

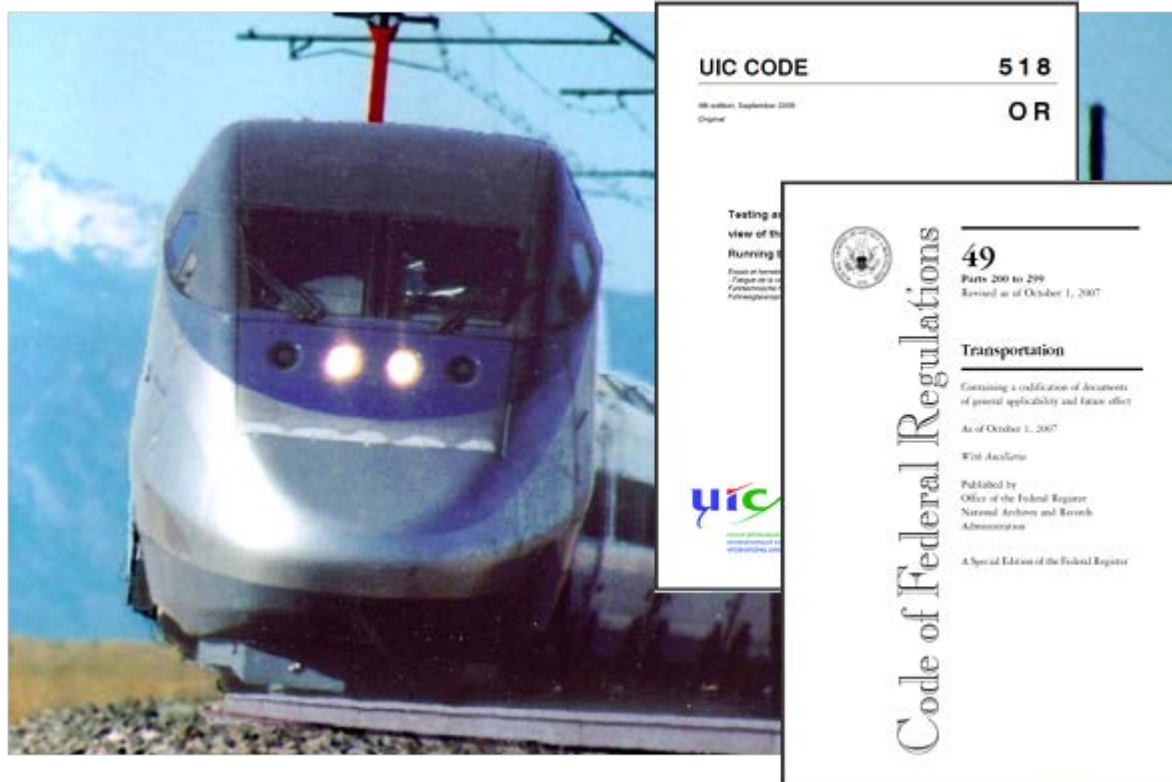


U.S. Department of
Transportation

**Federal Railroad
Administration**

Comparison of FRA Regulations to International High-Speed Rail Standards

Office of Research
and Development
Washington, DC 20590



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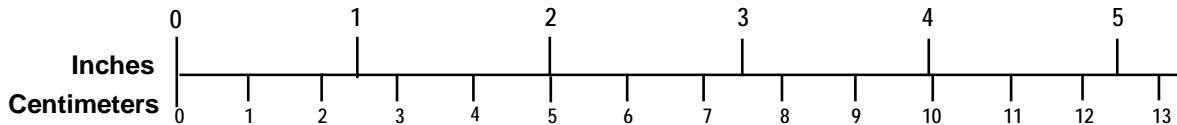
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LENGTH (APPROXIMATE)	
1 inch (in)	= 2.5 centimeters (cm)
1 foot (ft)	= 30 centimeters (cm)
1 yard (yd)	= 0.9 meter (m)
1 mile (mi)	= 1.6 kilometers (km)
AREA (APPROXIMATE)	
1 square inch (sq in, in ²)	= 6.5 square centimeters (cm ²)
1 square foot (sq ft, ft ²)	= 0.09 square meter (m ²)
1 square yard (sq yd, yd ²)	= 0.8 square meter (m ²)
1 square mile (sq mi, mi ²)	= 2.6 square kilometers (km ²)
1 acre = 0.4 hectare (he)	= 4,000 square meters (m ²)
MASS - WEIGHT (APPROXIMATE)	
1 ounce (oz)	= 28 grams (gm)
1 pound (lb)	= 0.45 kilogram (kg)
1 short ton = 2,000 pounds (lb)	= 0.9 tonne (t)
VOLUME (APPROXIMATE)	
1 teaspoon (tsp)	= 5 milliliters (ml)
1 tablespoon (tbsp)	= 15 milliliters (ml)
1 fluid ounce (fl oz)	= 30 milliliters (ml)
1 cup (c)	= 0.24 liter (l)
1 pint (pt)	= 0.47 liter (l)
1 quart (qt)	= 0.96 liter (l)
1 gallon (gal)	= 3.8 liters (l)
1 cubic foot (cu ft, ft ³)	= 0.03 cubic meter (m ³)
1 cubic yard (cu yd, yd ³)	= 0.76 cubic meter (m ³)
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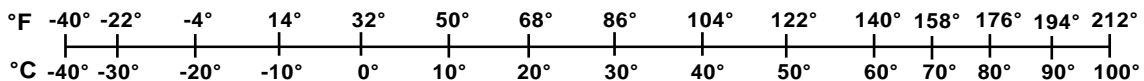
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LENGTH (APPROXIMATE)	
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1 centimeter (cm)	= 0.4 inch (in)
1 meter (m)	= 3.3 feet (ft)
1 meter (m)	= 1.1 yards (yd)
1 kilometer (km)	= 0.6 mile (mi)
AREA (APPROXIMATE)	
1 square centimeter (cm ²)	= 0.16 square inch (sq in, in ²)
1 square meter (m ²)	= 1.2 square yards (sq yd, yd ²)
1 square kilometer (km ²)	= 0.4 square mile (sq mi, mi ²)
10,000 square meters (m ²)	= 1 hectare (ha) = 2.5 acres
MASS - WEIGHT (APPROXIMATE)	
1 gram (gm)	= 0.036 ounce (oz)
1 kilogram (kg)	= 2.2 pounds (lb)
1 tonne (t)	= 1,000 kilograms (kg)
	= 1.1 short tons
VOLUME (APPROXIMATE)	
1 milliliter (ml)	= 0.03 fluid ounce (fl oz)
1 liter (l)	= 2.1 pints (pt)
1 liter (l)	= 1.06 quarts (qt)
1 liter (l)	= 0.26 gallon (gal)
1 cubic meter (m ³)	= 36 cubic feet (cu ft, ft ³)
1 cubic meter (m ³)	= 1.3 cubic yards (cu yd, yd ³)
TEMPERATURE (EXACT)	
$[(9/5) y + 32]^{\circ}\text{C} = x^{\circ}\text{F}$	

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Executive Summary

This report presents a comparison between Federal Railroad Administration (FRA) regulations and European and Asian high-speed rail (HSR) railroad standards. It compares part by part the contents of nine selected sections from Title 49 of the Code of Federal Regulations (49 CFR) *Transportation*. It is intended to identify regulatory and standards issues that may be of concern to FRA at a time when HSR service is expanding rapidly in the United States. The comparison identifies gaps and open points relative to the body of European HSR rail standards. The report summarizes the Asian standards from China, Japan, Taiwan, and Korea. It does not compare standards with Association of American Railroads (AAR), American Railway Engineering and Maintenance-of-Way Association (AREMA), or American Public Transportation Association (APTA) standards but only with a subset of the 49 CFR sections that were preselected by FRA. In summary, the comparison identifies potential standards issues that may merit further study as HSR expands in the United States.

1. Introduction

Transportation Technology Center, Inc. (TTCI), compared FRA regulations for infrastructure and rolling stock with European and Far East HSR standards. The comparison identifies open points and gaps in the standards that may merit further study as HSR expands in the United States. The comparison accounts for fundamental differences in the structure of the regulations. In general, international standards are found to be performance based, and FRA regulations tend to be prescriptive. The results of the study are presented in this report.

1.1 Background

This study is timely because HSR is expanding in the United States. To take advantage of state-of-the-art technology worldwide, some foreign rolling stock may be proposed for the new and upgraded corridors. Such rolling stock is designed to operate on infrastructure created to foreign standards. An understanding of foreign standards is essential for evaluating the suitability of foreign rolling stock to operate safely in the United States, possibly in interoperation with U.S. equipment.

Except for the Amtrak Northeast Corridor, there is no domestic experience of the application of standards for speeds between 125 and 150 miles per hour (mph). Although FRA standards exist for operation up to 200 mph, no revenue service train has run in the United States at that speed on track designed to those standards. Thus, this study of foreign HSR standards is expected to identify areas for further study and potential revisions to FRA safety regulations.

1.2 Objectives

The objectives of this study were to identify open points and gaps in the international HSR standards as they might apply to U.S. HSR and to report on them in a summary suitable for action by FRA.

1.3 Overall Approach

The study had two phases. The first phase, or preliminary report, analyzed European standards and compared them clause-by-clause with FRA standards. The preliminary report was delivered to FRA in December 2010, and feedback from it is included in this report. In the second phase, standards from the Far East are included but in a different manner than those of the European standards. Many of the Far East standards are published only in their native languages, and a direct comparison is not feasible without translation. Instead, a review of the Far East standards with a view toward their organization and content is made.

1.4 Scope

The study focused on HSR, which was defined in this report as an operating speed greater than 125 mph. When foreign standards do not use the same definition, the closest foreign definition was used. For example, European International Union of Railways, that is, Union International des Chemins de fer (UIC), Category II has maximum operating speeds up to 124 mph (200 kilometers per hour (km/h)). This study compares foreign standards to FRA regulations included

in Parts 200, 210, 213, 221, 223, 229, 231, 238, and 239 of the Code of Federal Regulations 49 CFR. It does not make comparisons to recommended practices published by AAR), AREMA), or APTA. References are made to these standards where appropriate, but the standards are not analyzed in detail.

1.5 Organization of the Report

This report contains a section by section analysis of the FRA regulations from 49 CFR relative to the European body of standards. It also contains an overview of the Far East HSR standards from China, Taiwan, Japan, and Korea. The body of the report gives the descriptions. There are nine appendices, one for each part of the FRA 49 CFR that was reviewed. The appendices presented in printed form are reflections of corresponding electronic spreadsheets, which are available from TTCL. The spreadsheets are best viewed on a computer while reading this report. They contain detailed information on each section of the regulations and imbedded comments viewable onscreen. The report also contains an index to make finding specific topics within the report easier.

1.6 Summary of Substantial Findings

Gaps and inconsistencies exist between the U.S. and European regulations. Some are due to the differences in format, that is, the U.S. regulations are prescriptive and the European standards are performance based. Operational inconsistencies arise from the differences between operating in a dedicated high-speed right-of-way versus mixed right-of-way with grade crossings. Also, procedural differences exist, such as varying requirements for inspections or maintenance and the documentation of either. The following shows the areas with the most substantial differences:

Vehicle/Track Interaction	49 CFR 213.345 is newly proposed
Noise	Noise measurement and limits
Safety Glazing	Differences in testing (angle of impact)
Locomotive Safety	Prescriptive versus performance specifications
Locomotive Crashworthiness	Differences in collision scenarios
Track Safety Aerodynamic	No U.S. regulations for tunnels, crosswinds, etc.
Emergency Exit Requirements	Differences in required number and locations

2. FRA Standards

Appendix A shows spreadsheets that list line by line selected sections of the FRA regulations. It also displays corresponding European regulations. The electronic versions of these files are available from TTCL. The electronic format displays comments that can be viewed by moving the mouse over the cells with a red triangle in the upper corner. Most of the FRA regulations can be viewed in this way. If a comment box is too small to read the entire text within, it may be necessary to right click the cell and select “edit comment.” In this way, the cursor enters the text box, and it becomes possible to scroll the contents of the text box. Graphics are not available in these comment boxes, so there are necessarily some omissions in this context. As such, the comments in this worksheet are to be considered only as references to the actual standards documents. Where omissions were required, a mark will indicate that more is available. The reader should consult the actual CFR document for the entire text. The CFR regulations can be obtained at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title49/49tab_02.tpl.

The sections selected from 49 CFR are as follows:

- Part 200 Informal Rules of Practice for Passenger Service
- Part 210 Railroad Noise Emission Compliance Regulations
- Part 213 Track Safety Standards
- Part 221 Rear End Marking Device – Passenger, Commuter and Freight Trains
- Part 223 Safety Glazing Standards – Locomotives, Passenger Cars and Cabooses
- Part 229 Railroad Locomotive Safety Standards
- Part 231 Railroad Safety Appliance Standards
- Part 238 Passenger Equipment Safety Standards
- Part 239 Passenger Train Emergency Preparedness

3. European Standards

The spreadsheets in *Appendix A. Spreadsheets Comparing FRA Regulations with European Standards* contain references to European standards. The comparison was made against the body of documents from the UIC. These standards were summarized in several formats. First was the Technical Specification for Interoperability (TSI). The TSIs were published in the official journal of the European Union and originate from the Commission of the European Communities: (CEC). They specify mandatory functional requirements for all railroads operating as part of the trans-European HSR system. The European Norms (EN standards) follow the TSIs. EN standards define detailed requirements or technical solutions and are used on a voluntary basis. A final consideration is the UIC code. The UIC code is the reference catalog of UIC leaflets. The UIC leaflets are professional recommendations that may not be obligatory. They are the result of international cooperation between experts of the member railway networks of the UIC. They are neither laws nor norms, but the measures they contain are often integrated in national norms, European norms, and global invitations to tender for railway equipment. Leaflets are produced by a subsidiary of the UIC known as the ETF (Editions Techniques Ferroviaires = Technical Railway Publications).

3.1 Background

The origin of European TSIs lies in the fundamental engineering work of the Office of Research and Experiments (ORE), which began in the 1950s. Committees were formed in which European railway administrations met to discuss engineering theory and principles. Experience and test data were shared, and a large library of technical reports was published. These technical and research reports are available today through the Editions Techniques Ferroviaires (ETF – www.uic.org/etf).

The UIC used the ORE work to develop a code intended to allow standardization and interoperability. The UIC code is a collection of approximately 600 UIC leaflets organized under the following headings:

0. Statutes and regulations
1. Passenger traffic and baggage traffic
2. Freight traffic
3. Finance, accounting, costs, statistics
4. Operation
5. Equipment
6. Haulage
7. Fixed installations
8. Technical specifications
9. Information technology, other

The UIC leaflets are not law, but they are often referred to in national and international norms and regulations.

The UIC's Research and Technology Department continues to support international collaboration. It is helping with the drafting of International Standards for Interoperability.

The European Committee for Standardization or Comité Européen de Normalisation (CEN) was founded in 1961 to develop standards referred to as ENs. Many ENs are mandatory under European Union law. The "CE" mark indicates that a product complies with the relevant ENs. A prEN is an EN in draft form.

CEN Technical Committee 256 manages the development of ENs for railway applications. There are currently 177 railway application-published ENs and 136 under development. Table 1 shows a list of ENs relevant to this study. Note that these are listed in the application guide of the TSI.

Table 1. Relevant EN Standards for Railway Applications

Reference	Title
CEN/TR 15874:2009	Noise emission – Road test of standard for rail roughness measurement EN 15610:2009
EN 12663-1:2010	Structural requirements of railway vehicle bodies
EN 13146-1:2002	Track – Test methods for fastening systems – Part 1: Determination of longitudinal rail restraint
EN:13146-8:2002	Track – Test methods for fastening systems – Part 8: In-service testing
EN 13231-3:2006	Track – Acceptance of works – Part 3: Acceptance of rail grinding, milling and planning work in track
EN 13232-3:2003	Track – Switches and crossings – Part 3: Requirements for wheel/rail interaction
EN 13674-1:2003+A1:2007	Track – Rail – Part 1: Vignole railway rails 46 kg/meters (m) and above*
EN 13674-2:20 06+A1:2010	Track – Rail – Part 2: Switch and crossing rails used in conjunction with Vignole railway rails 46 kg/m and above
EN 13674-3:2006+A1:2010	Track – Rail – Part 3: Check rails
EN 13674-4:2006+A1:2009	Track – Rail – Part 4: Vignole railway rails from 27 kg/m to, but excluding 46 kg/m
EN 14811:2006+A1:2009	Track – Special purpose rail – Grooved and associated construction
EN 15227:2008	Crashworthiness requirements for railway vehicle bodies
EN 15427:2008	Wheel/rail friction management – Flange lubrication
EN 15610:2009	Noise emission – Rail roughness measurement related to rolling noise generation
EN 50206-1:2010	Rolling Stock – Pantographs: Characteristics and tests
EN 50215:2009	Rolling Stock – Testing of rolling stock on completion of construction and before entry into service
prEN 16028	Railway applications – Wheel/rail friction management – Lubricants for trainborne and trackside applications

*Vignole rail means normal flat bottomed rail such as is commonly used in North America.

ENs refer throughout to UIC leaflets. They are made into law by CEC directives.

TSIs are intended to ensure trains can operate on all lines in the trans-European rail network. They can be thought of as a complementary set of ENs. They are also made into law by CEC directives.

The first set of TSIs prepared by the European Association for Railway Interoperability (AEIF) was adopted in 2002 for the trans-European HSR system. TSIs are now managed by the European Rail Agency (ERA) of the European Union. ERA was established in 2004 and began full operation mid-2006. It also acts as the system authority for the European Rail Traffic Management System (ERTMS) project, which has been set up to create signaling standards throughout Europe.

TSIs are separated into conventional rail and HSR. The original HSR TSIs have been revised, and new versions are now current. The conventional rail TSIs are being revised. Table 2 shows the titles and current status of TSIs.

Table 2. TSI References and Status

Subject	Conventional Rail	HSR
Energy		2008/284/EC L104/1
Rolling Stock Noise	2006/66/EC L37/1-49	
Freight Rolling Stock	2009/107/EC L45-1	n/a
Passenger Rolling Stock	Draft	2008/232/EC L84/132
Tractive Rolling Stock	Draft	
Infrastructure	Draft	2008/217/EC L77/1
Control Command & Signaling	2007/153/EC L67/13-17	2008/386/EC L136/11
Traffic Operation& Management	2009/107/EC L45-1	2008/231/EC L84/1

The titles listed in Table 2 are in reference to CEC decisions, which are notified in the *Official Journal of the European Union*. Each notified decision begins with information about applicability and superseded decisions. The full text of the TSI then follows.

In summary, TSIs refer to ENs, which refer to UIC leaflets and technical research reports.

TTCI purchased and reviewed two TSIs for this study. They are:

- High-Speed Rail – Infrastructure – 2008/217/EC L77/1
- High-Speed Rail – Passenger rolling stock – 2008/232/EC L84/132

3.2 Infrastructure

Table 3 shows the HSR definitions used for infrastructure in Europe.

Table 3. European Infrastructure HSR Definitions

Category		Maximum Speed (km/h)	Maximum Speed (mph)
I	Specially built	≥ 250	≥ 156
II	Specially upgraded	≈ 200	≈ 124
III	With special features where the speed must be adapted to each case		

For comparison, Table 4 shows the FRA class definitions for track as defined in 49CFR213.307.

Table 4. FRA Track Classes

Over Track that Meets All of the Requirements Prescribed in 49CFR Part 213	The Maximum Allowable Operating Speed for Freight Trains (mph)	The Maximum Allowable Operating Speed for Passenger Trains (mph)
Excepted track	10	N/A
Class 1 track	10	15
Class 2 track	25	30
Class 3 track	40	60
Class 4 track	60	80
Class 5 track	80	90
Class 6 track		110
Class 7 track		125
Class 8 track		160
Class 9 track		220

3.3 Rolling Stock

Table 5 shows the HSR definitions used for rolling stock in Europe.

Table 5. European Rolling Stock HSR Definitions

Class	Maximum Speed (km/h)	Maximum Speed (mph)
1	≥ 250	≥ 156
2	≥ 190 and < 250	≥ 119 and < 156

For comparison, Table 6 shows the speed tier classifications for FRA.

