Federal Railroad Administration Track Geometry Regulations

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Presentation Outline

- Mission, Purpose and Organization
- Historical Perspective
- Safety Perception
- Safety Inspection
- Adequacy of Track Safety Standards
- Prescriptive vs Performance-Based Standard
- Closing Remarks

FRA's Mission, Purpose and Organization

FRA's mission

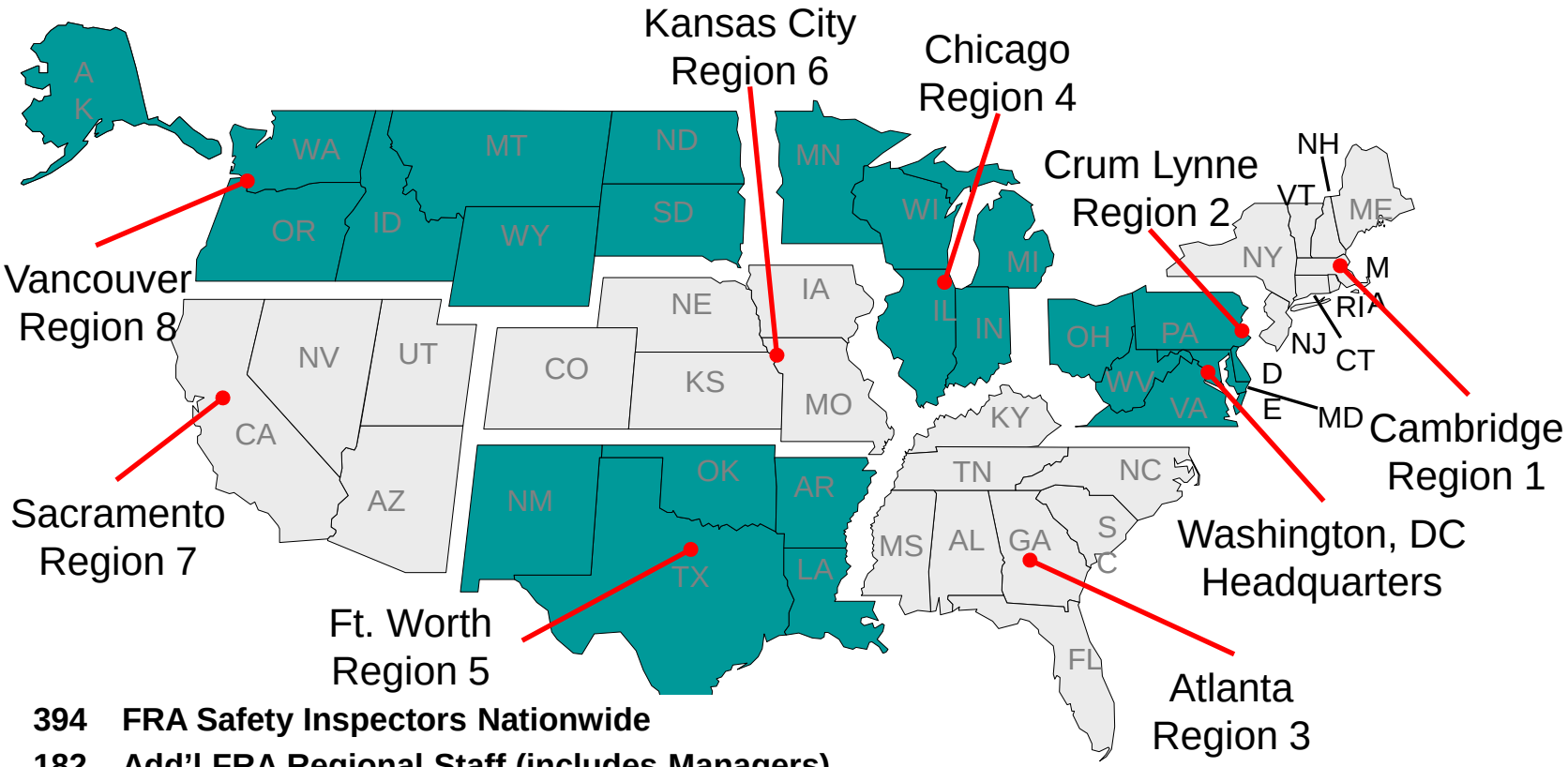
- To enable the safe, reliable, and efficient movement of people and goods for a strong America, now and in the future.

FRA's purpose

- Carry out all railroad safety laws of the United States
- Promote safety in all areas of railroad operations; and
- Reduce railroad-related accidents and incidents

FRA's Mission, Purpose and Organization

FRA Organization



394 **FRA Safety Inspectors Nationwide**

182 **Add'l FRA Regional Staff (includes Managers)**

172 **State Inspectors – 28 States**

FRA's Mission, Purpose and Organization

- Statutory requirements and congressional directives;
- Review of relevant safety statistics, findings in prior safety inspections and investigations; and
- Recommendations by the NTSB and other oversight bodies, including the DOT Office of the Inspector General (OIG).

