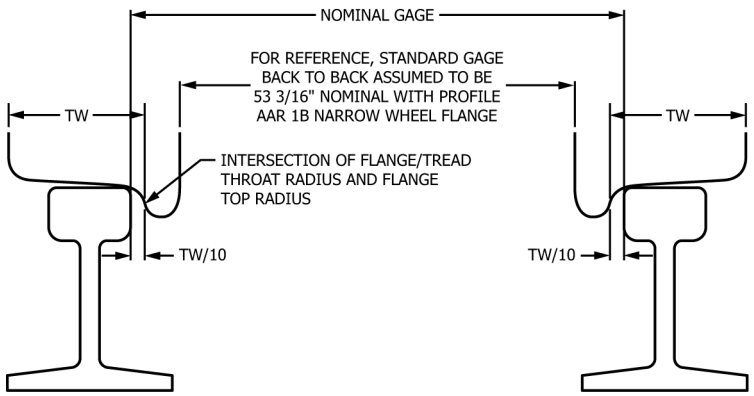

FIG. 2 Nominal Track Gauge (AAR stands for American Association of Railroads, TW stands for Tread Width)