Table 6. FRA Speed Tier Designations

Tier	0	IA	IB	IC	II	III	IV	V
Description	Regional Rail	Conventional	Emerging HSR	HSR Regional	HSR Mixed	HSR Passenger	HSR Dedicated	HSR Express
Speed range (mph)	0-65	0-79	0-80/110	0-111/125	0-126/150	0-150	0-150	0-200/220
Track Class	Class 4	Class 4	Class 5/6	Class 7	Class 8	Class 8	Class 8	Class 9

4. Section by Section Comparison with European Standards

The analyses that follow summarize the worksheets that are presented in Appendix A *Spreadsheets Comparing FRA Regulations with European Standards*. Each worksheet corresponds to each section. It is best to open the corresponding spreadsheet while reading each analysis.

4.1 Disclaimers

A review of the European regulations revealed that they are not complete. Since the trans-European HSR system passes through many countries, each with its own local standards, it is nearly impossible to standardize all aspects of the system. Accordingly, the TSIs, which are the overriding documents intended to ensure interchangeability, are essentially not comprehensive. The EN standards and UIC leaflets fill in many of the gaps, but inasmuch as the UIC leaflets are not law, they only provide technical guidelines rather than immutable standards. Of additional concern is the overall format and organization of the standards and how the format varies between the United States and Europe. For instance, the European standards are primarily performance based, whereas the U.S. regulations tend to be prescriptive in nature. These differences complicate the comparison but do not prevent it. The differences simply require some creative cross-referencing between various sections of the standards.

When reviewing the comparison spreadsheets, observe that notes are overlaid on many cells of the spreadsheet. These notes give details for the regulation listed, or analysis of the regulation, depending on context. The “Comments” field shows an analysis of the regulation in that line. A gap is implied on lines that have no entry in the “Corresponding UIC Regulation” column. These gaps are generally not significant to safety. For instance, penalties and waivers are called out in the FRA regulations but not in the international regulations. In general, enforcement differences are not regarded as significant to this effort. The gaps reported are where substantial differences have been identified between the content and the intent of the regulations.

Gaps are inferred by blank lines in the worksheet. The worksheet is arranged with a line for each section of the FRA regulations; the corresponding UIC regulations, whether TSI, EN, or leaflet, are listed on that line. In places where no UIC entries are listed, there may be no corresponding regulation, or the appropriate rule was not discerned from the literature researched. Thus, the gap analysis should not be considered comprehensive.

4.2 49 CFR Part 200 – Informal Rules of Practice for Passenger Service

The analysis for 49 CFR Part 200, *Informal Rules of Practice for Passenger Service* is almost trivial. It prescribes procedures under which applications will be received and heard and by which rules and orders will be issued under subsection 402(e) and section 406 of the Rail Passenger Service Act (45 U.S.C. 562(e) and 566). This section from the U.S. regulations has no direct counterpart in the European regulations. UIC Leaflet AO *UIC Internal Regulations* tells how to join the International Union of Railways, which is similar to garnering authority to change the rules.

4.3 49 CFR Part 210 – Railroad Noise Emission Compliance Regulations

The scope of 49 CFR Part 210.1, *Railroad Noise Emission Compliance Regulations*, reads: “This part prescribes minimum compliance regulations for enforcement of the Railroad Noise Emission Standards established by the Environmental Protection Agency in 40 CFR Part 201.” This aligns with the European Essential Requirements stated here: 2.6.1 *Health*: “Operation of the trans-European HSR system must remain within the statutory noise nuisance limits.” In addition, Essential Requirements 2.6.2 *Environmental protection* states: “Operation of the trans-European HSR system must not cause a level of ground vibrations which is unacceptable for activities and the immediate environment in the vicinity of the infrastructure and in a normal state of maintenance.” As such, the objectives and meaning of the sections are well aligned, even though the U.S. regulations are about noise emissions and the European regulations are about the impact of those noise emissions.

The analysis of 49CFR Part 210, *Railroad Noise Emission Compliance Regulations* is straightforward. The only deviations that are not gaps regarding enforcement rules are section 210.27 *New locomotive certification*, and Appendix B to Part 210 *Switcher Locomotive Enforcement Policy*. The European regulations do not distinguish locomotive age or service type. Finally, there are differences in the acceptable sound levels and the details of measuring, but overall, it appears that the spirit and substance of the noise regulations are similar between the United States and Europe. Tables 7 and 8 list the actual noise limits for Europe and the United States.

Table 7. European Limiting Values $L_{pAeq,Tp}$ for the Pass-by Noise of Rolling Stock*

Rolling Stock		Speed (km/h)			
		200	250	300	320
Class 1	Trainset		87 dB(A)	91 dB(A)	92 dB(A)
Class 2	Trainset or variable formations	88 dB(A)			

*From TSI Rolling Stock, Section 4.2.6.5.4.

Table 8. Abbreviated Summary of Noise Standards, 40 CFR Part 201**

Paragraph and Section	Noise Source	Noise Standard – A Weighted Sound Level in dB	Noise Measure
201.12(b)	Moving locomotive	90	Lmax(fast)
201.13(2)	Rail cars moving at speeds greater than 45 mph	93	Do

** From 49 CFR Part 210 Appendix A – Summary of Noise Standards.

Lmax = Maximum sound level.

4.4 49 CFR Part 213 – Track Safety Standards

Most of the 49 CFR Part 213 *Track Safety Standards* are captured in the TSI *High-Speed Infrastructure* L071 2008-217-EC. This TSI addresses many of the essential requirements that affect track safety. The European Essential Requirements relevant to track safety standards are listed here:

- *Essential Requirement 2.2.1. To guide the train*
- *Essential Requirement 2.2.2. To support the train*
- *Essential Requirement 2.2.3. To allow free and safe passage of a train within a given volume*
- *Essential Requirement 2.2.4. To allow passengers boarding and alighting from trains stopped in stations.*
- *Essential Requirement 2.2.5. To ensure safety*
- *Essential Requirement 2.2.6. To respect the environment*
- *Essential Requirement 2.2.7. To maintain the train*

Other Essential Requirements also relate to track safety standards covered in 49 CFR Part 213:

- *Essential Requirement 1.1.1. The design, construction or assembly, maintenance and monitoring of safety-critical components, and more particularly of the components involved in train movements must be such as to guarantee safety at the level corresponding to the aims laid down for the network, including those for specific degraded situations.*
- *Essential Requirement 1.1.2. The parameters involved in the wheel/rail contact must meet the stability requirements needed in order to guarantee safe movement at the maximum authorised speed.*
- *Essential Requirement 1.1.3. The components used must withstand any normal or exceptional stresses that have been specified during their period in service. The safety repercussions of any accidental failures must be limited by appropriate means.*
- *Essential Requirement 1.1.4. The design of fixed installations and rolling stock and the choice of the materials used must be aimed at limiting the generation, propagation and effects of fire and smoke in the event of a fire.*
- *Essential Requirement 1.2. Reliability and availability.*
- *Essential Requirement 1.2. The monitoring and maintenance of fixed or movable components that are involved in train movements must be organised, carried out and quantified in such a manner as to maintain their operation under the intended conditions.*
- *Essential Requirement 1.4. Environmental protection.*
- *Essential Requirement 1.4.1. The repercussions on the environment of the establishment and operation of the trans-European high-speed rail system must be assessed and taken*

into account at the design stage of the system in accordance with the Community provisions in force.

- *Essential Requirement 1.4.2. The materials used in the trains and infrastructures must prevent the emission of fumes or gases which are harmful and dangerous to the environment, particularly in the event of fire.*
- *Essential Requirement 1.4.3. The rolling stock and energy-supply systems must be designed and manufactured in such a way as to be electromagnetically compatible with the installations, equipment and public or private networks with which they might interfere.*
- *Essential Requirement 1.5. Technical compatibility.*

The technical characteristics of the infrastructures and fixed installations must be compatible with each other and with those of the trains to be used on the trans-European HSR system. If adherence to these characteristics proves difficult on certain sections of the network, temporary solutions, which ensure compatibility in the future, may be implemented.

- *Essential Requirement 2.1.1. Safety*

Appropriate steps must be taken to prevent access to or undesirable intrusions into installations on lines travelled at high speed. Steps must be taken to limit the dangers to which persons are exposed, particularly in stations through which trains pass at high speed. Infrastructures to which the public has access must be designed and made in such a way as to limit any human health hazards (stability, fire, access, evacuation, platforms, etc.).

- *Essential Requirement 2.6.2. Environmental protection*

Operation of the trans-European HSR system must not cause a level of ground vibrations which is unacceptable for activities and the immediate environment in the vicinity of the infrastructure and in a normal state of maintenance.

Safety

To meet the general requirements, the infrastructure is, at the level of safety corresponding to the aims laid down for the network, to:

- *allow trains to run without the risk of derailment or collisions between them or with other vehicles or fixed obstacles, and avoiding unacceptable risks associated with the proximity of the electric traction supply,*
- *withstand without failure the vertical, lateral and longitudinal loads, whether static or dynamic, exerted by the trains, in the specified track environment and while achieving the required performance,*
- *permit the monitoring and maintenance of the installations necessary to keep the critical components in safe condition,*
- *not comprise materials prone to generate noxious fumes in the event of fire; this requirement concerns only those infrastructure elements located in confined air spaces (tunnels, covered cuts and underground stations).*

- *deter access to the installations, other than the platform areas accessible to passengers, by people who are not authorised staff,*
- *permit control of the risk of intrusion by undesirable persons or vehicles into the railway premises,*
- *ensure that the areas accessible to passengers in the course of normal line operation are located away from the tracks carrying trains at high-speed, or are suitably segregated from those tracks, to minimize the risk to the passengers, and are provided with the necessary access ways to evacuate passengers, in underground stations in particular,*
- *allow disabled passengers appropriate means of access and evacuation to/from public areas made accessible to them, by appropriate measures,*
- *ensure that passengers may be kept clear of hazardous areas in the event that a high-speed train stops out of course outside the station areas provided for the purpose,*
- *ensure that in long tunnels special measures are taken to prevent fire, and to mitigate the outcome and to facilitate the evacuation of passengers should a fire occur*
- *ensure that the equipment provide the right quality of the sand.*

Several of the European track safety standards are also addressed in the TSI *Rolling Stock*. The spreadsheet *Appendix A 49CFR213 Track Safety FRA Regs to UIC.xlsx* summarizes the overall results considering both TSIs and the supporting documents.

4.4.1 Analysis of Track Safety Standards

The track safety standards defined in 49 CFR Part 213 *Track Safety Standards* have several open points and gaps. The following discussion will address these points on a subpart by subpart basis.

4.4.1.1 49 CFR Part 213 Subpart A – General

The scope for 49 CFR Part 213 Subpart A – *General* of the U.S. regulations states: “This part prescribes minimum safety requirements for railroad track that is part of the general railroad system of transportation. The requirements prescribed in this part apply to specific track conditions existing in isolation.” This part of the U.S. code specifies track classes and designation of persons qualified to supervise renewals and inspections. Both of these functions are represented by equivalent sections in the European documents. This subpart also details requirements for renewing and measuring track under both traffic and unloaded conditions. The European regulations are not arranged based on these distinctions but do call out maintenance rules that accomplish the same objectives. Also, this section of the U.S. code calls out responsibility for compliance, penalties, waivers, and information collection requirements. Enforcement rules will vary based on local customs and thus appear as a gap.

4.4.1.2 49 CFR Part 213 Subpart B – Roadbed

49 CFR Part 213 Subpart B – *Roadbed* prescribes minimum requirements for roadbed and areas immediately adjacent to the roadbed. Relative to the European standards, there are several open points. One is specification of gradients. The TSI *Infrastructure* calls out maximum rising and falling gradients. These ensure train performance as related to acceleration and braking.

Gradient in the United States was established by the *Land Grants Act of 1862*, which essentially limited maximum gradient to the existing maximum on the Baltimore and Ohio Railroad at the time. Gradient is not addressed in the FRA regulations. The next specifications are vegetation and drainage. The U.S. standards specify maintenance and upkeep of culverts and control of vegetation. No corresponding rules were found in the body of the European regulations.

4.4.1.3 49 CFR Part 213 Subpart C – Track Geometry

49 CFR Part 213 Subpart C – *Track Geometry* prescribes requirements for the gage, alignment, and surface of track, and the elevation of outer rails and speed limitations for curved track. One notable difference exists in the specification of track geometry. There is a gap in how rail section is specified. EN 13674-1:2003 specifies rail cross sections. In the United States, a rail section is an AREMA standard and is not regulated by FRA. Other track geometry specifications are consistent between U.S. and European standards. Even though they are categorized differently, the essential track geometry features of gage, alignment, curvature, elevation, cant, runoff, and track surface are addressed to some extent in U.S. and European bodies of regulations. The spreadsheet lists the governing European documents.

4.4.1.4 49CFR Part 213 Subpart D – Track Structure

49 CFR Part 213 Subpart D – *Track Structure* prescribes minimum requirements for ballast, crossties, track assembly fittings, and the physical conditions of rails. This subpart has several notable gaps and open points. The first issue is ballast pickup. The TSI *Rolling Stock* Section 4.2.3.11 *Aerodynamic effects on ballast* lists ballast pickup as an open point. The FRA regulations address the function of ballast but not the potential pickup of ballast during high-speed operation. The current state of the U.S. regulation has the same verbiage in both Sections 213.103 *Ballast*, under Subpart D – *Track Structure*, and 213.334 *Ballast*, under Subpart G – *Train Operations at Track Classes 6 and Higher*. Although it is generally recognized that ballast must be secured for HSR lines, there is no regulation on this topic in the FRA code.

Next is the issue of track resistance or strength. The TSI *Infrastructure* Section 4.2.13 *Track Resistance* specifies track strength requirements. In the United States, track strength is regulated more by features (e.g., number of fasteners) than by overall objective (i.e., strength sufficient for regulated maximum axle load). This gap is in part due to maximum freight car axle load being governed by AAR standards rather than FRA regulations. The U.S. regulations also have a more detailed treatment of special components such as frogs and guard rails. Finally, the U.S. regulations have very specific details regarding rail joining methods, specifically continuous welded rail, rail joints, or torch cut rails. The May 10, 2010 Notice of Proposed Rule Making (NPRM) proposes a new section 213.118 *Continuous Welded Rail (CWR); Plan Review and Approval*. The European regulations are not organized to the same specifics.

4.4.2 49 CFR Part 213 Subpart E – Track Appliances and Track Related Devices

49 CFR Part 213 Subpart E – *Track Appliances and Track Related Devices* of the U.S. regulation covers derails. Its scope states that “this subpart prescribes minimum requirements for certain track appliances and track-related devices.” It has no counterpart in the European regulations.

4.4.2.1 49 CFR Part 213 Subpart F – Inspection

The scope of 49 CFR Part 213 Subpart F – *Inspection*, states: “This subpart prescribes requirements for the frequency and manner of inspecting track to detect deviations from the standards prescribed in this part.” The entire section is a gap relative to European regulations. There is no specific section in the European regulations that calls out inspection frequency. The European regulations specify test methods rather than inspection schedules to assure compliance of track structure.

4.4.2.2 49 CFR Part 213 Subpart G – Train Operations at Track Classes 6 and Higher

49 CFR Part 213 Subpart G – *Train Operations at Track Classes 6 and Higher* has gaps and open points. Its scope states: “This subpart applies to all track used for the operation of trains at a speed greater than 90 mph for passenger equipment and greater than 80 mph for freight equipment.” Several gaps are observed. First are a number of aerodynamic effects of HSR operation that are not yet mentioned in the U.S. regulations. Leaflet 734, *Adaptation of safety installations to high-speed requirements*, and TSI *Infrastructure* sections 4.2.16, *Maximum pressure variation in tunnels*, 4.2.14.7 *Aerodynamic actions from passing trains on line side structures*, and 4.2.17 *Effects of crosswinds*, are examples of aerodynamic regulations that exist in the European standards but have no equivalent in the U.S. code. An additional European regulation that may have no U.S. HSR counterpart is 4.2.18, *Electrical characteristics*. This section regards electrical resistance and the signaling system, which does not fall within the track safety subpart of the U.S. regulations. Reciprocal gaps, items listed in the U.S. regulation but not specifically detailed in the European body, include the following 49 CFR Parts: 213.309 *Restoration or renewal of track under traffic conditions*, 213.311 *Measuring track not under load*, 213.317 *Waivers*, 213.319 *Drainage*, and 213.321 *Vegetation*.

Next, inspection of rails is called out differently in the U.S. than in Europe. 49 CFR Parts 213.341 *Initial inspection of new rail and welds* and 213.343 *Continuous welded rail (CWR)* are unique to the U.S. regulations. In addition, the 49 CFR Parts 213.347 *Automotive or railroad crossings at grade*, 213.351 *Rail joints*, 213.352 *Torch cut rail*, 213.361 *Right of way*, 213.365 *Visual inspections*, 213.367 *Special inspections*, and 213.369 *Inspection records* all have no specific counterpart in the European HSR regulations.

One open point in Subpart G is ballast pickup. The European regulations indicate this is as an open point, and the U.S. regulations do not address it, as similar in 49CFR Part 213 Subpart D. An additional open point appears relative to Appendix D to Part 213 – *Minimally Compliant Analytical Track (MCAT) Simulations Used for Qualifying Vehicles to Operate at High Speed and at High Cant Deficiency*. The European regulations address vehicle dynamics in Annex G, *Effects of Crosswinds*, specifically under Section G.5.4 *Vehicle dynamics determination*. The goals of assuring safe operation are the same, but the scenarios and conditions vary substantially. The MCAT regulation as proposed in 49 CFR Part 213.345 of the May 10, 2010 Vehicle Track Interaction Notice of Proposed Rule Making (VTINPRM) from FRA is closely related to the European standards listed in the spreadsheet.

An arguable open point exists regarding Track Stiffness. Track Stiffness is listed as an open point in the TSI *Infrastructure* Section 4.2.15 *Global Track Stiffness*. FRA regulation 49 CFR Part 213.359 does specify track stiffness. So although the specification for track stiffness is open

in the European standards, it is already accounted for in the United States. It is interesting to note that the TSI *Infrastructure* does have a Section 4.2.13 *Track Resistance*, which does specify minimum load bearing capability of the track.

49 CFR Part 213.361, *Right of way* of the U.S. code requires that “The track owner in Class 8 and 9 shall submit a barrier plan, termed a ‘right-of-way plan,’ to the Federal Railroad Administration for approval. At a minimum, the plan will contain provisions in areas of demonstrated need for the prevention of—(a) Vandalism; (b) Launching of objects from overhead bridges or structures into the path of trains; and (c) Intrusion of vehicles from adjacent rights of way.” European standards prohibit grade crossings but leave the issue of limiting intrusion to the discretion of each nation.

Finally, the apparent gap regarding 49 CFR Part 213.365 *Visual inspections*, Part 213.367 *Special inspections*, and Part 213.369 *Inspection records* is not so much a gap as a difference in how the track geometry is ensured. Maintenance procedures and inspection records are required in the European standards, but they are not specified by the same headings. Inspection records are referred to in TSI *Infrastructure* 4.2.10 *Track geometrical quality and limits on isolated defects*.

4.5 49 CFR Part 221 – Rear End Marking Device – Passenger, Commuter and Freight Trains

The scope of 49 CFR Part 221 – *Rear End Marking Device – Passenger, Commuter and Freight Trains* reads: “This part prescribes minimum requirements governing highly visible marking devices for the trailing end of the rear car of all passenger, commuter and freight trains. So long as these minimum requirements are met, railroads may adopt additional or more stringent requirements for rear end marking devices.” The rear end marking device is intended to increase visibility of the train. In general, it functions in conjunction with the headlamps, horn, and conspicuity devices to increase awareness of the presence of the train. The European regulations have sections for horns and lamps, which generally include the function of the rear marking device in the United States. The essential requirement that is satisfied by external marking devices is 2.4.3.3. *Technical Compatibility*, “The characteristics of the rolling stock must be such as to allow it to travel on any line on which it is expected to operate.” The gaps between the U.S. regulation and the European requirements are primarily differences of enforcement and inspection.

4.6 49 CFR Part 223 – Safety Glazing Standards – Locomotives, Passenger Cars, and Caboose

The scope of 49 CFR Part 223 – *Safety Glazing Standards – Locomotives, Passenger Cars, and Caboose* reads: “This part provides minimum requirements for glazing materials in order to protect railroad employees and railroad passengers from injury as a result of objects striking the windows of locomotives, caboose and passenger cars.” There are two European essential requirements that are satisfied: Essential requirement 1.1.1 *Safety*: “The design, construction or assembly, maintenance and monitoring of safety-critical components, and more particularly of the components involved in train movements must be such as to guarantee safety at the level corresponding to the aims laid down for the network, including those for specific degraded situations.” And Essential requirement 1.1.3 *Safety*: “The components used must withstand any

normal or exceptional stresses that have been specified during their period in service. The safety repercussions of any accidental failures must be limited by appropriate means.” The TSI *Rolling Stock* Section 4.2.2.7 *Windscreen and front of the train* gives the European specification for the safety glazing. Annex J *Windscreen properties* of the same TSI prescribes the optical and strength properties and the test required of the windscreen. One difference in the qualification testing may affect the overall strength requirement of the windscreen. This difference is that the European standard allows impacting the glazing at the installed angle rather than requiring a right angle impact test as in the United States. The U.S. qualification test will impose a much higher glazing strength requirement on trains operated in the United States. The gaps in this section are otherwise relative to enforcement.