Geometry Standards Historical Perspective

- Track Safety Standards (Standards) were first promulgated in October 1971, following the enactment of the Federal Railroad Safety Act of 1970

- FRA envisioned the Standards as a evolving set of requirements subject to continuous revisions that were intended to keep pace with both FRA and industry innovations and research

Geometry Standards Historical Perspective

FRA measures track safety with a ‘pass or fail’ approach, i.e.,

- Either compliant or noncompliant with the regulations
- The *Standards* represents a mix of design prescriptive text and performance-based criteria

Geometry Standards
Historical Perspective

TSS amended in 1998

- Gage limit on designated “excepted track’ locations
- Minimum vehicle/track performance safety limits
- Introduced a 31-foot chord alignment on curves in Class 3-5 track
- Limits crosslevel at any point in a curve

Geometry Standards
Historical Perspective

- Higher curving speeds based on four inches of unbalance (cant deficiency) that demonstrate safe curving performance

- Updated the Track Surface table—added three footnotes to address specific ‘warp’ situations

- Subpart G revised significantly

Safety Perception

The concept of rail safety is in harmony with the concept of safety generally

- Varies with the time, the issue, the role of various stakeholders, and the status of technology and customary practice

- The level of acceptable risks of accident and injury is on a continuum where public values and attitudes toward risks, as well as, benefits change (for example, Chatsworth collision)

Safety Perception

- Public demand for railroad safety generally continues evolving to higher acceptable levels and is viewed from two perspectives—safety of people and property

- The effectiveness of either a maintenance or safety program is predicated on assessing the level of risk when discovering and remediating defective condition(s)

Safety Inspection

- Visual inspections tend to focus on the structure requirements
- Automated inspection is focused on geometry condition and its associated lateral and vertical accelerations
- There are 'intangibles', but automated inspections are a vital supplement to visual inspections and need to be combined
- Both inspection types have stood alone

Safety Inspection

Four major track geometry conditions:

- Gage
- Alignment
- Profile
- Crosslevel

Adequacy of Track Safety Standards

- How likely will a derailment occur considering borderline compliant equipment and track combinations that 'excite' wheel lift/climb, center-bowl separation scenarios
- Why does track-caused main and yard derailment rate remains a high especially when we have state-of-the-art visual and automated inspection technology—do we fully understand the failure mechanism?

Adequacy of Track Safety Standards

- Inherent combinations of poor track geometry and its (overloading compliant and noncompliant stress-state) effect on the track structure that leads to conditions of instability, such as fouled ballast

- Is there too much focus and reliance on individual conditions in isolation and not enough focus on deteriorating equipment and track combinations

Adequacy of Track Safety Standards

- Additionally, 'autonomous' inspections can be used to better understand the safety tendencies of those locations where safety is threatened and needs improving through effective maintenance planning

- Inspection procedures and frequency standards will likely evolve based on risk assessment, time, and tonnage

Areas to Explore

- Effective response to rail safety problems
- Adequate railroad safety statutory framework to address safety problems (heavier wheel loads, traffic capacity, etc.)
- Cost-benefit and effectiveness of accident prevention resulting from FRA methodology
- Improve and measure the effectiveness of our safety successes

Prescriptive vs Performance-Based Standard

A prescriptive standard, typically:

- Suggests materials, design and construction methods and usually do not state Goals and Objectives

Most of the regulatory language in the Standards is prescriptive design

Prescriptive vs Performance-Based Standard

A performance-based standard:

- States goals and objectives to be achieved and describes methods that can be used to demonstrate whether geometry criteria met the specified goals and objectives
- Flexibility in choosing materials, design and construction, desired characteristics (results) rather than the requirements for the process to produce it,
- Allows for and encourages optimal allocation of resources

Prescriptive vs Performance-Based Standard

- Whether or not a standard can be effectively performance-based rather than prescriptive depends on whether products or services meet its goals and objectives

- When performance-based requirements involve costly and complicated testing procedures, prescriptive requirements should be considered, with optional performance-based requirements

Prescriptive vs Performance-Based Standard

Performance Criteria

- Are they necessary to meet the objectives
- Tend to be the most specific parts of performance-based documents
- Criteria can be considered as quantified objectives, which state in engineering terms the required level of performance

Prescriptive vs Performance-Based Standard

Verification

- A performance-based design will frequently involve features that do not comply with prescriptive requirements, it is necessary to verify that the track geometry / structure components meets the goals and objectives
- Verification can involve tests, examinations, calculations, or a combination
- When a criterion is described in terms of probability of failure of (track geometry / structure) components, a risk analysis may be required to verify compliance with the standard

Prescriptive vs Performance-Based Standard

The Way Forward

- Combined design and performance standards where appropriate (e.g.—design gage will always be 56 ½ inch; Plate “C” Clearance for Unrestricted Interchange; and Wheel Profile limits)
- Some standards, like inspection procedures and frequencies, will likely evolve based upon risk, time, and tonnage

Closing Remarks

- Current FRA geometry regulations are a mixture of performance and design
- Performance-based TSS already used include automated inspection of concrete tie track; VTI and geometry limits for high speed tracks, and GRMS in classes 1-5
- New technology and innovation will change safety assessment and derailment prevention
- Performance-based rather than prescriptive TSS seem inevitable

THANK YOU!