4.7 49 CFR Part 229 – Railroad Locomotive Safety Standards

The intent of 49 CFR Part 229 – *Railroad Locomotive Safety Standards* is to ensure the safety of the train operator. The European standards do not have a correlating heading. Instead, the safety of the power unit of trains is specified in the same standards sections as the rolling stock. The safety of European rolling stock is ensured by those regulations that address the essential requirements. The European essential requirements relevant to rolling stock safety are:

- Essential requirement 2.4.1.1 *Safety*: “The rolling stock structures and those of the links between vehicles must be designed in such a way as to protect the passenger and driving compartments in the event of collision or derailment.”
- Essential requirement 1.2 *Reliability and Availability*: “The monitoring and maintenance of fixed or moveable components that are involved in train movements must be organised, carried out and quantified in such a manner as to maintain their operation under the intended conditions.”
- Essential requirement 2.4.2 *Reliability and Availability*: “The design of the vital equipment and the running, traction and braking equipment and also the control command system must, in a specific degraded situation, be such as to enable the train to continue without adverse consequences for the equipment remaining in service.”
- Essential requirement 2.4.1.6 *Safety*: “The access door must incorporate an opening and closing system which guarantees passenger safety.”
- Essential requirement 1.1.5 *Safety*: “Any devices intended to be handled by users must be so designed as not to impair their safety if used foreseeably in a manner not in accordance with the posted instructions.”
- Essential requirement 1.1.3 *Safety*: “The components used must withstand any normal or exceptional stresses that have been specified during their period in service. The safety repercussions of any accidental failures must be limited by appropriate means.”
- Essential requirement 2.4.1.4: “Steps must be taken to prevent access to electrically live constituents in order not to endanger the safety of persons”.
- Essential requirement 1.1.1 *Safety*: “The design, construction or assembly, maintenance and monitoring of safety-critical components, and more particularly of the components involved in train movements must be such as to guarantee safety at the level

corresponding to the aims laid down for the network, including those for specific degraded situations.”

- Essential requirement 1.1.2 *Safety*: “The parameters involved in the wheel-rail contact must meet the stability requirements needed in order to guarantee safe movement at the maximum authorised speed.”

4.7.1 Analysis of Railroad Locomotive Safety Standards

Because of the differing regulatory approaches, there are many gaps between the U.S. code and European standards regarding locomotive safety. The following analysis investigates the differences one subpart at a time.

4.7.1.1 49 CFR Part 229 Subpart A – General

The scope of 49 CFR Part 229 Subpart A reads: “This part prescribes minimum Federal safety standards for all locomotives except those propelled by steam power.” There is no corresponding section in the European standards. The only common element is found in 49 CFR Part 229.4 *Information Collection*. Here, the U.S. regulations call out what data must be recorded during locomotive inspections. TSI *Rolling Stock*, Section 4.2.10 *Maintenance*, calls out documentation requirements for management of maintenance data. All other sections of this subpart are gaps relative to the European standards.

4.7.1.2 49 CFR Part 229 Subpart B – Inspection and Tests

49 CFR Part 229 Subpart B – *Inspection and Tests* establishes inspection schedules for locomotives. The European regulations do not call out inspection schedules but rather require documented maintenance plans. TSI *Rolling Stock* Section 4.2.10 *Maintenance* contains the sections that specify the maintenance file, the maintenance design justification file, and the maintenance documentation. All other sections of this subpart are gaps relative to the European standards.

4.7.1.3 49 CFR Part 229 Subpart C – Safety Requirements

49 CFR Part 229 Subpart C – *Safety Requirements* has several categories. These include General Requirements, Brake System, Draft System, Suspension System, Electrical System, Internal Combustion Equipment, Steam Generators, and Cabs and Cab Equipment. The European standards do at least touch on most of these categories but often in very different ways. First are the General Requirements. This section establishes driver protection by establishing safety of the cab environment in terms of shielding, noxious gas entry, and securement of equipment in the cab. The TSI *Rolling Stock* Section 4.2.2 *Structure and mechanical parts* establishes similar requirements in Europe. The gap here is that there are few European regulations that pertain specifically to the locomotive.

The *Brake System* regulations in the U.S. code are based on inspection and mechanical assurance of components. The TSI *Rolling Stock* Section 4.2.4 *Braking* specifies the braking performance rather than the condition of the components.

Draft System requirements exhibit the most similarities between the two bodies of regulation, although, once again the U.S. regulations are based on measurable inspection criteria, whereas

the TSI *Rolling Stock* Section 4.2.2.2 *End couplers and coupling arrangements to rescue trains* specifies the hardware required rather than the assurance of its condition.

Suspension System requirements appear to gap substantially. The differences are primarily in assurance of performance. In the U.S. regulations, measurable inspection criteria are called out. In the European regulations, suspension system performance is specified by dynamic behavior. TSI *Rolling Stock* Section 4.2.3.4 *Rolling stock dynamic behavior* and EN14363:2005 *Railway Applications – Testing for the acceptance of running characteristics of railway vehicles* are the relevant European documents. The dynamic behavior in the United States is currently addressed by 49 CFR Part 213.345 *Vehicle/track system qualification*. Low-speed dynamic safety in terms of severe track twist over the length of the bogie/car, wheel unloading, and truck rotation resistance is explicitly addressed in the European documents. In the U.S. regulations (49 CFR Part 213 Subpart C), track geometry is specified but not dynamic performance of the vehicles. This may be significant for interoperability of HSR equipment on mixed right-of-way.

Electrical System requirements in the U.S. regulations cover current collection, manually operated switches, cover doors and markings, jumpers, and motors and generators. Both function and measurable criteria are called out. In the European regulations, TSI *Rolling Stock* Section 4.2.8.3 *Functional and technical specification related to the electric power supply* and a series of leaflets 600, 603, 605, 606-1, 608, and 611 specify the electrical requirements. Overall, the European electrical system is more completely specified than the United States, as would be expected on a mature all electric system.

Neither *Internal Combustion Equipment* nor *Steam Generators* have a counterpart in the European HSR regulations. This is a reciprocal gap in which the U.S. regulations are more complete than the European standard.

The majority of *Cabs and Cab Equipment* regulated items are consistent with European standards, but there are several notable gaps. First is 49 CFR Part 229.115 *Slip/slide alarms*. Traction control is required on all European HSR trains, obviating the need for an alarm. Next is 49 CFR Part 229.117 *Speed indicators*. This section specifies requirements for the speed indicator. TSI *Rolling Stock* Section 4.2.7.14 *Driver-machine-interface (DMI)* indicates that the display for driving cabs is an open point, so the presence of a speed indicator is not ensured. 49 CFR Part 229.119 *Cabs, floors, and passageways* specifies the physical requirements of the cab regarding seating, passage, and heating/ventilation in the cab. TSI *Rolling Stock* Sections 4.2.7.12 *Driver's cab emergency exits* and 4.2.2.6 *Driver's cab* are the most similar European standards. An interesting gap is that the European standards require a storage facility for the staff's uniforms and required personal gear. No such facility is mentioned in the U.S. regulations. 49 CFR Part 229.123 *Pilots, snowplows, end plates* is a gap relative to European standards. No mention of snow plows was found in the European literature. 49 CFR Part 229.127 *Cab lights* does not have a specific counterpart in the TSI *Rolling Stock*. However, essential requirement 2.4.1.9 states: "An emergency lighting system having a sufficient intensity and duration is an absolute requirement on board trains." The remaining sections of 49 CFR Part 229 Subpart C, regarding headlights, auxiliary lights, locomotive horn, marker lights, event recorders, and sanitation are generally consistent with European requirements.

4.7.1.4 49 CFR Part 229 Subpart D – Locomotive Crashworthiness Design Requirements

49 CFR Part 229 Subpart D – *Locomotive Crashworthiness Design Requirements* is largely gapped relative to European standards. The European standards do not isolate locomotive crashworthiness from all passenger vehicle crashworthiness. Two notable EN standards address vehicle structural requirements for crashworthiness. These are EN12663-1:2010 *Railway applications – Structural requirements of railway vehicle bodies Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)* and EN 15227:2008 *Railway Applications – Crashworthiness requirements for railway vehicle bodies*. TSI Rolling Stock Section 4.2.2.3 *Strength of vehicle structure* and Section 4.2.2.3.2 *Principles (functional requirements)* correspond closely with U.S. 49 CFR Part 229.141 *Body Structure, MU locomotives* and 59 CFR Part 229.206 *Design requirements*. Other sections of the U.S. code are gaps by virtue of their specificity to locomotives. A notable gap in the U.S. code arises from the TSI Rolling Stock Annex A, Section 4.2.2.3.3 *Specifications (simple load cases and design collision scenarios)*, in which specific collision scenarios are defined. The U.S. code specifies different collision scenarios.

4.8 49 CFR Part 231 – Railroad Safety Appliance Standards

49 CFR Part 231 – *Railroad Safety Appliance Standards*, imposes requirements on the mechanical condition of the man-machine touch point hardware on rail cars. Note that most of the sections in this part are with regard to freight vehicles that do not apply to HSR passenger service. There are very few corresponding European regulations. The European essential requirement that applies is Essential Requirement 1.2: “The monitoring and maintenance of fixed or moveable components that are involved in train movements must be organized, carried out and quantified in such a manner as to maintain their operation under the intended conditions.” TSI Rolling Stock Section 4.2.2.2 *End couplers and coupling arrangement to rescue trains* addresses coupler requirements but is aimed more at the essential function of interchangeability. From the same TSI, Section 4.2.2.9 *External steps for use by shunting staff* requires step hardware for making up trains of variable consist. Finally, leaflet 560, *Doors, footboards, windows, steps, handles and handrails of coaches and luggage vans* addresses the human-machine interface requirements on European coaches. The organization of this part in the U.S. code seems outdated, and the entire section is otherwise open relative to the European standards.

4.9 49 CFR Part 238 – Passenger Equipment Safety Standards

The scope from 49 CFR Part 238 Subpart A – *General* states in part, “The purpose of this part is to prevent collisions, derailments, and other occurrences involving railroad passenger equipment that cause injury or death to railroad employees, railroad passengers, or the general public; and to mitigate the consequences of such occurrences to the extent they cannot be prevented.” As such, the regulations in this section are extremely important to ensuring safety.

The following is a review of European Essential Requirements that pertain to passenger equipment safety standards:

- Essential requirement 2.4.1.10 *Safety* “Trains must be equipped with a public address system which provides a means of communication to the public from on-board staff and ground control.”
- Essential requirement 2.7.1.2 *Safety* “The operations and maintenance intervals, the training and qualifications of maintenance staff and the quality assurance system set up in the maintenance centers of the operators concerned must be such as to ensure a high level of safety.”
- Essential requirement 2.7.2 *Reliability and availability* “The operation and maintenance periods, the training and qualifications of the maintenance staff and the quality assurance system set up by the operators concerned in the maintenance centers must be such as to ensure a high level of system reliability and availability.”
- Essential Requirement 2.4.1.9 *Safety* “An emergency lighting system having a sufficient intensity and duration is an absolute requirement on board trains.”
- Essential Requirement 2.4.1.4 *Safety* “Steps must be taken to prevent access to electrically live constituents in order not to endanger the safety of persons.”
- Essential requirement 1.1.2 *Safety* “The parameters involved in the wheel-rail contact must meet the stability requirements needed in order to guarantee safe movement at the maximum authorized speed.”
- Essential Requirement 2.4.1.1 *Safety* “The rolling stock structures and those of the links between vehicles must be designed in such a way as to protect the passenger and driving compartments in the event of collision or derailment.”
- Essential Requirement 2.4.1.3 *Safety* “The braking techniques and the stresses exerted must be compatible with the design of the tracks, engineering structures and signaling systems.”
- Essential Requirement 2.4.1.5 *Safety* “In the event of danger, devices must enable passengers to inform the driver and accompanying staff to contact him.”
- Essential Requirement 2.4.1.6 *Safety* “The access door must incorporate an opening and closing system which guarantees passenger safety.”
- Essential Requirement 2.4.1.7 *Safety* “Emergency exits must be provided and indicated.”
- Essential Requirement 2.4.1.8 *Safety* “Appropriate provisions must be laid down to take account of the particular safety conditions in very long tunnels.”
- Essential requirement 2.4.2: *Reliability and Availability* “The design of the vital equipment and the running, traction and braking equipment and also the control command system must, in a specific degraded situation, be such as to enable the train to continue without adverse consequences for the equipment remaining in service.”
- Essential requirement 1.2 *Reliability and Availability* “The monitoring and maintenance of fixed or moveable components that are involved in train movements must be organized, carried out and quantified in such a manner as to maintain their operation under the intended conditions.”

- Essential requirement 1.1.1: *Safety*: “The design, construction or assembly, maintenance and monitoring of safety-critical components, and more particularly of the components involved in train movements must be such as to guarantee safety at the level corresponding to the aims laid down for the network, including those for specific degraded situations.”
- Essential requirement 1.1.3: *Safety*: “The components used must withstand any normal or exceptional stresses that have been specified during their period in service. The safety repercussions of any accidental failures must be limited by appropriate means.”
- Essential requirement 1.1.4: *Safety*: “The design of fixed installation and rolling stock and the choice of the materials used must be aimed at limiting the generation, propagation and effects of fire and smoke fumes in the event of a fire.”
- Essential requirement 1.1.5: *Safety*: “Any devices intended to be handled by users must be so designed as not to impair their safety if used foreseeably in a manner not in accordance with the posted instructions.”

4.9.1 Analysis of Passenger Equipment Safety Standards

A subpart by subpart analysis of the U.S. regulations for 49 CFR Part 238 *Passenger Equipment Safety Standards* follows:

4.9.1.1 49 CFR Part 238 Subpart A – General

49 CFR Part 238 Subpart A – *General* establishes the enforcement rules in the United States. As such, this subpart is gapped relative to the European standards in areas of enforcement and of historical development. Parts 238.15 *Movement of passenger equipment with power brake defect* and 238.17 *Movement of passenger equipment with other than power brake defects* do not have corresponding sections in the European code. None of the gaps in this section seem relevant to the technical aspects of safety.

4.9.1.2 49 CFR Part 238 Subpart B – Safety Planning and General Requirements

The scope of 49 CFR Part 238 Subpart B – *Safety Planning and General Requirements* states: “This subpart contains safety planning and general safety requirements for all railroad passenger equipment subject to this part.” The most obvious section that has no direct European equivalent is Part 238.119 *Rim-stamped straight-plate wheels*. Part 238.113 *Emergency window exits* does not show a direct counterpart, but this is because the U.S. regulation is more restrictive. Emergency exits in the European regulations are not specifically required to be window exits. Refer to TSI *Rolling Stock* Section 4.2.7.1 *Emergency exits*.

4.9.1.3 49 CFR Part 238 Subpart C – Specific Requirements for Tier I Passenger Equipment

The scope for 49 CFR Part 238 Subpart C – *Specific Requirements for Tier I Passenger Equipment* states, “This subpart contains requirements for railroad passenger equipment operating at speeds not exceeding 125 miles per hour.” There are 20 sections in this subpart, 15 of which are well matched by the European standards. The sections that have no equivalent in

the European documents are Parts 238.201 *Scope/alternative compliance*, 238.223 *Locomotive fuel tanks*, 238.229 *Safety appliances – general*, and 238.230 *Safety appliances – new equipment*. Several gaps are noted in the following sections. 238.221 *Glazing* specifies glazing for passenger windows. The European regulation, TSI *Rolling Stock* Section 4.2.2.7 *Windscreen and front of the train*, only covers the windscreen on the front of the train. No mention is made for glazing of passenger windows. 49 CFR Part 238.227 *Suspension system* has corresponding sections in TSI *Rolling Stock* Sections 4.2.3.2 *Static axle load* and 4.2.3.4 *Rolling stock dynamic behavior*. The gap observed is that the European standards specify vehicle dynamic behavior and wheel/rail interactions that in the United States are otherwise specified by AAR standards. Finally, 49 CFR Part 238.233 *Interior fittings and surfaces* calls for enclosed overhead bins. The European regulations have no such provision.

4.9.1.4 49 CFR Part 238 Subpart D – Inspection, Testing, and Maintenance Requirements for Tier I Passenger Equipment

The scope for 49 CFR Part 238 Subpart D – *Inspection, Testing, and Maintenance Requirements for Tier I Passenger Equipment* states, “This subpart contains requirements pertaining to the inspection, testing, and maintenance of passenger equipment operating at speeds not exceeding 125 miles per hour. The requirements in this subpart address the inspection, testing, and maintenance of the brake system as well as other mechanical and electrical components covered by this part.” European standards call out performance assurance requirements and tests. Corresponding sections of the TSI *Rolling Stock* document are Section 6.2.4 *Assessment of maintenance* and Annex P *Calculation method of decelerations in degraded mode and unfavorable climatic conditions*. There are remaining gaps because of enforcement and differences in the method of approach.

In the European regulations, suspension system performance is specified by dynamic behavior. TSI *Rolling Stock* Section 4.2.3.4 *Rolling stock dynamic behavior* and EN14363:2005 *Railway applications – Testing for the acceptance of running characteristics of railway vehicles* are the relevant European documents. The high-speed dynamic behavior in the United States is currently addressed by 49 CFR Part 213.345 *Vehicle/track system qualification*. In the U.S. regulations, low-speed dynamic performance of the vehicles is not explicitly regulated. This may be significant for interoperability with HSR equipment on mixed right-of-way.

4.9.2 49 CFR Part 238 Subpart E – Specific Requirements for Tier II Passenger Equipment

The scope of 49 CFR Part 238 Subpart E – *Specific Requirements for Tier II Passenger Equipment* states in part, “This subpart contains specific requirements for railroad passenger equipment operating at speeds exceeding 125 mph, but not exceeding 150 mph.” This section covers crash impact and structural safety, glazing, fuel tanks, electrical system, suspension, safety appliances, brake system, draft system, interior fittings, emergency communications, doors and emergency exits, headlights, automated monitoring, and cab controls layout. The notable gaps are discussed here. Part 238.421 *Glazing* specifies performance for both the leading windscreen and the side glasses. TSI *Rolling Stock* does not address the side glass strength. Part 238.429 *Safety Appliances* is much more involved than the European counterpart. Very few European regulations exist regarding safety appliances. Part 238.435 *Interior fittings and*

surfaces calls for enclosed overhead bins. The European regulations have no such provision. Part 238.437 *Emergency communication* of the U.S. code does not require a public address system. Part 238.441 *Emergency roof entrance location* is more restrictive than the European counterpart. The European regulations do not specifically require a roof exit. Finally, in Part 238.447 *Train operator's controls and power car cab layout*, the U.S. regulation is more complete than the European requirements. The European traffic control system display for driving cabs remains an open point.

4.9.2.1 49 CFR Part 238 Subpart F – Inspection, Testing, and Maintenance Requirements for Tier II Passenger Equipment

The scope of 49 CFR Part 238 Subpart F – *Inspection, Testing, and Maintenance Requirements for Tier II Passenger Equipment* states, “This subpart contains inspection, testing, and maintenance requirements for railroad passenger equipment that operates at speeds exceeding 125 mph but not exceeding 150 mph.” This subpart has three sections and all are well represented by European standards.

Note that in the European regulations, suspension system performance is specified by dynamic behavior. TSI *Rolling Stock* Section 4.2.3.4 *Rolling stock dynamic behavior* and EN14363:2005 *Railway applications – Testing for the acceptance of running characteristics of railway vehicles* are the relevant European documents. The dynamic behavior of HSR equipment in the United States is currently addressed by Part 213.345 *Vehicle/track system qualification*. In the U.S. regulations, low-speed dynamic performance of the vehicles is not explicitly regulated. This may be significant for interoperability of HSR equipment on mixed right-of-way.

4.9.2.2 49 CFR Part 238 Subpart G – Specific Safety Planning Requirements for Tier II Passenger Equipment

The scope of 49 CFR Part 238 Subpart G – *Specific Safety Planning Requirements for Tier II Passenger Equipment* states, “This subpart contains specific safety planning requirements for the operation of Tier II passenger equipment, procurement of Tier II passenger equipment, and the introduction or major upgrade of new technology in existing Tier II passenger equipment that affects a safety system on such equipment.” It has only one section other than scope, and its objectives are well matched in the European code.

4.10 49 CFR Part 239 – Passenger Train Emergency Preparedness

The scope of 49 CFR Part 239 – *Passenger Train Emergency Preparedness* states in part: “The purpose of this part is to reduce the magnitude and severity of casualties in railroad operations by ensuring that railroads involved in passenger train operations can effectively and efficiently manage passenger train emergencies.” This part goes on to require a written emergency plan for each railroad, regular simulation tests, and debriefing after each test/emergency to determine the effectiveness of the plan. No directly correlating sections were found in the TSI *Rolling Stock* document. Section 4.4 *Operating rules* suggests a number of rules for ensuring safe operation, but the spirit of this section is not the same as the emergency planning required in the U.S. document.

5. Far East Standards

5.1 China HSR Standards

The China HSR systems are solely owned by the Chinese government and are constructed under the regulation of Ministry of Railways (MOR) of China. MOR issued “Code for Design of High-Speed Railway” (TB10621-2009), abbreviated as China Code in this report, published in both Chinese and English, on December 1, 2009. China Code includes the standards for regulating HSR infrastructures, such as track, earth structure, bridge, tunnel, station and yard, sewerage, and signal systems. China Code applies to the HSR lines in China with operating speeds of 250–350 km/h, which are all HSR passenger dedicated lines. Figure 1 shows the HSR network in China. Interoperability is not an issue for the HSR systems in China, because they are structured and operated in compliance with the same standards.

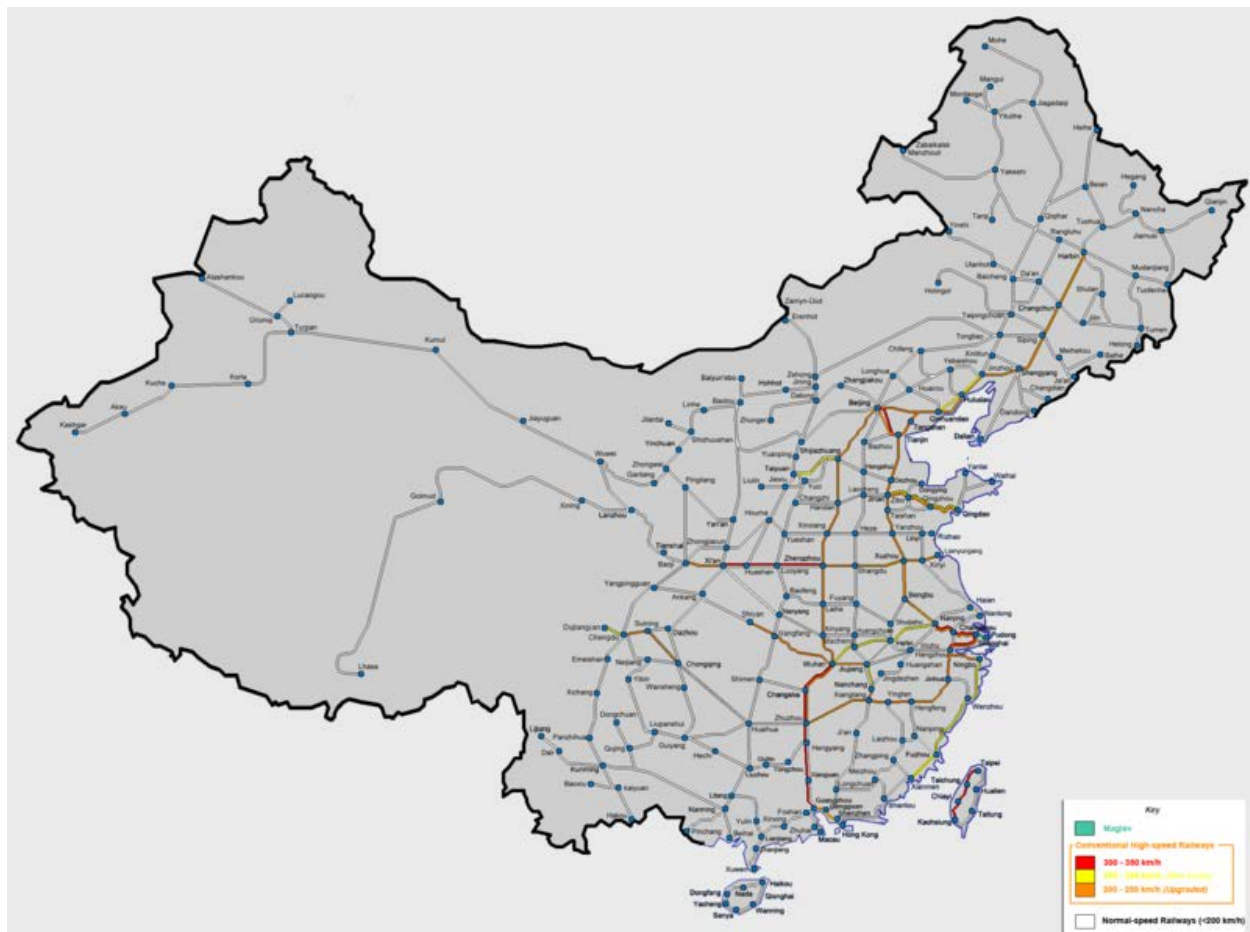


Figure 1. HSR network in China, Red – 300-350 km/h, Yellow – 250–300 km/h, Orange – 200–250 km/h

China Code contains 22 chapters and 5 appendices. Table 9 lists the chapter titles.

Table 9. Chapter Titles of Code for Design of HSR – China

Chapter No.	Chapter Title	Chapter No.	Chapter Title
1	General Provision	12	Electric Power
2	Glossaries and Symbols	13	Communication
3	Overall Design	14	Signaling
4	Transport Organization	15	Information
5	Alignment	16	Disaster Prevention and Safety Monitoring
6	Earth Structure	17	EMU Facilities
7	Bridge and Culvert	18	Comprehensive Maintenance
8	Tunnel	19	Water Supply and Sewerage
9	Track	20	Building Construction
10	Station and Yard	21	Integrated Earthing
11	Traction Power Supply	22	Environmental protection
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Appendix B	Calculation of the Soft Foundation Settlement		
Appendix C	Equivalent Evenly Distributed Load Converted From ZK Live Load		
Appendix D	Reduction Coefficient of Effective Width of Box Girder		
Appendix E	Design Length of ZPW-2000 A Track Circuit		

5.1.1 Correspondence between 49 CFR and the China Code

On the basis of the contents of China Code, 49 CFR is comparable to three sections that are related to the railway infrastructure.

- 49 CFR Part 200 *Informal Rules of Practice for Passenger Service*
 - China Code Chapter 1. General Provision
- 49 CFR Part 210 *Railroad Noise Emission Compliance Regulations*
 - China Code Chapter 22. Environment Protection
- 49 CFR Part 213 *Track Safety Standards*
 - China Code Chapter 5 Alignment
 - China Code Chapter 9 Track

Appendix B contains a spreadsheet that gives more details comparing China Code with U.S. regulations.

5.1.2 HSR Rolling Stock

China's HSR rolling stock uses both domestic developed technologies and imported technologies from Germany (Siemens), Canada (Bombardier), France (Alstom), Japan (Kawasaki), and Sweden. Each foreign rolling stock supplier has a local railway rolling stock factory to collaborate the technology transfer. China has now localized HSR train production.

MOR is currently working on the Code that regulates HSR rolling stocks. The Code for regulating rolling stock is expected to be published in 2011.

5.1.3 Other HSR-Related Codes and Standards

There are other Codes or Standards for regulating the acceptance of track and vehicle, monitoring, maintenance, and safety for the HSR systems. They are published in Chinese and may be requested or purchased from MOR.

Some codes or specifications related to the HSR monitoring, testing, and safety were stated in the presentations from MOR and CARS.

1. Guidance of Dynamic Inspection of Completion Acceptance of Passenger Dedicated Line
《客运专线铁路工程竣工验收动态检测指导意见》(铁建设[2008]7号)
2. Guidance of Dynamic Acceptance of HSR 《高速铁路动态验收指导意见》
3. Rules of Track and Bridge Maintenance of Existing Lines with Speed up to 200-250 km/h
《既有线提速200~250km/h线桥设备维修规则》(铁运[2007]44号)
4. Technical Management Ways of Passenger Dedicated Line
《铁路客运专线技术管理办法》(铁科技[2009]116、212号)
5. Emergency Rescue System
6. TB/T 2708-1996, "Technical Conditions of Mono-bloc Rolled Steel Wheel of Fast Passenger Train"
7. TB/T 449-2003, "Flange Tread Profile of Locomotive and Rolling Stock"
8. Test Specifications of Whole Set EMU (TieYun[2008]28)
9. Design Specifications of Electric Traction and Power Supply (TB10009-2005)
10. Pantograph Characteristics and Tests of Rolling Stock of Main Track (GB/T 21561.1-2008)

5.1.4 Summary

The document *Code for Design of High-Speed Railway*, obtained from MOR of China, regulates the requirements for the HSR infrastructures with operating speeds of 250–350 km/h. There are other separate documents of Codes or Standards, which have not yet been obtained (and are written in Chinese), that regulate the acceptance of track and vehicle, monitoring, maintenance, and safety for the HSR systems.

There are overlaps and many gaps between 49 CFR and the China Code (and other related standards). The structure and format of the standards vary significantly between the United States and China. However, some direct comparisons are made in certain areas, which are summarized in Appendix B.

5.2 Taiwan HSRail Standards

Taiwan HSRail (THSR) is a high-speed network that runs along the west coast of Taiwan (Figure 2) with speeds up to 300 km/h. It is the only HSR passenger dedicated system currently operating in Taiwan. THSR is structured on the basis of Japan's Shinkansen system and operates a variant of the 700 Series Shinkansen (700T EMUs, supplied by Kawasaki). All specifications were developed and applied specifically for this system. Therefore, there is no interoperability issue for Taiwan HSR operation.



Figure 2. HSR Network in Taiwan, up to 300 km/h

THSR Corporation issued *Design Specifications for Civil Works* in January 2000 (abbreviated as the Taiwan Specification in the Taiwan section of this report). It is written in English. The Taiwan Specification contains 10 sections and 20 appendices. Table 10 lists the section titles of this document, and Table 11 lists the titles of the appendices. Section 1.3 of the Taiwan Specification lists the accordance standards that support it, which include the standards from German, American, and European railways and other related Taiwan transportation and infrastructure building codes.

Table 10. Section Titles of Design Specifications for Civil Works – Taiwan

Section No.	Description
Section 1	General Design Specification
Section 2	Alignment Design Specification
Section 3	Bridge Design Specification
Section 4	Bridge and Viaduct Foundation Design Specification
Section 5	Earth Work Design Specification
Section 6	Tunnel Design Specification
Section 7	Underground Structure Design Specification
Section 8	System Safety and System wide Interface Design Specification
Section 9	Building Structure Design Specification
Section 10	Drainage Design Specification

Table 11. Titles of Appendices of the Taiwan Specification

Appendix	Description
Section 1 – Appendix A	Modified UIC Loading Diagram
Section 1 – Appendix A-1	Position of Loading
Section 1 – Appendix B	Characteristic Lengths L □
Section 1 – Appendix B-1	The Limit Natural Frequency of Structure
Section 1 – Appendix C	Reduction Factors for Centrifugal Forces due to Modified UIC Loading
Section 1 – Appendix D	Conventional (TRA) Train Loading Diagram and Clearance Diagrams
Section 1 – Appendix E	U.I.C. Clearance Dimensions
Section 1 – Appendix F	High Speed Train Loadings
Section 1 – Appendix G	Earthing, Bonding and Corrosion Control Systems
Section 1 – Appendix H	SPT-N Method for Soil Liquefaction Analysis
Section 1 – Appendix I	Design Ground Acceleration Coefficient
Section 1 – Appendix J	Actions due to Traction and Braking
Section 1 – Appendix K	Fatigue Traffic Loads
Section 1 – Appendix L	Impact by HSR Train on Structures
Section 2 – Appendix A	Cant
Section 2 – Appendix B	HSR Alignment Design Criteria for Panchiao Extension Project for Trupo
Section 3 – Appendix A	Creep and Shrinkage of Concrete
Section 3 – Appendix B	Allowable Angular Change in Viaduct Structures
Section 3 – Appendix C	Assessment of Longitudinal Actions
Section 3 – Appendix D	Slipstream Effects from Passing Trains
Section 5 – Appendix A	Technical Backfill
Section 5 – Appendix B	Stone Trap Protection against Rockfall
Section 7 – Appendix A	Seismic Design Criteria for Underground Structures
Section 10 – Appendix A	Runoff Coefficients
Section 10 – Appendix B-1	Rainfall Intensity Formula
Section 10 – Appendix B-2	Rainfall Intensity Formula
Section 10 – Appendix C	Subsurface Drains

The Taiwan Specification regulates the requirements for HSR system infrastructure, such as track, earth structure, bridge, tunnel, earth work, building structure, and drainage. No issues related to the vehicle responses are stated in the Taiwan Specification. No specifications have yet been obtained related to the HSR rolling stock operating in Taiwan.

Although it is a stand-alone system, the Taiwan Specification provides extensive computation methods and equations for evaluating the railway structures and loads in its appendices. The design criteria in track structure and track geometry addressed in the Taiwan Specification may also be included into the comparison with other international standards.

5.3 Japan

In 1987, Japan privatized the Japanese National Railways. Six passenger railway companies and one freight railway company were established. Collectively, they are known as the Japan Railways Group or the JR Group. With a few exceptions, the passenger railway companies operate in geographically distinct areas, and they own the infrastructure. The freight railway company operates throughout Japan.

Japan's Railway Bureau of the Ministry of Land, Infrastructure, Transport, and Tourism published the *Ministerial Ordinance Providing for the Technological Standard for Railways* in 2001, marking a significant change in philosophy for the regulation of railway infrastructure and rolling stock. Prior to this, Japanese regulations included many detailed specifications for infrastructure and rolling stock. After the Ministerial Ordinance took effect, the principles intended by the Ministerial Ordinance rules replaced most of the detailed specifications. The Japanese philosophy was that detailed specifications enforced before the Ministerial Ordinance were barriers to improving safety and service quality and made it impossible for the JR Group members to introduce new technologies. In the current system, the JR Group members have substantial freedom to adopt new technologies but now must take full responsibility for the results.

The Ministerial Ordinance carries the force of law, and each member of the JR Group is responsible for compliance with Ministerial Ordinance provisions in their own operations. Each JR Group member has in-house standards, known as Implementation Standards through which they seek to comply with the Ministerial Ordinance. Accordingly, safety practices vary among the JR Group members. The Ministerial Ordinance includes Approved Specifications that are not compulsory but provide guidelines for meeting Ministerial Ordinance requirements.

With a few exceptions, the Ministerial Ordinance does not distinguish among conventional passenger rail, HSR passenger, and freight rail.

Table 12 lists the Table of Contents of the Ministerial Ordinance. The Ministerial Ordinance is well organized by chapter topics. As indicated previously, the requirements offer general principles rather than detailed specifications.

Table 12. Ministerial Ordinance Table of Contents

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The following examples illustrate some of the principles of the Japanese Ministerial Ordinance.

Chapter 3, Guideway, Article 12, Gauge contains the following (mandatory) Ministerial Ordinance:

(Gauge)

Article 12. Gauge shall be able to maintain the safe and stable car operation, given the structure of rolling stock, the maximum design speed and other relevant factors into consideration.

The companion (optional) Approved Specification is as follows:

III-1 Related to Article 12 (Gauge) Gauge shall be as follows in order to ensure the safe rolling stock operation, and shall take the structure of the rolling stock, such as width, and past performance records into consideration.

(1) Gauge of ordinary railways (excluding Shinkansen railways) shall be 0.762m, 1.067m, 1.372m, or 1.435m.

(2) Gauge of Shinkansen railways shall be 1.435m.

Articles 6, 25, and 71 relate to the generation of noise.

(Prevention of Extreme Noise)

Article 6. A railway enterprise shall strive to prevent extreme noise to be generated with the movement of a train.

In Japan, the Ministry of Environment regulates noise from Shinkansen trains. In residential areas, the limit is 70 decibels (dBa), and in commercial and industrial areas, the limit is 75 dBa. The Environmental Quality Standard for noise contains specific details about measuring Shinkansen noise levels. It also includes target dates for achievement as the limits are not currently strictly met. For details, refer to <http://www.env.go.jp/en/air/noise/railway.html>.

In the above two examples, which refer to gauge and noise levels, (optional) Approved Specifications either contain or lead to specific quantitative values of the subject items. Ministerial Ordinance Article 70 on carbody structure leads to a different kind of Approved Specification.

(Structure of Car Body)

Article 70. Rolling stock car body shall be made sturdy with enough strength and be capable of withstanding train operation.

The associated Approved Specification provides the following:

VIII-6 Relating to Article 70 (Structure of Car Body)

(Basic Items)

The car body of the rolling stock shall have sufficient strength, rigidity and durability to withstand the anticipated loads, etc., to the car body during normal operation.

These carbody structural excerpts illustrate the Japanese approach to carbody structural strength and collision features, that is, no detailed regulations are required. Collisions are to be prevented by system design features including automatic train control, fail-safe signaling systems, prevention of collisions on track by not having grade crossings on Shinkansen lines, and systems to prevent derailments in the event of earthquakes. See for example “Crashworthiness Features of HSR Equipment,” presented at FRA Rail Safety Advisory Committee Engineering Task Force October, 21, 2010, by Kawasaki Heavy Industries, Ltd., and “The Shinkansen, Japan’s High-Speed Railway,” available at

<http://republicans.transportation.house.gov/Media/File/Testimony/Rail/4-19-07-Matsumoto2.pdf>.

As a final example, the Ministerial Ordinance addresses vehicle stability in Chapter 8, which covers Rolling Stock. Article 66 requires the following:

(Stability)

Article 66. Rolling stock shall be able to maintain a safe and reliable operation under any conceivable operational conditions including the track stability.

2. Rolling stock shall be of the stable structure that will not cause overturn when stopped or stalled at curved track.

Related and associated Approved Specifications provide mostly qualitative guidance on hunting stability, wheel unloading, curve negotiation, and related performance measures.

5.4 Korea

South Korea is planning ahead for rail interchange through North Korea with China, Russia, Central Asia, and Europe. Part of the planning includes study and alignment of rail regulations among South Korea, China, and other destinations. See, for example, Hee-Seung Na, “Strategy of Trans-Korean Railway Transportation and Development of International Corridors,” Korea Railroad Research Institute, downloaded from:

http://www.unescap.org/ttdw/common/TIS/CorridorStudy/EGM_files/ROK_1.pdf, February 20, 2010. South Korean rail regulations are still developing, and the exchange with other parts of Asia and Europe provides part of the impetus for the development.

The South Korean railroad-related regulations are available only in the Korean language. The regulations may be found on the Internet at <http://law.go.kr/main.html>. At the Web site, if one searches for 철도 (railroad), the Web site displays a list of 40 items that make up Korean Rail Regulations. The regulations are promulgated by the Ministry of Land Transport and Maritime Affairs. TTCI has downloaded all 40 items and viewed automated online (nonprofessional) translations of all items. Table 13 summarizes the contents of the Korea rail regulations.

Table 13. Overview of South Korean Rail Regulations

No.	Name and Description	Relates to HSR
1	Ministry of Land and jurisdiction and supervision – legal issues	no
2	Urban Railway Construction Rules – relates to track gage, ballast, curves, stations, catenaries	no?
3	City Railway Act – relates to planning, licensing, land acquisition	no
4	Urban Rail Rules of Law – legal issues	no
5	City Railway Act – business, financial issues, law	no
6	City Railway Act Enforcement Rules – legal issues	no
7	Urban rail facility rules on safety standards – rail, tunnels, bridges, power, fire safety, catenary equipment, signal and train control	no?
8	Urban rail operating rules – training, safety, maintenance, train braking, speed limits, signaling, appears to relate to light rail	no
9	Urban rail vehicle on the management rules – requires performance testing of rail vehicles, appears to set the service life of urban rail vehicles at 25 years	no
10	Urban rail vehicle safety standards, rules on – appears to set safety standards for urban rail vehicles rather than high speed rail vehicles, crash speed of 5 km/h must not damage the carbody	no
11	Urban rail bond purchases office handling rules – financial	no
12	Dangerous Rail Transport Rules – contains rules for transport of hazardous materials, applies to freight rail	no
13	Railway construction rules – Chapter 2, Design Rules for Tracks specifies 1435 mm gage, curves must consider design speed, requires curve transitions, Chapter 3 – station design, Chapter 4 – electric power and related items, Chapter 5 – Signal and Communication,	yes

No.	Name and Description	Relates to HSR
14	Railway Construction Law – defines high speed rail as 200 km/h and above Chapter 2 – plans to build national railway system in 10 years, sets conditions for planning rail construction, considers land access, addresses environmental issues, costs, Chapter 3 – Station Area Development other chapters refer to plan reports, planning, and associated laws	yes
15	Railway Construction Law Decree – global issues including cultural survey, business issues, investment plans, traffic impact, environmental impact, land purchase, competition	no
16	Railway Construction Law Enforcement Regulations – legal requirements	no
17	Railway Civil Service railway security exams for physical strength test rules	no
18	Railway business law	no
19	Railway business law enforcement ordinance – laws and fines	no
20	Railway Act Enforcement Rules	no
21	Railway special accounting rules for processing business – asset depreciation and more	no
22	Railway Industrial Development Act – railways serve the public interest	no
23	Railway Industrial Development Framework Act – administrative issues	no
24	Railway Industrial Development Act Enforcement Rules – more administrative issues	no
25	Railway conservancy facilities – registration of rail facilities	no
26	Railway conservancy facility enforcement rules – procedures for registration	no
27	Railway facility rules on safety standards – safety issues for tunnels, catenary systems, bridges, stations, and more	no
28	Railway Safety Act (Legal) – provides legal structure for RSA and sets penalties	no
29	Railway Safety Act (Presidential Decree) – details of RSA	no
30	Railway Safety Act Enforcement Rules – emergency response, hospitals, train, ...	no
31	Railway regulations relating to vehicle safety standards – Chapter 1 requires risk analysis to be done and railcars to be designed with intended direction of travel, Chapter 2 requires cars to be designed to minimize risk of fire, ISO test methods be used for fire prevention, and requires electric safety standards, Chapter 3 contains requirements on wheel rail force limits, size and weight distribution limits, and safety crash standards. Chapter 4 requires further strength requirements, pressure equalization for high speed tunnel entry and exit, cab controls and displays, cab and passenger door strength and longevity, safety glass in windows, seat strength, air conditioning, emergency lighting. Chapter 4 also contains wheel, flange, and axle design details, suspension, brake, auxiliary power unit propulsion, traction motor, lighting, signaling and control requirements, and more.	yes
32	Railway vehicle driving rules – contains rules for driving and requires signals and automatic train control	yes
33	Railway operations to encourage production allowance rules – regards payment for work	no

No.	Name and Description	Relates to HSR
34	KORAIL law – establishes KORAIL	no
35	Korea Railroad Corporation Act – more legal issues	no
36	Korean Rail Network Authority law – legal and financial	no
37	Korean Rail Network Authority law enforcement ordinance – legal and financial	no
38	Air, Rail Accident Investigation Act – requires investigating and reporting of accidents	no
39	Air, Rail Accident Investigation Law Enforcement Decree – accident investigation	no
40	Air and Railway Accident Investigation law Enforcement Rule – accident investigation	no

Table 14 contains the official designations of the four regulations that are relevant to HSR operations.

Table 14. South Korean HSR Regulation Designations

Item	Regulation Name	Ministry of Land Transport and Maritime Affairs Reference No.	Article and Date
13	Railway Construction Rules	02-2110-6494	No. 163, 2009. 9. 1
14	Railway Construction Law	02-2110-8786	No. 10331, 2010. 5.31
31	Railway Regulations Relating to Vehicle Safety Standards	02-2110-8853	No. 280, 2010. 9. 3
32	Railway Vehicle Driving Rules	02-2110-8826	No. 296, 2010, 10.18

Items 2 and 7 in Table 13 are marked “no?” as to their relationship to HSR. Both items appear, to the best of our interpretation from the nonprofessional translations, to refer to urban rail systems that operate only within cities rather than inter-urban HSR systems.

South Korean regulations appear to have no counterparts to 49 CFR Parts 200, 210, 221, and 231. A number of technical papers from Korea were found relating to noise emissions. The study activity shows interest in the issue, but currently Korea has no regulations relating to railroad noise emissions. (49 CFR Part 210, Railroad Noise Emission Compliance Regulations in the U.S.)

- Table 13, Item 13, Railway Construction Rules, relates to topics in 49CFR Part 213
- Table 13, Item 14, Railway Construction Law, relates to topics in 49 CFR Part 213

- Table 13, Item 31, Railway Regulations Relating to Vehicle Safety Standards, relates to topics in 49 CFR Parts 213, 223, 229, 238, and 239
- Table 13, Item 32, Railway Vehicle Driving Rules, relates to topics in 49CFR Parts 213, 229, and 238

Item 31 in Table 13, Railway Regulations Relating to Vehicle Safety Standards, contains a requirement that risk analyses must be conducted for new rail cars and operations. A recent study carried out by researchers at the Korean Railroad Research Institute addresses risks of death associated with rail activities. See Park et al., “Review and Assessment of the Korea Rail’s Safety Performance using Risk Assessment Models,” International Rail Safety Conference, 2009.

The study addressed five main risk areas: (1) train collision accident, (2) train derailment accident, (3) train fire accident, (4) level crossing accident, and (5) railway casualty accident. Causes of risk were grouped into (1) the risk from public behavior, (2) passenger behavior, (3) workforce behavior, and (4) engineering issues including rolling stock, infrastructure, and equipment. Engineering issues were by far the lowest risk group. The risk assessment allows the highest areas of risk to be identified and measures taken to reduce them. The experience is that this approach in recent years has effectively reduced overall risk of death.

6. Conclusion

This report compares international standards with selected parts of FRA Regulation Title 49 CFR *Transportation*. The parts were selected by FRA prior to beginning the effort and are meant to reflect those areas of the regulations most influencing operational safety. The comparisons in this paper identify gaps and open points relative to European standards. Notable differences were found in the areas of vehicle track interaction, noise, safety glazing, locomotive safety, locomotive crashworthiness, aerodynamics, and emergency exit requirements. The report also reviews the more accessible Far East standards from China, Taiwan, and Japan. TTCI recommends formal translation and study of the Korean standards at a later time, possibly in conjunction with a study of railroad regulations in India, Central Asia, and Australia.

7. References

- 49 CFR Part 200 Informal Rules of Practice for Passenger Service.
- 49 CFR Part 210 Railroad Noise Emission Compliance Regulations.
- 49 CFR Part 213 Track Safety Standards.
- 49 CFR Part 221 Rear End Marking Device – Passenger, Commuter, and Freight Trains.
- 49 CFR Part 223 Safety Glazing Standards – Locomotives, passenger Cars, and Cabooses.
- 49 CFR Part 229 Railroad Locomotive Safety Standards.
- 49 CFR Part 231 Railroad Safety Appliance Standards.
- 49 CFR Part 238 Passenger Equipment Safety Standards.
- 49 CFR Part 239 Passenger Train Emergency Preparedness.
- EN 12663-1:2010 Railway Applications – Structural requirements of railway vehicle bodies. Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons).
- EN 13146-8:2002 Railway Applications – Track – Test methods for fastening systems.
- EN 14363:2005 Railway Applications – Testing for the acceptance of running characteristics of railway vehicles – Testing of running behavior and stationary tests.
- EN 15227:2008 Railway Applications – Crashworthiness requirements for railway vehicle bodies.
- EN 50206-1:2010 Railway Applications – Rolling Stock – Pantographs: Characteristics and tests. Part1: Pantographs for main line vehicles.
- EN 50215:2009 Railway applications – Rolling Stock – Testing of rolling stock on completion of construction and before entry into service.
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TSI Rolling Stock. Commission Decision of 21 February, 2008 concerning a technical specification for interoperability relating to the "rolling stock" sub-system of the trans-European HSR system. Document L084 (2008/232/CE).

TSI Infrastructure. Commission decision of 20 December, 2007, concerning a technical specification for interoperability relating to the "infrastructure" sub-system of the trans-European HSR system. Document number L071 (2008/217/EC).

Wu, Kejian, "Track Safety Standard of High Speed Railway," presented at the 3rd Sino-American Transportation Forum, Cambridge, MA, September 2010.

8. Appendix A.
Spreadsheets Comparing FRA Regulations with European
Standards

Table A1. 49 CFR Part 200 Informal Rules of Practice for Passenger Service Compared with UIC

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
200	Informal Rules of Practice for Passenger Service	200.1 General	Leaflet 413 Leaflet AO Essential Requirement 2.7.1 Safety section 1	413 Measures to facilitate travel by rail AO UIC Internal regulations 2.7.1 Safety	GAP: This section has no direct counterpart in the European regulations.
		200.3 Definitions.			
		200.5 Applications.			
		200.7 Objections.			
		200.9 Hearings.			
		200.11 Orders, approvals, and determinations.			
		200.13 Publication.			

Table A2. 49 CFR Part 210 Railroad Noise Emission Compliance Regulations Compared with UIC

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
210	Railroad Noise Emission Compliance Regulations	Subpart A—General Provisions 210.1 Scope of part.	Essential Requirement 2.6.1. Health Essential Requirement 2.6.2. Environmental protection		
		210.3 Applicability.			
		210.5 Definitions.	TSI Rolling Stock - 4.2.6.5. Exterior noise	4.2.6.5 Exterior noise 4.2.6.5.1 Introduction	
		210.7 Responsibility for noise defective railroad equipment			
		210.9 Movement of a noise defective locomotive, rail car, or consist of a locomotive and rail cars.			
		210.11 Waivers.			
		210.13 Penalty.			

Table A2. 49 CFR Part 210 Railroad Noise Emission Compliance Regulations Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
210	Railroad Noise Emission Compliance Regulations	Subpart B— Inspection and Testing 210.21 Scope of subpart.	TSI Noise 2006/66/EC L37/1-49	2006/66/EC L37/1-49 Rolling Stock Noise	
		210.23 Authorization.			
		210.25 Measurement criteria and procedures.	WG 3 EN ISO 3095:2005 Directive: M/275 (96/48/EC - C 68 2006-03-21) EN ISO 3381:2005 Directive: M/275 (96/48/EC - C 68 2006-03-21)	Railway applications – Acoustics - measurement of noise emitted by rail bound vehicles (ISO 3095:2005) M/275 (96/48/EC - C 68 2006-03-21) Railway applications – Acoustics - Measurement of noise inside rail bound vehicles (ISO 3381:2005) M/275 (96/48/EC - C 68 2006-03-21)	
		210.27 New locomotive certification.			

Table A2. 49 CFR Part 210 Railroad Noise Emission Compliance Regulations Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
210	Railroad Noise Emission Compliance Regulations	210.29 Operation standards (moving locomotives and rail cars).	TSI Rolling Stock 4.2.6.5.4 4.3.5.22.	4.2.6.5.4 Limits for pass-by noise 4.3.5.22 Exterior noise	
		210.31 Operation standards (stationary locomotives at 30 meters).	TSI Rolling Stock - 4.2.6.5.2.	4.2.6.5.2 Limits for stationary noise	
		210.33 Operation standards (switcher locomotives, load cell test stands, car coupling operations, and retarders).	TSI Rolling Stock - 4.2.6.5.3	4.2.6.5.3 Limits for starting noise	GAP: European standards do not distinguish between locomotive type and age.
		APPENDIX A TO PART 210— SUMMARY OF NOISE STANDARDS, 40 CFR PART 201			
		APPENDIX B TO PART 210— SWITCHER LOCOMOTIVE ENFORCEMENT POLICY			

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	Subpart A—General 213.1 Scope of part.	TSI - L071 2008-217-EC	L071 2008-217-EC High Speed Infrastructure	L071 2008-217-EC High Speed Infrastructure is the overriding document for European track standards.
		213.2 Preemptive effect.			
		213.3 Application.			
		213.4 Excepted track.			
		213.5 Responsibility for compliance.			
		213.7 Designation of qualified persons to supervise certain renewals and inspect track.	TSI Infrastructure 4.6	4.6 Professional competences	

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.9 Classes of track: operating speed limits.	Leaflet 714 Leaflet 715-1	714 Classification of lines for the purpose of track maintenance 715-1 Application of digital track geometry analysis to the planning of tamping and lining/levelling work	Category I — specially built high-speed lines equipped for speeds generally equal to or greater than 250 km/h (155 mph) Category II — specially upgraded high-speed lines equipped for speeds of the order of 200 km/h (124 mph) Category III — specially upgraded high-speed lines which have special features as a result of topographical, relief or town-planning constraints, on which the speed must be adapted to each case.
		213.11 Restoration or renewal of track under traffic conditions.	TSI Infrastructure 4.5	4.5 Maintenance rules	
		213.13 Measuring track not under load.	Leaflet 715-1	715-1 Application of digital track geometry analysis to the planning of tamping and lining/leveling work	

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.15 Penalties.			
		213.17 Waivers.			
		213.19 Information collection.			
		Subpart B—Roadbed 213.31 Scope.	Leaflet 719	719 Earthworks and track bed construction for railway lines	GAP: European TSI's regulate gradients as follows: TSI Infrastructure 4.2.5. Maximum rising and falling gradients TSI Rolling stock 4.2.3.6. maximum gradients 4.2.4.7 Brake performance on steep gradients FRA regulations do not address gradient.
		213.33 Drainage.			
		213.37 Vegetation.			

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	Subpart C—Track Geometry 213.51 Scope.	TSI Infrastructure 4.2.10	4.2.10 Track Geometrical Quality and limits on isolated defects 4.2.10.1 Introduction 4.2.10.2 Definitions 4.2.10.3 Intermediate action, interventions, and alert limits 4.2.10.4 Immediate action limit 4.2.10.4.1 Track twist - isolated defects - zero to peak value	
		213.53 Gage.	Leaflet 710 TSI Infrastructure 4.2.9.3.1 4.2.10.4.2 4.2.3 TSI Rolling Stock 4.2.3.1 4.2.3.3	710 Minimum track gauge in curves 4.2.9.3.1 Minimum values of mean track gauge 4.2.10.4.2 Variation of gauge — isolated defects — nominal gauge to peak value 4.2.3 Minimum infrastructure gauge 4.2.3.1 Kinematic gauge 4.2.3.3 Rolling stock parameters which influence ground based train monitoring systems	

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.55 Alignment.	EN 13848-1:2003	EN 13848-1:2003 Railway applications — Track — Track geometry quality — Part 1 : Characterisation of track geometry	
		213.57 Curves; elevation and speed limitations.	TSI Rolling Stock 4.2.3.7 TSI Infrastructure 4.2.25.3	4.2.3.7 Minimum curve radius 4.2.25.3 Radius of curvature	
		213.59 Elevation of curved track; runoff.	TSI Infrastructure 4.2.8.	4.2.8 cant deficiency	
		213.63 Track surface.	EN 13674-1:2003 TSI Infrastructure 4.2.10	EN 13674-1:2003 Railway applications — Track — Rail — Part 1: Vignole railway rails 46 kg/m and above 4.2.10 Track geometrical quality and limits on isolated defects	GAP: EN sited here specifies rail section, which is an AAR standard in the US.
		Subpart D—Track Structure 213.101 Scope.			GAP: European TSI's regulate track resistance (strength) as follows: TSI Infrastructure: 4.2.13 track resistance TSI Rolling stock 4.2.3.2 Static axle load

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.101 Scope (continued)			4.2.4.5. Eddy current brake
		213.103 Ballast; general.	Leaflet 719 TSI Rolling Stock 4.2.3.11	719 Earthworks and track bed construction for railway lines 4.2.3.11 Aerodynamic effects on ballast	OPEN: Ballast pickup is an open point
		213.109 Crossties.	Leaflet 713	713 Design of monoblock concrete sleepers	
		213.110 Gage restraint measurement systems.			
		213.113 Defective rails.	Leaflet 712	712 Rail defects	
		213.115 Rail end mismatch.	Leaflet 715-2	715-2 Recommendations for management of rails	
		213.118—Continuous welded rail (CWR); plan Review and approval			
		213.119 Continuous welded rail (CWR); general.			

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.121 Rail joints.			
		213.122 Torch cut rail.			
		213.123 Tie plates.			
		213.127 Rail fastening systems.	EN 13146-1:2002 SC 1 WG 17 EN 13481-1:2002 Directives: M/275 (96/48/EC - C 68 2006-03-21) M/275 (96/48/EC – C 332 2006-12-30) M/275 (96/48/EC - C 68 2006-03-21) M/275 (96/48/EC – C 332 2006-12-30) M/275 (96/48/EC – C 332 2006-12-30) M/275 (96/48/EC - C 68 2006-03-21)	EN 13146-1:2002 Track-Test methods for fastening systems - Part 1: Determination of longitudinal rail restraint EN 13481-1:2002 Railway applications - Track - Performance requirements for fastening systems - Part 1: Definitions Directive(s): M/275 (96/48/EC - C 68 2006-03-21) Directive(s): M/275 (96/48/EC – C 332 2006-12-30) Part 2: Fastening systems for concrete sleepers Directive(s): M/275 (96/48/EC - C 68 2006-03-21)	

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.127 Rail fastening systems (continued)	M/275 (96/48/EC – C 332 2006-12-30) M/275 (96/48/EC – to be cited in OJEU)	Directive(s): M/275 (96/48/EC – C 332 2006-12-30) Part 3: Fastening systems for wood sleepers Part 4: Fastening systems for steel sleepers Part 5: Fastening systems for slab track Directive(s): M/275 (96/48/EC - C 68 2006-03-21) Directive(s): M/275 (96/48/EC – C 332 2006-12-30) Part 6: Special fastening systems for attenuation of vibration Part 8: Fastening systems for track with heavy axle loads Directive(s): M/275 (96/48/EC – to be cited in OJEU)	

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	Subpart D--Track Structure 213.133 Turnouts and track crossings generally.	SC 1 WG 17 EN 13481-1:2002	EN 13481-7:2002 Railway applications - Track - Performance requirements for fastening systems - Part 7: Special fastening systems for switches and crossing and check rails	
		213.135 Switches.	716 SC 1 WG 17 EN 13481-1:2002 EN 13232-4:2005 EN 13232-5:2005 EN 13232-6:2005 EN 13232-7:2006 EN 13232-9:2006	716 Maximum permissible wear profiles for switches EN 13481-7:2002 Railway applications - Track - Performance requirements for fastening systems - Part 7: Special fastening systems for switches and crossing and check rails EN 13232-4:2005 Railway applications — Track — Switches and crossings — Part 4: Actuation, locking and detection EN 13232-5:2005 Railway applications — Track — Switches and crossings — Part 5: Switches	

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.135 Switches (continued)	TSI Infrastructure 4.2.12	EN 13232-6:2005 Railway applications — Track — Switches and crossings — Part 6: Fixed common and obtuse crossings EN 13232-7:2006 Railway applications — Track — Switches and crossings — Part 7: Crossings with moveable parts EN 13232-9:2006 Railway applications — Track — Switches and crossings — Part 9: Layouts 4.2.12 Switches and crossings	
		213.137 Frogs.			
		213.139 Spring rail frogs.			
		213.141 Self-guarded frogs.			
		213.143 Frog guard rails and guard faces; gage.			

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	Subpart E—Track Appliances and Track-Related Devices 213.201 Scope.			
		213.205 Derails			
		Subpart F—Inspection 213.231 Scope.	EN 13146-1:2002 Directives: M/275(96/48/EC - to be cited in OJEU)	EN 13146-1:2002 Railway applications - Track - Test methods for fastening systems - Part 1: Determination of longitudinal rail restraint Directive(s): M/275(96/48/EC - to be cited in OJEU) - Part 2: Determination of torsional resistance - Part 3: Determination of attenuation of impact loads - Part 4: Effect of repeated loading Directive(s): M/275 (96/48/EC - to be cited in OJEU) Directive(s): M/275 (96/48/EC - To be cited in OJEU) - Part 5: Determination of electrical resistance	

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.231 Scope (continued)	Directives: M/275(96/48/EC - to be cited in OJEU)	Directive(s): M/275 (96/48/EC – To be cited in OJEU) - Part 6: Effect of severe environmental conditions - Part 7: Determination of clamping force - Part 8: In service testing Directive(s): M/275 (96/48/EC - To be cited in OJEU)	
		213.233 Track inspections.	EN 13231-3:2006	EN 13231-3:2006 Track - Acceptance of works - Part 3: Acceptance of rail grinding, milling and planning work in track	
		213.235 Inspection of switches, track crossings, and lift rail assemblies or other transition devices on moveable bridges.			
		213.237 Inspection of rail.			
		213.239 Special inspections.			
		213.241 Inspection records.			

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	Subpart G—Train Operations at Track Classes 6 and Higher 213.301 Scope of subpart.	Leaflet 734 TSI Infrastructure 4.2.16 4.2.17 4.2.18 4.2.14.7	734 Adaptation of safety installations to high-speed requirements 4.2.16 Maximum pressure variation in tunnels 4.2.17 Effects of crosswinds 4.2.18 Electrical characteristics 4.2.14.7 Aerodynamic actions from passing trains on line side structures	GAP: UIC standards listed here may not have a counterpart in FRA regulations
		213.303 Responsibility for compliance.			
		213.305 Designation of qualified individuals; general qualifications.	TSI Infrastructure 4.6	4.6 Professional competences	
		213.307 Class of track: operating speed limits.	TSI - L071 2008-217-EC	L071 2008-217-EC High Speed Infrastructure	Category I — specially built high-speed lines equipped for speeds generally equal to or greater than 250 km/h (155 mph)

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.307 Class of track: operating speed limits (continued)	TSI - L071 2008-217-EC (continued)	L071 2008-217-EC High Speed Infrastructure (continued)	<p>Category II — specially upgraded high-speed lines equipped for speeds of the order of 200 km/h (124 mph)</p> <p>Category III — specially upgraded high-speed lines which have special features as a result of topographical, relief or town-planning constraints, on which the speed must be adapted to each case.</p>
		213.309 Restoration or renewal of track under traffic conditions.			
		213.311 Measuring track not under load.			
		213.317 Waivers.			
		213.319 Drainage.			
		213.321 Vegetation.			

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.323 Track gage.	TSI Infrastructure 4.2.2 4.2.3	4.2.2 Nominal track gauge 4.2.3 Minimum infrastructure gauge	
		213.327 Alignment.	TSI Infrastructure 4.2.4	4.2.4 Distance between track centres	
		213.329 Curves, elevation and speed limitations.	TSI Infrastructure 4.2.5 4.2.6 4.2.7 4.2.8 4.2.9	4.2.5 Maximum rising and falling gradients 4.2.6 Minimum radius of curvature 4.2.7 Track cant 4.2.8 Cant deficiency 4.2.9 Equivalent conicity	
		213.331 Track surface.	TSI Infrastructure 4.2.10 4.2.11 5.3.1	4.2.10 Track geometrical quality and limits on isolated defects 4.2.11 Rail inclination 5.3.1 Railhead profile	
		213.332 Combined Alignment and Surface Deviations	TSI Infrastructure 4.2.10	4.2.10 Track geometrical quality and limits on isolated defects	
		213.333 Automated vehicle inspection systems.	Leaflet 715-1 Leaflet 518 EN14363:2005	715-1 Application of digital track geometry analysis to the planning of tamping and lining/levelling work	

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.333 Automated vehicle inspection systems (continued)	EN14363:2005	518 Testing and approval of railway vehicles from the point of view of their dynamic behaviour - Safety - Track fatigue - Running behaviour EN 14363:2005 Railway applications - Testing for the acceptance of running characteristics of railway vehicles - Testing of running behaviour and stationary tests	
		213.334 Ballast; general.	Leaflet 719 TSI Rolling Stock 4.2.3.11	719 Earthworks and track bed construction for railway lines 4.2.3.11 Aerodynamic effects on ballast	OPEN: Ballast pickup is an open point
		Subpart G--Train Operations at Classes 6 and Higher 213.335 Crossties.	Leaflet 713 EN 13230-1:2002 EN 13481-1:2002	713 Design of monoblock concrete sleepers EN 13230-1:2002 Railway applications — Track — Concrete sleepers and bearers — Part 1: General requirements	

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	Subpart G--Train Operations at Classes 6 and Higher 213.335 Crossties (continued)	EN 13481-2:2002 EN 13481-5:2002	Railway applications — Track — Performance requirements for fastening systems — Part 1: Definitions Railway applications — Track — Performance requirements for fastening systems — Part2: Fastening systems for concrete sleepers Railway applications — Track — Performance requirements for fastening systems — Part5: Fastening systems for slab track	
		213.337 Defective rails.	Leaflet 712	712 Rail defects	
		213.339 Inspection of rail in service.	Leaflet 715-2	715-2 Recommendations for management of rails	
		213.341 Initial inspection of new rail and welds.			

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.343 Continuous welded rail (CWR).			
		213.345 Vehicle/Track System Qualification:	TSI Infrastructure 4.2.10 TSI Rolling Stock - 4.2.3.4 4.2.3.4.7	4.2.10 Track geometrical quality and limits on isolated defects 4.2.3.6 Rolling stock dynamic behaviour; 4.2.3.4.7 design values for wheel profiles	
		213.347 Automotive or railroad crossings at grade.			
		213.349 Rail end mismatch.	Leaflet 715-2	715-2 Recommendations for management of rails	
		213.351 Rail joints.			
		213.352 Torch cut rail.			
		213.353 Turnouts, crossovers, and lift rail assemblies or other transition devices on moveable bridges.	Leaflet 716 TSI Infrastructure 4.2.12- 5.3.4 4.2.14	716 Maximum permissible wear profiles for switches 4.2.12- 5.3.4 Switches and crossings 4.2.14 Traffic loads on structures	

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	213.355 Frog guard rails and guard faces; gage.	EN 13674-2:2006+A1:2010	EN 13674-2:2006 Track - Rail - Part 2: Switch and crossing rails used in conjunction with Vignole railway rails 46 kg/m and above	
		213.357 Derails.			
		213.359 Track stiffness.	TSI Infrastructure 4.2.15 - 5.3.2 4.2.13	4.2.15 - 5.3.2 Global track stiffness 4.2.13 Track resistance	OPEN: Track stiffness is an open point in TSI Infrastructure 4.2.15
		213.361 Right of way.	TSI Infrastructure 4.2.22	4.2.22 Access to or intrusion into line installations	
		213.365 Visual inspections.			
		213.367 Special inspections.			
		213.369 Inspection records.			

Table A3. 49 CFR Part 213 Track Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
213	Track Safety Standards	APPENDIX A TO PART 213 — MAXIMUM ALLOWABLE CURVING SPEEDS			
		APPENDIX B TO PART 213 — SCHEDULE OF CIVIL PENALTIES			
		APPENDIX C TO PART 213 — STATEMENT OF AGENCY POLICY ON THE SAFETY OF RAILROAD BRIDGES			
		APPENDIX D TO PART 213— Minimally Compliant Analytical Track (MCAT) Simulations Used for Qualifying Vehicles To Operate at High Speeds and at High Cant Deficiencies			

Table A4. 49 CFR Part 221 Rear End Marking Device – Passenger, Commuter, and Freight Trains Compared with UIC

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
221	Rear End Marking Device- Passenger, Commuter and Freight Trains	Subpart A— General 221.1 Scope.			
		221.3 Application.			
		221.5 Definitions.			
		221.7 Civil penalty			
		221.9 Waivers.			
		221.11 State regulation.			
		Subpart B— Marking Devices 221.13 Marking device display.	TSI Rolling Stock 4.2.7.4.1.4	4.2.7.4.1.4 Lamp controls	

**Table A4. 49 CFR Part 221 Rear End Marking Device – Passenger, Commuter, and Freight Trains Compared with UIC
(continued)**

49CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
221	Rear End Marking Device- Passenger, Commuter and Freight Trains	221.14 Marking devices.	BS EN 15153-1:2007 BS EN 15153-2:2007 TSI Rolling Stock 4.2.7.4.1.3	EN 15153-1:2007 Railway applications. External visible and audible warning devices for high speed trains. Head, marker and tail lamps EN 15153-2:2007 Railway applications. External visible and audible warning devices for high speed trains. Warning horns 4.2.7.4.1.3 Tail Lights	
		221.15 Marking device inspection.			GAP: Inspection and maintenance of tail lamps are not specified in the European code.
		221.16 Inspection procedure.			

**Table A4. 49 CFR Part 221 Rear End Marking Device – Passenger, Commuter, and Freight Trains Compared with UIC
(continued)**

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
221	Rear End Marking Device- Passenger, Commuter and Freight Trains	221.17 Movement of defective equipment.			
		APPENDIX A TO PART 221 — PROCEDURES FOR APPROVAL OF REAR END MARKING DEVICES			
		APPENDIX B TO PART 221 — APPROVED REAR END MARKING DEVICES			
		APPENDIX C TO PART 221 — SCHEDULE OF CIVIL PENALTIES			

Table A5. 49 CFR Part 223 Safety Glazing Standards – Locomotive, Passenger Cars, and Cabooses Compared with UIC

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
223	Safety Glazing Standards-- Locomotives, Passenger Cars and Cabooses	Subpart A— General 223.1 Scope.			
		223.3 Application.			
		223.5 Definitions.			
		223.7 Responsibility.			
		Subpart B— Specific Requirements 223.8 Additional requirements for passenger equipment.	TSI Rolling Stock - 4.2.2.7 Annex J	4.2.2.7 Windscreen and front of the train Annex J Windscreen properties J.2. Structural requirements	
		223.9 Requirements for new or rebuilt equipment.			

Table A5. 49 CFR Part 223 Safety Glazing Standards – Locomotive, Passenger Cars, and Cabooses Compared with UIC
(continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
223	Safety Glazing Standards-- Locomotives, Passenger Cars & Cabooses	223.11 Requirements for existing locomotives.			
		223.13 Requirements for existing cabooses.			
		223.15 Requirements for existing passenger cars.			
		223.17 Identification of equipped locomotives, passenger cars and cabooses.			
		APPENDIX A TO PART 223 — CERTIFICATION OF GLAZING MATERIALS			
		APPENDIX B TO PART 223 —SCHEDULE OF CIVIL PENALTIES			

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	Subpart A—General 229.1 Scope.			
		229.3 Applicability.			
		229.4 Information collection.	TSI Rolling Stock - 4.2.10.3 4.2.10.4 4.2.10.5	4.2.10.3 Management of the maintenance file. 4.2.10.4 Management of maintenance information. 4.2.10.5 Implementation of the maintenance	GAP: European standards require documentation of maintenance information.
		229.5 Definitions.			
		229.7 Prohibited acts.			
		229.9 Movement of non-complying locomotives.			
		229.11 Locomotive identification.			
		229.13 Control of locomotives.			
		229.14 Non-MU control cab locomotives.			

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	229.17 Accident reports.			
		229.19 Prior waivers.			
		Subpart B—Inspections and Tests 229.21 Daily inspection.	TSI Rolling Stock - 4.2.10	4.1.10 Maintenance 4.2.10.1 The maintenance file 4.2.10.2.1 The maintenance design justification file 4.2.10.2.2 The Maintenance Documentation	GAP: European regulations do not call out inspection schedules but rather require documented maintenance plans.
		229.23 Periodic inspection: General.			
		229.25 Tests: Every periodic inspection.			
		229.27 Annual tests.			
		229.29 Biennial tests.			
		229.31 Main reservoir tests.			
		229.33 Out-of-use credit.			

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	Subpart C—Safety Requirements GENERAL REQUIREMENTS 229.41 Protection against personal injury.	TSI Rolling Stock - 4.2.2	4.2.2 Structure and mechanical parts 4.2.2.1 General	GAP: European HSR regulations are generally performance oriented and few regulations pertain specifically to the locomotive.
		229.43 Exhaust and battery gases.			
		229.45 General condition.			
		BRAKE SYSTEM	TSI Rolling Stock - 4.2.4	4.2.4 Braking 4.2.4.1 Minimum braking performance	GAP: Braking is specified by performance in the European regulations.
		229.46 Brakes: General.			
		229.47 Emergency brake valve.			
		229.49 Main reservoir system.			
		229.51 Aluminum main reservoirs.			
		229.53 Brake gauges.			
		229.55 Piston travel.			

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	229.57 Foundation brake gear.			
		229.59 Leakage.			
		DRAFT SYSTEM 229.61 Draft system.	TSI Rolling Stock - 4.2.2.2	4.2.2.2 End couplers and coupling arrangements to rescue trains 4.2.2.2.1 Subsystem Requirements	
		SUSPENSION SYSTEM	TSI Rolling Stock - 4.2.3.4	4.2.3.4 Rolling stock dynamic behavior	GAP: Suspension system performance is specified by dynamic behavior in the European regulations.
		229.63 Lateral motion.	EN14363:2005	EN14363:2005 Railway applications. Testing for the acceptance of running characteristics of railway vehicles. Testing of running behavior and stationary tests	
		229.64 Plain bearings.			
		229.65 Spring rigging.			
		229.67 Trucks.			

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	229.69 Side bearings.			
		229.71 Clearance above top of rail.			
		229.73 Wheel sets.			
		229.75 Wheel and tire defects.			
		Subpart C--Safety Requirements ELECTRICAL SYSTEM	TSI Rolling Stock - 4.2.8.3	4.2.8.3 Functional and technical specification related to the electric power supply	GAP: The European electrical system is more completely specified than the US.
		229.77 Current collectors.	Leaflet 600 Leaflet 603 Leaflet 605 Leaflet 606-1 Leaflet 608	600 Electric traction with aerial contact line 603 Measures to be taken to prevent the formation of sparks from traction current in areas where filling and emptying installations for inflammable liquids or gases are located 605 Protection from corrosion - Measures to be taken on direct current catenaries to reduce the risks on adjacent piping and cable systems	

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	229.77 Current collectors (continued)	Leaflet 611	606-1 Consequences of the application of the kinematic gauge defined by UIC Leaflets in the 505 series on the design of the contact lines 608 Conditions to be complied with for the pantographs of tractive units used in international services 611 Regulations governing acceptance of electric locomotives, power cars and multiple-unit sets for running on international services	
		229.79 Third rail shoes.			
		229.81 Emergency pole; shoe insulation.			
		229.83 Insulation or grounding of metal parts.			
		229.85 Doors and cover plates marked 'Danger'.			

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	229.87 Hand-operated switches.			
		229.89 Jumpers; cable connections.			
		229.91 Motors and generators.			
		INTERNAL COMBUSTION EQUIPMENT 229.93 Safety cut-off device.			GAP: No European HSR regulations exist regarding internal combustion
		229.95 Venting.			
		229.97 Grounding fuel tanks.			
		229.99 Safety hangers.			
		229.101 Engines.			
		STEAM GENERATORS			GAP: No European HSR regulations exist regarding steam
		229.103 Safe working pressure; factor of safety.			

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	229.105 Steam generator number.			
		229.107 Pressure gauge.			
		229.109 Safety valves.			
		229.111 Water-flow indicator.			
		229.113 Warning notice.			
		CABS AND CAB EQUIPMENT 229.115 Slip/slide alarms.	TSI Rolling Stock 4.2.8.2	4.2.8.2 Traction wheel/rail adhesion requirements	GAP: Traction control is required on European high speed trains
		229.117 Speed indicators.	TSI Rolling Stock - 4.2.7.14	4.2.7.14 Driver-Machine-Interface (DMI)	OPEN: The display for driving cabs remains an open point in Europe
		229.119 Cabs, floors, and passageways.	TSI Rolling Stock - 4.2.7.1.2 4.2.2.6	4.2.7.1.2 Driver's cab emergency exits 4.2.2.6 Driver's cab	GAP: Cab storage facility for use by staff is a gap
		229.121 Locomotive cab noise.	TSI Rolling Stock 4.2.7.6	4.2.7.6 Interior noise	

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	229.123 Pilots, snowplows, end plates.			GAP: No European regulation was found for the topic of snowplows
		229.125 Headlights and auxiliary lights.	TSI Rolling Stock - 4.2.7.4.1.1 4.2.7.4.1.2	4.2.7.4.1.1 Head lights 4.2.7.4.1.2 Marker lights	
		229.127 Cab lights.	Essential requirement 2.4.1 § 9:	4.2.7.12 Emergency lighting system	GAP: Emergency lighting and cab lighting are not the same ref 238.115
		229.129 Locomotive horn.	TSI Rolling Stock 4.2.7.4.2.	4.2.7.4.2. Horns 4.2.7.4.2.1 General 4.2.7.4.2.2 Warning horn sound pressure levels 4.2.7.4.2.3 Protection 4.2.7.4.2.4 Verification of sound pressure levels 4.2.7.4.2.5 Interoperability constituent requirements	
		229.131 Sanders.	TSI Rolling Stock 4.2.3.10 4.2.9.6 4.3.4.5 4.3.5.9 7.3.2.11	4.2.3.10 Sanding 4.2.9.6 Sand restocking equipment 4.3.4.5 Sanding 4.3.5.9 Sanding 7.3.2.11 Sanding	

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	229.133 Interim locomotive conspicuity measures—auxiliary external lights.	TSI Rolling Stock 4.2.7.4.1.2	4.2.7.4.1.2 Marker lights	
		229.135 Event recorders.	TSI Rolling Stock 4.2.7.10 4.3.4.9 4.3.5.30	4.2.7.10 Monitoring and diagnostic concepts 4.3.4.9 Monitoring and diagnostic concepts 4.3.5.30 Monitoring and diagnostic concepts	
		Subpart C--Safety Requirements CABS AND CAB EQUIPMENT 229.137 Sanitation, general requirements.	TSI Rolling Stock 4.2.2.5	4.2.2.5 Toilets	
		229.139 Sanitation, servicing requirements.	TSI Infrastructure 4.2.26.	4.2.26 Fixed installations for service trains 4.2.26.1 Toilet Discharge	
		Subpart D—Locomotive Crashworthiness Design Requirements 229.141 Body structure, MU locomotives.	TSI Rolling Stock - 4.2.2.3.3 Annex A	4.2.2.3.3 Specifications (simple load cases and design collision scenarios)	GAP: The European standards define different collision scenarios for testing

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	229.141 Body structure, MU locomotives.	TSI Rolling Stock - 4.2.2.3 4.2.2.3.1	4.2.2.3 Strength of vehicle structure 4.2.2.3.1 General Description	
		229.201 Purpose and scope.			
		229.203 Applicability.			
		229.205 General requirements.			
		229.206 Design requirements.	TSI Rolling Stock 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		229.207 New locomotive crashworthiness design standards and changes to existing FRA-approved locomotive crashworthiness design standards.			
		229.209 Alternative locomotive crashworthiness designs.			
		229.211 Processing of petitions.			

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards	229.213 Locomotive manufacturing information.			
		229.215 Retention and inspection of designs.			
		229.217 Fuel tank.			
		APPENDIX A TO PART 229 —FORM FRA 6180–49A [NOTE]			
		APPENDIX B TO PART 229 — SCHEDULE OF CIVIL PENALTIES			
		APPENDIX C TO PART 229 —FRA LOCOMOTIVE STANDARDS—CODE OF DEFECTS [NOTE]			

Table A6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
229	Railroad Locomotive Safety Standards (continued)	APPENDIX D TO PART 229— CRITERIA FOR CERTIFICATION OF CRASHWORTHY EVENT RECORDER MEMORY MODULE			
		APPENDIX E TO PART 229 — PERFORMANCE CRITERIA FOR LOCOMOTIVE CRASHWORTHINESS	TSI Rolling Stock - Annex A	Annex A 4.2.2.3.3 Specifications (simple load cases and design collision scenarios)	GAP: Collision scenarios
		APPENDIXES F–G TO PART 229 [RESERVED]			
		APPENDIX H TO PART 229— STATIC NOISE TEST PROTOCOLS—IN-CAB STATIC			

Table A7. 49 CFR Part 231 Railroad Safety Appliance Standards Compared with UIC

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
231	Railroad Safety Appliance Standards	PART 231— RAILROAD SAFETY APPLIANCE STANDARDS 231.0 Applicability and penalties.	Essential requirement 1.2: TSI Rolling Stock - 4.2.2.2	4.2.2.2 End couplers and coupling arrangement to rescue trains	OPEN: Very few regulations exist within the European TSI's regarding safety appliances
		231.1 Box and other house cars built or placed in service before October 1, 1966.			
		231.2 Hopper cars and high-side gondolas with fixed ends.			
		231.3 Drop-end high-side gondola cars.			
		231.4 Fixed-end low-side gondola and low side hopper cars.			
		231.5 Drop-end low-side gondola cars.			
		231.6 Flat cars.			

Table A7. 49 CFR Part 231 Railroad Safety Appliance Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
231	Railroad Safety Appliance Standards	231.7 Tank cars with side platforms.			
		231.8 Tank cars without side sills and tank cars with short side sills and end platforms.			
		231.9 Tank cars without end sills.			
		231.10 Caboose cars with platforms.			
		231.11 Caboose cars without platforms.			
		231.12 Passenger-train cars with wide vestibules.	Leaflet 560	560 Doors, footboards, windows, steps, handles and handrails of coaches and luggage vans	
		231.13 Passenger-train cars with open-end platforms.	TSI Rolling Stock - 4.2.2.9	4.2.2.9 External steps for use by shunting staff	

Table A7. 49 CFR Part 231 Railroad Safety Appliance Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
231	Railroad Safety Appliance Standards (continued)	231.14 Passenger-train cars without end platforms.			
		231.15 Steam locomotives used in road service.			
		231.16 Steam locomotives used in switching service.			
		231.17 Specifications common to all steam locomotives.			
		231.18 Cars of special construction.			
		231.19 Definition of "Right" and "Left."			
		231.20 Variation in size permitted.			
		231.21 Tank cars without under frames.			

Table A7. 49 CFR Part 231 Railroad Safety Appliance Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
231	Railroad Safety Appliance Standards (continued)	231.22 Operation of track motor cars.			
		231.23 Unidirectional passenger-train cars adaptable to van-type semi-trailer use.			
		231.24 Box and other house cars with roofs, 16 feet 10 inches or more above top of rail.			
		231.25 Track motorcars (self-propelled 4- wheel cars which can be removed from the rails by men).			
		231.26 Pushcars.			

Table A7. 49 CFR Part 231 Railroad Safety Appliance Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
231	Railroad Safety Appliance Standards (continued)	231.27 Box and other house cars without roof hatches or placed in service after October 1, 1966.			
		231.28 Box and other house cars with roof hatches built or placed in service after October 1, 1966.			
		231.29 Road locomotives with corner stairways.			
		231.30 Locomotives used in switching service.			
		231.31 Drawbars for freight cars; standard height.			
		APPENDIX A TO PART 231 — SCHEDULE OF CIVIL PENALTIES			

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards	Subpart A—General 238.1 Purpose and scope.			
		238.3 Applicability.			
		238.5 Definitions.			
		238.7 Waivers.	TSI Rolling Stock - 6.2.3	6.2.3 Innovative solutions	GAP: Correlation is very weak.
		238.9 Responsibility for compliance.	TSI Rolling Stock - 6.2.1 6.2.3	6.2.1 Conformity assessment (general) 6.2.2 Conformity assessment procedures (modules)	GAP: Correlation is very weak.
		238.11 Penalties.			
		238.13 Preemptive effect.	TSI Rolling Stock - 6.3	6.3 Interoperable Constituents Not Holding an EC Declaration	GAP: Correlation is very weak.
		238.15 Movement of passenger equipment with power brake defects.			GAP: No corresponding European regulation was found regarding movement of defective equipment.

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.17 Movement of passenger equipment with other than power brake defects.			
		238.19 Reporting and tracking of repairs to defective passenger equipment.	TSI Rolling Stock - 4.2.10.3	4.2.10.3 Management of the maintenance file	
		238.21 Special approval procedure.	TSI Rolling Stock - 6.2.5	6.2.5 Assessment of single vehicles	
		238.23 Information collection.	TSI Rolling Stock - 4.2.10.2.2	4.2.10.2.2 The Maintenance Documentation	
		Subpart B— Safety Planning and General Requirements 238.101 Scope.	Essential requirement 2.4.1 § 10:		

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.103 Fire safety.	TSI Rolling Stock 4.2.7.2	4.2.7.2 Fire safety 4.2.7.2.1 Introduction 4.2.7.2.2 Measures to prevent fire 4.2.7.2.3 Measures to detect/control fire 4.2.7.2.3.1 Fire detection 4.2.7.2.3.2 Fire extinguisher 4.2.7.2.3.3 Fire resistance 4.2.7.2.4 Additional measure to improve running capability 4.2.7.2.4.1 Trains of all categories fire safety 4.2.7.2.4.2 Category B fire safety 4.2.7.2.5 Specific measures for tanks containing flammable liquids 4.2.7.2.5.1 General 4.2.7.2.5.2 Specific requirements for fuel tanks	

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.105 Train electronic hardware and software safety.	TSI Rolling Stock - 4.2.7.13 EN50128: 2001 EN50155:2001	4.2.7.13 Software EN50128:2001 Railway applications. Communications, signalling and processing systems. Software for railway control and protection systems EN50155:2001 Railway applications. Electronic equipment used on rolling stock	
		238.107 Inspection, testing, and maintenance plan.	Essential requirement 2.7.1. Safety Section 2 TSI Rolling Stock 4.1.10. 4.2.9	4.2.9 Servicing 4.1.10 Maintenance 4.2.10.1 The maintenance file 4.2.10.2.1 The maintenance design justification file 4.2.10.2.2 The Maintenance Documentation 4.2.10.3 Management of the maintenance file. 4.2.10.4 Management of maintenance information. 4.2.10.5 Implementation of the maintenance	

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.109 Training, qualification, and designation program.	Essential Requirement 2.7.2 Reliability and availability TSI Rolling stock - 4.2.10.	4.2.10 Maintenance	
		238.111 Pre-revenue service acceptance testing plan.	TSI Rolling Stock - 4.2.3.4.1 General EN 14363:2005	4.2.3.4.1 General EN 14363:2005 Railway applications. Testing for the acceptance of running characteristics of railway vehicles. Testing of running behavior and stationary tests	
		238.113 Emergency window exits.	TSI Rolling Stock 4.2.2.4 4.2.7.1	4.2.2.4 Access 4.2.7.1 Emergency Exits	GAP: European emergency exits need not be window exits.
		238.115 Emergency lighting.	Essential Requirement 2.4.1 § 9: TSI Rolling Stock - 4.2.7.12	4.2.7.12 Emergency lighting system	

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.117 Protection against personal injury.	Essential Requirement 2.4.1 § 4: TSI Rolling Stock - 4.2.7.3	4.2.7.3. Protection against electric shock	
		238.119 Rim-stamped straight-plate wheels.			
		Subpart C—Specific Requirements for Tier I Passenger Equipment 238.201 Scope/alternative compliance.			
		238.203 Static end strength.	TSI Rolling Stock - 4.2.2.3 4.2.2.3.1	4.2.2.3 Strength of vehicle structure 4.2.2.3.1 General Description	
		238.205 Anti-climbing mechanism.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.207 Link between coupling mechanism and car body.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.209 Forward-facing end structure of locomotives.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.211 Collision posts.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.213 Corner posts.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.215 Rollover strength.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.217 Side structure.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.219 Truck-to-car-body attachment.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.221 Glazing.	TSI Rolling Stock - 4.2.2.7	4.2.2.7 Windscreen and front of the train	GAP: European standards call out cab glazing but not passenger windows.
		238.223 Locomotive fuel tanks.	TSI Rolling Stock - 4.2.9.8	4.2.9.8 Refuelling equipment	OPEN: Refuelling equipment is an open point in European standards

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.225 Electrical system.	TSI Rolling Stock - 4.2.7.3 4.2.6.6	4.2.7.3 Protection against electric shock 4.2.6.6 Exterior Electromagnetic Interference	
		238.227 Suspension system.	Essential requirement 1.1.2: Rolling Stock TSI - 4.2.3.2 4.2.3.4 Annex M	4.2.3.2 (static axle load) 4.2.3.4 (rolling stock dynamic behaviour) 4.2.3.4.2 Limit values for running safety 4.2.3.4.3 Track loading limit values 4.2.3.4.4 Wheel/rail interface 4.2.3.4.5 Design for vehicle stability 4.2.3.4.6 Definition of equivalent conicity 4.2.3.4.7 Design values for wheel profiles 4.2.3.4.8 In service values of equivalent conicity Annex M In service limits of the geometric dimensions of wheels and wheelsets	GAP: European TSI standards specify vehicle dynamic behavior and wheel/rail interactions that in the US are specified by AAR standards

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.229 Safety appliances—general.			GAP: Very few regulations exist within the European TSI's regarding safety appliances
		238.230 Safety appliances—new equipment.	Essential requirement 1.2: TSI Rolling Stock - 4.2.2.2	4.2.2.2 End couplers and coupling arrangement to rescue trains	
		238.231 Brake system.	TSI Rolling Stock - 4.2.4	4.2.4 Braking	
		238.233 Interior fittings and surfaces.			GAP: European regulations have no provision for enclosed overhead storage
		238.235 Doors.	TSI Rolling Stock 4.2.2.4	4.2.2.4 Access	

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.237 Automated monitoring.	TSI Rolling Stock - 4.2.7.20 4.2.7.8	4.2.7.10 Monitoring and diagnostic concepts 4.2.7.8 Driver's vigilance device	
		Subpart D—Inspection, Testing, and Maintenance Requirements for Tier I Passenger Equipment			
		238.301 Scope			
		238.303 Exterior calendar day mechanical inspection of passenger equipment.			
		238.305 Interior calendar day mechanical inspection of passenger cars.			
		238.307 Periodic mechanical inspection of passenger cars and unpowered vehicles used in passenger trains.	TSI Rolling Stock - 6.2.4	6.2.4 Assessment of maintenance	
		238.309 Periodic brake equipment maintenance.			
		238.311 Single car test.	TSI Rolling Stock - Annex P	Annex P Calculation method for decelerations in degraded mode and unfavorable climatic conditions	

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.313 Class I brake test.			GAP: Inspection frequencies are not specified in European regulations
		238.315 Class IA brake test.			
		238.317 Class II brake test.			
		238.319 Running brake test.			
		238.321 Out-of-service credit.			
		Subpart E—Specific Requirements for Tier II Passenger Equipment 238.401 Scope.			
		238.403 Crash energy management.	Essential Requirement 2.4.1 § 1: TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.405 Longitudinal static compressive strength.	Essential Requirement 2.4.1 § 1: EN 12663:2000	EN 12663:2000 Railway applications - Structural requirements of railway vehicle bodies. Directive M/275 (96/48/EC - C 140 2002-06-13)	
		238.407 Anti-climbing mechanism.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.409 Forward end structures of power car cabs.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.411 Rear end structures of power car cabs.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.413 End structures of trailer cars.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.415 Rollover strength.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	
		238.417 Side loads.	TSI Rolling Stock - 4.2.2.3.2	4.2.2.3.2 Principles (functional requirements)	

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.419 Truck-to-car-body and truck component attachment.	515-0 515-1 515-3 515-4 515-5 567 567-1 567-2 569	515-0 Passenger rolling stock - Trailer bogies - Running gear 515-1 Passenger rolling stock - Trailer bogies - Running gear - General provisions applicable to the components of trailers bogies 515-3 Method of axle design calculation. 515-4 Bogie-frame structure strength tests. 515-5 Axle-box tests. 567 General provisions for coaches 567-1 Standard X and Y coaches accepted for running on international services 567-2 Standard Z-type coaches accepted for running in international traffic – Characteristics 569 Regulations to be observed in the construction of coaches and vans suitable for conveyance by train ferry	

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.421 Glazing.	TSI Rolling Stock - 4.2.2.7 Annex J	4.2.2.7 Windscreen and front of the train Annex J Windscreen Properties J.2 Structural Requirements	GAP: European standards call out cab glazing but not passenger windows.
		238.423 Fuel tanks.	TSI Rolling Stock - 4.2.7.2.5.2	4.2.7.2.5.2 Specific requirements for fuel tanks	
		238.425 Electrical system.	Essential Requirement 2.4.1 § 2: Essential Requirement 2.4.1 § 4: TSI Rolling Stock - 4.2.7.3 EN 50153: 2002 Annex O	4.2.7.3 Protection against electric shock EN 50153: 2002 Railway applications. Rolling stock. Protective provisions relating to electrical hazards ANNEX O Earth Protection of the vehicles' metal parts	
		238.427 Suspension system.	513	513 Guidelines for evaluating passenger comfort in relation to vibration in railway vehicles	

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.429 Safety appliances.	Essential requirement 1.2: TSI Rolling Stock - 4.2.2.2	4.2.2.2 End couplers and coupling arrangement to rescue trains	GAP: Very few regulations exist within the European TSI's regarding safety appliances
		238.431 Brake system.	410 Essential Requirement 2.4.1 § 3:	410 Composition and calculation of the weight and braking of passenger trains	
		238.433 Draft system.	Essential Requirement 1.2: TSI Rolling Stock - 4.2.2.2	4.2.2.2 End couplers and coupling arrangement to rescue trains	
		238.435 Interior fittings and surfaces.			GAP: European regulations have no provision for enclosed overhead storage

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.437 Emergency communication.	Essential Requirement 2.4.1 § 5: Essential Requirement 2.4.1 § 10: TSI Rolling Stock - 4.2.5	4.2.5 Passenger information and communication 4.2.5.1 Public address system 4.2.5.2 Passenger information signs 4.2.5.3 Passenger alarm	GAP: Public address system required in Europe - not found in US regulations
		238.439 Doors.	Essential Requirement 2.4.1 § 6: TSI Rolling Stock 4.2.2.4.2.1 Passenger access doors 4.2.2.4.2.2 Doors for freight use and for use of the train crew	4.2.2.4.2.1 Passenger access doors	
		238.441 Emergency roof entrance location.	Essential Requirement 2.4.1 § 7: TSI Rolling Stock - 4.2.7.4.1.1 4.2.7.4.1.2	4.2.2.4 Access 4.2.7.1 Emergency exits	GAP: European emergency exits need not be window exits.

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	238.443 Headlights.	TSI Rolling Stock - 4.2.7.4.1.1 4.2.7.4.1.2	4.2.7.4.1.1 Head lights 4.2.7.4.1.2 Marker lights	
		238.445 Automated monitoring.	TSI Rolling Stock - 4.2.7.20 4.2.7.8	4.2.7.10 Monitoring and diagnostic concepts 4.2.7.8 Driver's vigilance device	
		238.447 Train operator's controls and power car cab layout.	TSI Rolling Stock - 4.2.7.1	4.2.7.14 Driver-Machine-Interface (DMI)	OPEN: The European Traffic Control System display for driving cabs remains an open point.

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	Subpart F—Inspection, Testing, and Maintenance Requirements for Tier II Passenger Equipment			
		238.501 Scope.			
		238.503 Inspection, testing, and maintenance requirements	Essential Requirement 2.7.1. Safety Section 2 TSI Rolling Stock 4.1.10. 4.2.9	4.2.9 Servicing 4.1.10 Maintenance 4.2.10.1 The maintenance file 4.2.10.2.1 The maintenance design justification file 4.2.10.2.2 The Maintenance Documentation 4.2.10.3 Management of the maintenance file. 4.2.10.4 Management of maintenance information. 4.2.10.5 Implementation of the maintenance	
		238.505 Program approval procedure.	TSI Rolling Stock - 6. Annex F	6. Assessment of Conformity and/or suitability for use Annex F Procedures for assessment of conformity and suitability for use	

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	Subpart G—Specific Safety Planning Requirements for Tier II Passenger Equipment 238.601 Scope.			
		238.603 Safety planning requirements.	Essential Requirement 2.4.1 § 8: TSI Rolling Stock - 6. Annex F	6. Assessment of Conformity and/or suitability for use Annex F Procedures for assessment of conformity and suitability for use	
		APPENDIX A TO PART 38 —SCHEDULE OF CIVIL PENALTIES			
		APPENDIX B TO PART 238 —TEST METHODS AND PERFORMANCE CRITERIA FOR THE FLAMMABILITY AND SMOKE EMISSION CHARACTERISTICS OF MATERIALS USED IN PASSENGER CARS AND LOCOMOTIVE CABS			

Table A8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
238	Passenger Equipment Safety Standards (continued)	APPENDIX C TO PART 238 —SUSPENSION SYSTEM SAFETY PERFORMANCE STANDARDS			
		APPENDIX D TO PART 238 —REQUIREMENTS FOR EXTERNAL FUEL TANKS ON TIER I LOCOMOTIVES			
		APPENDIX E TO PART 238 —GENERAL PRINCIPLES OF RELIABILITY-BASED MAINTENANCE PROGRAMS			

Table A9. 49 CFR Part 239 Passenger Train Emergency Preparedness Compared with UIC

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
239	Passenger Train Emergency Preparedness	Subpart A—General 239.1 Purpose and scope.			
		239.3 Application.			
		239.5 Preemptive effect.			
		239.7 Definitions.			
		239.9 Responsibility for compliance.			
		239.11 Penalties.			
		239.13 Waivers.			
		239.15 Information collection.			
		Subpart B—Specific Requirements 239.101 Emergency preparedness plan.			
		239.103 Passenger train emergency simulations.			
		239.105 Debriefing and critique.			

Table A9. 49 CFR Part 239 Passenger Train Emergency Preparedness Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
239	Passenger Train Emergency Preparedness (continued)	239.107 Emergency exits.	Essential Requirement 2.4.1 § 7: TSI Rolling Stock — 4.2.5.2 — 4.2.7.1	4.2.5.2 Passenger information signs 4.2.7.1 Emergency exits	
		Subpart C —Review, Approval, and Retention of Emergency Preparedness Plans 239.201 Emergency preparedness plan; filing and approval.			
		239.203 Retention of emergency preparedness plan.			

Table A9. 49 CFR Part 239 Passenger Train Emergency Preparedness Compared with UIC (continued)

49 CFR Section	Title	Section Parts	Corresponding UIC Regulation	Title	Comments
239	Passenger Train Emergency Preparedness (continued)	Subpart D —Operational (Efficiency) Tests; Inspection of Records and Recordkeeping 239.301 Operational (efficiency) tests.	TSI Rolling Stock - 4.4	4.4. Operating rules	GAP: Operating rules are not of the same spirit as emergency preparedness testing. GAP: Record keeping for emergency preparedness is not mentioned in the TSI Rolling Stock.
		239.303 Electronic recordkeeping.			
		APPENDIX A TO PART 239 —SCHEDULE OF CIVIL PENALTIES			

9. Appendix B.
Spreadsheet Comparing FRA Regulations with China Code

Table B1. 49 CFR Part 200 Informal Rules of Practice for Passenger Service Compared with China Code

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
200	Informal Rules of Practice for Passenger Service	200.1 General. 200.3 Definitions. 200.5 Applications. 200.7 Objections. 200.9 Hearings. 200.11 Orders, approvals, and determinations. 200.13 Publication.	1. General Provision 2. Glossaries and Symbols	

Table B2. 49 CFR Part 210 Railroad Noise Emission Compliance Regulations Compared with China Code

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
210	Railroad Noise Emission Compliance Regulations	Subpart A—General Provisions 210.1 Scope of part. 210.3 Applicability. 210.5 Definitions. 210.7 Responsibility for noise defective railroad equipment 210.9 Movement of a noise defective locomotive, rail car, or consist of a locomotive and rail cars. 210.11 Waivers. 210.13 Penalty.	22 Environment Protection 22.2 Sound Barrier 22.2.1 Requirements of sound barrier design 22.2.2 Requirements of sound barrier location 22.2.3 Requirements of sound barrier structure type 22.2.4 Acoustic design of sound barrier shall be based on the intensity of noise source and receptors receiving limits and requirement to comply 22.2.5 Requirements of sound barrier structure 22.2.6 Dynamic calculation of wind pressure on sound barrier for train speed higher than 250 km/h	

Table B2. 49 CFR Part 210 Railroad Noise Emission Compliance Regulations Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
210	Railroad Noise Emission Compliance Regulations (continued)	Subpart A—General Provisions (continued)	22.2.7 Concerns needs to be addressed in computing aerodynamic load on sound barrier panel 22.2.8 Requirements of sound absorptive and insulation materials 22.2.9 Requirements of auxiliary facilities design of sound barrier 22.2.10. Requirements of interface design between sound barrier foundation and other structures	

Table B2. 49 CFR Part 210 Railroad Noise Emission Compliance Regulations Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
210	Railroad Noise Emission Compliance Regulations (continued)	Subpart B—Inspection and Testing 210.21 Scope of subpart. 210.23 Authorization. 210.25 Measurement criteria and procedures. 210.27 New locomotive certification. 210.29 Operation standards (moving locomotives and rail cars). 210.31 Operation standards (stationary locomotives at 30 meters). 210.33 Operation standards (switcher locomotives, load cell test stands, car coupling operations, and retarders).		
		APPENDIX A TO PART 210 —SUMMARY OF NOISE STANDARDS, 40 CFR PART 201 APPENDIX B TO PART 210 —SWITCHER LOCOMOTIVE ENFORCEMENT POLICY		

Table B3. 49 CFR Part 213 Track Safety Standards Compared with China Code

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
213	Track Safety Standards	Subpart A—General 213.1 Scope of part. 213.2 Preemptive effect. 213.3 Application. 213.4 Excepted track. 213.5 Responsibility for compliance. 213.7 Designation of qualified persons to supervise certain renewals and inspect track. 213.9 Classes of track: operating speed limits. 213.11 Restoration or renewal of track under traffic conditions. 213.13 Measuring track not under load. 213.15 Penalties. 213.17 Waivers. 213.19 Information collection.		Category I — specially built high-speed lines equipped for speeds generally equal to or greater than 250 km/h (155 mph) Category II — specially upgraded high-speed lines equipped for speeds of the order of 200 km/h (124 mph) Category III — specially upgraded high-speed lines which have special features as a result of topographical, relief or town-planning constraints, on which the speed must be adapted to each case.
		Subpart B—Roadbed 213.31 Scope. 213.33 Drainage. 213.37 Vegetation.	6.7 Drainage 22.4 Vegetation planning and green corridor	

Table B3. 49 CFR Part 213 Track Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
213	Track Safety Standards (continued)	Subpart C—Track Geometry 213.51 Scope. 213.53 Gage. 213.55 Alignment. 213.57 Curves; elevation and speed limitations. 213.59 Elevation of curved track; runoff. 213.63 Track surface.		
		Subpart D—Track Structure 213.101 Scope. 213.103 Ballast; general.		
		213.109 Crossties.		
		213.110 Gage restraint measurement systems.		
		213.113 Defective rails.		
		213.115 Rail end mismatch.		
		213.119 Continuous welded rail (CWR); general.		
		213.121 Rail joints.		

Table B3. 49 CFR Part 213 Track Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
213	Track Safety Standards (continued)	213.122 Torch cut rail.		
		213.123 Tie plates.		
		213.127 Rail fastening systems.	9.2 Rail and fasteners	
		213.133 Turnouts and track crossings generally.		
		213.135 Switches.		
		213.137 Frogs.		
		213.139 Spring rail frogs.		
		213.141 Self-guarded frogs.		
		213.143 Frog guard rails and guard faces; gage.		
		Subpart E—Track Appliances and Track-Related Devices 213.201 Scope. 213.205 Derails		

Table B3. 49 CFR Part 213 Track Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
213	Track Safety Standards (continued)	Subpart F—Inspection 213.231 Scope. 213.233 Track inspections. 213.235 Inspection of switches, track crossings, and lift rail assemblies or other transition devices on moveable bridges. 213.237 Inspection of rail. 213.239 Special inspections. 213.241 Inspection records.		
		Subpart G—Train Operations at Track Classes 6 and Higher 213.301 Scope of subpart. 213.303 Responsibility for compliance. 213.305 Designation of qualified individuals; general qualifications. 213.307 Class of track: operating speed limits. 213.309 Restoration or renewal of track under traffic conditions. 213.311 Measuring track not under load. 213.317 Waivers. 213.319 Drainage.	5. Alignment 5.1 General requirement 5.2 Requirement of track plane 5.3 Requirements of track profile 5.4 Railway and high way cross, subsidiary facility and others 9. Track 9.1 General requirement 9.2 Rail and auxiliary parts	

Table B3. 49 CFR Part 213 Track Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
213	Track Safety Standards (continued)	213.321 Vegetation. 213.323 Track gage. 213.327 Alignment. 213.329 Curves, elevation and speed limitations. 213.331 Track surface. 213.333 Automated vehicle inspection systems. 213.334 Ballast; general. 213.335 Crossties	9.3 Accuracy for track Laying 9.4 Ballastless track 9.5 Ballasted track for main line 9.6 Transition section for track structure 9.7 Rail expansion joint 9.8 Interface design 9.9 Station track	
		213.337 Defective rails. 213.339 Inspection of rail in service. 213.341 Initial inspection of new rail and welds. 213.343 Continuous welded rail (CWR). 213.345 Vehicle qualification testing. 213.347 Automotive or railroad crossings at grade. 213.349 Rail end mismatch. 213.351 Rail joints.		

Table B3. 49 CFR Part 213 Track Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
213	Track Safety Standards (continued)	213.352 Torch cut rail. 213.353 Turnouts, crossovers, and lift rail assemblies or other transition devices on moveable bridges. 213.355 Frog guard rails and guard faces; gage. 213.357 Derails. 213.359 Track stiffness. 213.361 Right of way. 213.365 Visual inspections. 213.367 Special inspections. 213.369 Inspection records.		
		APPENDIX A TO PART 213 —MAXIMUM ALLOWABLE CURVING SPEEDS APPENDIX B TO PART 213 —SCHEDULE OF CIVIL PENALTIES APPENDIX C TO PART 213 —STATEMENT OF AGENCY POLICY ON THE SAFETY OF RAILROAD BRIDGES		

Table B4. 49 CFR Part 221 Rear End Marking Device – Passenger, Commuter, and Freight Trains Compared with China Code

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
221	Rear End Marking Device- Passenger, Commuter and Freight Trains	Subpart A—General 221.1 Scope. 221.3 Application. 221.5 Definitions. 221.7 Civil penalty 221.9 Waivers. 221.11 State regulation.		
		Subpart B—Marking Devices 221.13 Marking device display. 221.14 Marking devices. 221.15 Marking device inspection. 221.16 Inspection procedure. 221.17 Movement of defective equipment.		
		APPENDIX A TO PART 221 —PROCEDURES FOR APPROVAL OF REAR END MARKING DEVICES APPENDIX B TO PART 221 —APPROVED REAR END MARKING DEVICES APPENDIX C TO PART 221 —SCHEDULE OF CIVIL PENALTIES		

Table B5. 49 CFR Part 223 Safety Glazing Standards—Locomotives, Passenger Cars and Cabooses Compared with China Code

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
223	Safety Glazing Standards-- Locomotives, Passenger Cars and Cabooses	Subpart A—General 223.1 Scope. 223.3 Application. 223.5 Definitions. 223.7 Responsibility.		No China code available for Rolling stock
		Subpart B—Specific Requirements 223.8 Additional requirements for passenger equipment. 223.9 Requirements for new or rebuilt equipment. 223.11 Requirements for existing locomotives. 223.13 Requirements for existing cabooses. 223.15 Requirements for existing passenger cars. 223.17 Identification of equipped locomotives, passenger cars and cabooses.		No China code available for Rolling stock
		APPENDIX A TO PART 223 —CERTIFICATION OF GLAZING MATERIALS APPENDIX B TO PART 223 —SCHEDULE OF CIVIL PENALTIES		No China code available for Rolling stock

Table B6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with China Code

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
229	Railroad Locomotive Safety Standards	Subpart A—General 229.1 Scope. 229.3 Applicability. 229.4 Information collection. 229.5 Definitions. 229.7 Prohibited acts. 229.9 Movement of non-complying locomotives. 229.11 Locomotive identification. 229.13 Control of locomotives. 229.14 Non-MU control cab locomotives. 229.17 Accident reports. 229.19 Prior waivers.		No China code available for Rolling stock
		Subpart B—Inspections and Tests 229.21 Daily inspection. 229.23 Periodic inspection: General. 229.25 Tests: Every periodic inspection. 229.27 Annual tests. 229.29 Biennial tests. 229.31 Main reservoir tests. 229.33 Out-of-use credit.		No China code available for Rolling stock

Table B6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
229	Railroad Locomotive Safety Standards (continued)	Subpart C—Safety Requirements GENERAL REQUIREMENTS 229.41 Protection against personal injury. 229.43 Exhaust and battery gases. 229.45 General condition. BRAKE SYSTEM 229.46 Brakes: General. 229.47 Emergency brake valve. 229.49 Main reservoir system. 229.51 Aluminum main reservoirs. 229.53 Brake gauges. 229.55 Piston travel. 229.57 Foundation brake gear. 229.59 Leakage.		No China code available for Rolling stock
		DRAFT SYSTEM 229.61 Draft system. SUSPENSION SYSTEM 229.63 Lateral motion. 229.64 Plain bearings. 229.65 Spring rigging. 229.67 Trucks. 229.69 Side bearings.		No China code available for Rolling stock

Table B6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
229	Railroad Locomotive Safety Standards (continued)	SUSPENSION SYSTEM (continued) 229.71 Clearance above top of rail. 229.73 Wheel sets. 229.75 Wheel and tire defects. ELECTRICAL SYSTEM 229.77 Current collectors. 229.79 Third rail shoes. 229.81 Emergency pole; shoe insulation. 229.83 Insulation or grounding of metal parts. 229.85 Doors and cover plates marked "Danger." 229.87 Hand-operated switches. 229.89 Jumpers; cable connections. 229.91 Motors and generators.		No China code available for Rolling stock
		INTERNAL COMBUSTION EQUIPMENT 229.93 Safety cut-off device. 229.95 Venting. 229.97 Grounding fuel tanks. 229.99 Safety hangers. 229.101 Engines.		No China code available for Rolling stock

Table B6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
229	Railroad Locomotive Safety Standards (continued)	STEAM GENERATORS 229.103 Safe working pressure; factor of safety. 229.105 Steam generator number. 229.107 Pressure gauge. 229.109 Safety valves. 229.111 Water-flow indicator. 229.113 Warning notice.		No China code available for Rolling stock
		CABS AND CAB EQUIPMENT 229.115 Slip/slide alarms. 229.117 Speed indicators. 229.119 Cabs, floors, and passageways. 229.121 Locomotive cab noise. 229.123 Pilots, snowplows, end plates. 229.125 Headlights and auxiliary lights. 229.127 Cab lights. 229.129 Locomotive horn. 229.131 Sanders. 229.133 Interim locomotive conspicuity measures—auxiliary external lights. 229.135 Event recorders.		No China code available for Rolling stock

Table B6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
229	Railroad Locomotive Safety Standards	229.137 Sanitation, general requirements. 229.139 Sanitation, servicing requirements.		
		Subpart D—Locomotive Crashworthiness Design Requirements 229.141 Body structure, MU locomotives. 229.201 Purpose and scope. 229.203 Applicability. 229.205 General requirements. 229.206 Design requirements. 229.207 New locomotive crashworthiness design standards and changes to existing FRA-approved locomotive crashworthiness design standards. 229.209 Alternative locomotive crashworthiness designs. 229.211 Processing of petitions. 229.213 Locomotive manufacturing information. 229.215 Retention and inspection of designs. 229.217 Fuel tank.		No China code available for Rolling stock

Table B6. 49 CFR Part 229 Railroad Locomotive Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
229	Railroad Locomotive Safety Standards (continued)	APPENDIX A TO PART 229 —FORM FRA 6180–49A [NOTE] APPENDIX B TO PART 229 —SCHEDULE OF CIVIL PENALTIES APPENDIX C TO PART 229 —FRA LOCOMOTIVE STANDARDS—CODE OF DEFECTS [NOTE] APPENDIX D TO PART 229— CRITERIA FOR CERTIFICATION OF CRASHWORTHY EVENT RECORDER MEMORY MODULE APPENDIX E TO PART 229 —PERFORMANCE CRITERIA FOR LOCOMOTIVE CRASHWORTHINESS APPENDIXES F–G TO PART 229 [RESERVED] APPENDIX H TO PART 229— STATIC NOISE TEST PROTOCOLS—IN-CAB STATIC		

Table B7. 49 CFR Part 231 Railroad Safety Appliance Standards Compared with China Code

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
231	Railroad Safety Appliance Standards	PART 231—RAILROAD SAFETY APPLIANCE STANDARDS 231.0 Applicability and penalties. 231.1 Box and other house cars built or placed in service before October 1, 1966. 231.2 Hopper cars and high-side gondolas with fixed ends. 231.3 Drop-end high-side gondola cars. 231.4 Fixed-end low-side gondola and low side hopper cars. 231.5 Drop-end low-side gondola cars. 231.6 Flat cars. 231.7 Tank cars with side platforms. 231.8 Tank cars without side sills and tank cars with short side sills and end platforms. 231.9 Tank cars without end sills. 231.10 Caboose cars with platforms. 231.11 Caboose cars without platforms.		No China code available for Rolling stock

Table B7. 49 CFR Part 231 Railroad Safety Appliance Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
231	Railroad Safety Appliance Standards (continued)	231.12 Passenger-train cars with wide vestibules. 231.13 Passenger-train cars with open-end platforms. 231.14 Passenger-train cars without end platforms. 231.15 Steam locomotives used in road service. 231.16 Steam locomotives used in switching service.		
		231.17 Specifications common to all steam locomotives. 231.18 Cars of special construction. 231.19 Definition of "Right" and "Left." 231.20 Variation in size permitted. 231.21 Tank cars without under frames. 231.22 Operation of track motor cars. 231.23 Unidirectional passenger-train cars adaptable to van-type semi-trailer use. 231.24 Box and other house cars with roofs, 16 feet 10 inches or more above top of rail.		No China code available for Rolling stock

Table B7. 49 CFR Part 231 Railroad Safety Appliance Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
231	Railroad Safety Appliance Standards (continued)	<p>231.25 Track motorcars (self-propelled 4 – wheel cars which can be removed from the rails by men).</p> <p>231.26 Pushcars.</p> <p>231.27 Box and other house cars without roof hatches or placed in service after October 1, 1966.</p> <p>231.28 Box and other house cars with roof hatches built or placed in service after October 1, 1966.</p> <p>231.29 Road locomotives with corner stairways.</p> <p>231.30 Locomotives used in switching service.</p> <p>231.31 Drawbars for freight cars; standard height.</p>		No China code available for Rolling stock
		APPENDIX A TO PART 231 —SCHEDULE OF CIVIL PENALTIES		

Table B8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with China Code

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
238	Passenger Equipment Safety Standards	Subpart A—General 238.1 Purpose and scope. 238.3 Applicability. 238.5 Definitions. 238.7 Waivers. 238.9 Responsibility for compliance. 238.11 Penalties. 238.13 Preemptive effect. 238.15 Movement of passenger equipment with power brake defects. 238.17 Movement of passenger equipment with other than power brake defects. 238.19 Reporting and tracking of repairs to defective passenger equipment. 238.21 Special approval procedure. 238.23 Information collection.		No China code available for Rolling stock

Table B8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
238	Passenger Equipment Safety Standards (continued)	Subpart B—Safety Planning and General Requirements 238.101 Scope. 238.103 Fire safety. 238.105 Train electronic hardware and software safety. 238.107 Inspection, testing, and maintenance plan. 238.109 Training, qualification, and designation program. 238.111 Pre-revenue service acceptance testing plan. 238.113 Emergency window exits. 238.115 Emergency lighting. 238.117 Protection against personal injury. 238.119 Rim-stamped straight-plate wheels.		No China code available for Rolling stock

Table B8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
238	Passenger Equipment Safety Standards (continued)	Subpart C—Specific Requirements for Tier I Passenger Equipment 238.201 Scope/alternative compliance. 238.203 Static end strength. 238.205 Anti-climbing mechanism. 238.207 Link between coupling mechanism and car body. 238.209 Forward-facing end structure of locomotives. 238.211 Collision posts. 238.213 Corner posts. 238.215 Rollover strength. 238.217 Side structure. 238.219 Truck-to-car-body attachment. 238.221 Glazing. 238.223 Locomotive fuel tanks. 238.225 Electrical system. 238.227 Suspension system. 238.229 Safety appliances—general. 238.230 Safety appliances—new equipment. 238.231 Brake system. 238.233 Interior fittings & surfaces. 238.235 Doors. 238.237 Automated monitoring.		No China code available for Rolling stock

Table B8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
238	Passenger Equipment Safety Standards (continued)	Subpart D—Inspection, Testing, and Maintenance Requirements for Tier I Passenger Equipment 238.301 Scope. 238.303 Exterior calendar day mechanical inspection of passenger equipment. 238.305 Interior calendar day mechanical inspection of passenger cars. 238.307 Periodic mechanical inspection of passenger cars and unpowered vehicles used in passenger trains. 238.309 Periodic brake equipment maintenance. 238.311 Single car test. 238.313 Class I brake test. 238.315 Class IA brake test. 238.317 Class II brake test. 238.319 Running brake test. 238.321 Out-of-service credit.		No China code available for Rolling stock
		Subpart E—Specific Requirements for Tier II Passenger Equipment 238.401 Scope. 238.403 Crash energy management. 238.405 Longitudinal static compressive strength.		No China code available for Rolling stock

Table B8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
238	Passenger Equipment Safety Standards (continued)	238.407 Anti-climbing mechanism. 238.409 Forward end structures of power car cabs. 238.411 Rear end structures of power car cabs. 238.413 End structures of trailer cars. 238.415 Rollover strength. 238.417 Side loads. 238.419 Truck-to-car-body and truck component attachment.		No China code available for Rolling stock
		238.421 Glazing. 238.423 Fuel tanks. 238.425 Electrical system. 238.427 Suspension system. 238.429 Safety appliances. 238.431 Brake system. 238.433 Draft system. 238.435 Interior fittings and surfaces. 238.437 Emergency communication. 238.439 Doors. 238.441 Emergency roof entrance location. 238.443 Headlights. 238.445 Automated monitoring. 238.447 Train operator's controls and power car cab layout.		No China code available for Rolling stock

Table B8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
238	Passenger Equipment Safety Standards (continued)	Subpart F—Inspection, Testing, and Maintenance Requirements for Tier II Passenger Equipment 238.501 Scope. 238.503 Inspection, testing, and maintenance requirements. 238.505 Program approval procedure. Subpart G—Specific Safety Planning Requirements for Tier II Passenger Equipment 238.601 Scope. 238.603 Safety planning requirements.		No China code available for Rolling stock
		APPENDIX A TO PART 38 — SCHEDULE OF CIVIL PENALTIES APPENDIX B TO PART 238 —TEST METHODS AND PERFORMANCE CRITERIA FOR THE FLAMMABILITY AND SMOKE EMISSION CHARACTERISTICS OF MATERIALS USED IN PASSENGER CARS AND LOCOMOTIVE CABS		No China code available for Rolling stock

Table B8. 49 CFR Part 238 Passenger Equipment Safety Standards Compared with China Code (continued)

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
238	Passenger Equipment Safety Standards (continued)	APPENDIX C TO PART 238 — SUSPENSION SYSTEM SAFETY PERFORMANCE STANDARDS APPENDIX D TO PART 238 — REQUIREMENTS FOR EXTERNAL FUEL TANKS ON TIER I LOCOMOTIVES APPENDIX E TO PART 238 — GENERAL PRINCIPLES OF RELIABILITY-BASED MAINTENANCE PROGRAMS		No China code available for Rolling stock

Table B9. 49 CFR Part 239 Passenger Train Emergency Preparedness Compared with China Code

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
239	Passenger Train Emergency Preparedness	Subpart A—General 239.1 Purpose and scope. 239.3 Application. 239.5 Preemptive effect. 239.7 Definitions. 239.9 Responsibility for compliance. 239.11 Penalties. 239.13 Waivers. 239.15 Information collection.		No China code available
		Subpart B—Specific Requirements 239.101 Emergency preparedness plan. 239.103 Passenger train emergency simulations. 239.105 Debriefing and critique. 239.107 Emergency exits.		No China code available
		Subpart C—Review, Approval, and Retention of Emergency Preparedness Plans 239.201 Emergency preparedness plan; filing and approval. 239.203 Retention of emergency preparedness plan.		No China code available

Table B9. 49 CFR Part 239 Passenger Train Emergency Preparedness Compared with China Code

49 CFR Section	CFR Title	Section Parts	Corresponding China Code	Comments
239	Passenger Train Emergency Preparedness (continued)	Subpart D —Operational (Efficiency) Tests; Inspection of Records and Recordkeeping 239.301 Operational (efficiency) tests. 239.303 Electronic recordkeeping.		No China code available
		APPENDIX A TO PART 239 —SCHEDULE OF CIVIL PENALTIES		No China code available

Abbreviations and Acronyms

AAR	Association of American Railroads
AEIF	European Association for Railway Interoperability
APTA	American Public Transportation Association
AREMA	American Railway Engineering and Maintenance-of-Way Association
CEC	Commission of the European Communities
CEN	Comité Européen de Normalisation
CFR	Code of Federal Regulations
EN	European Norm (standard)
ERA	European Rail Agency
ERTMS	European Rail Traffic Management System
ETF	Editions Techniques Ferroviares
FMVSS	Federal Motor Vehicle Safety Standards
FRA	Federal Railroad Administration
HSR	high-speed rail
MCAT	Minimally Compliant Analytical Track
MOR	Ministry of Railways (China)
NPRM	Notice of Proposed Rule Making
ORE	Office of Research and Experiments
OSHA	Occupational Safety and Health Administration
TSI	Technical Specification for Interoperability
TTCI	Transportation Technology Center, Inc.
UIC	Union Internationale des Chemins de fer
UTU	United Transportation Union
VTINPRM	Vehicle Track Interaction Notice of Proposed Rule Making

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