American Railway Engineering & Maintenance-of-Way Association
Letter Ballot 15-22-03

Assignment: At the February 2022 meeting in Fort Worth, TX, letter ballot 15-22-03 was proposed by the subcommittee and general committee to revise Article 9.1.2.1.

Rationale: The temperature isoline maps in current 9.1.2.1 are of poor graphic quality and outdated. Replacement maps are not easily generated. Additional guidance is provided. Some material is also re-arranged and/or corrected.

Submitted by: Heather Gilmer, Chair SC 2 Materials
Due Date: April 29, 2022

Edit Article 9.1.2.1 as shown (deletions in ~~**bold red strikethrough**~~, new text in **red bold underline**, explanatory text in brackets [ ] not part of published text):

9.1.2.1 MATERIALS (2019)

a. **Weathering Steel:** ASTM A588 and …

[Re-number "Impact Test Requirements for Structural Steel" to 9.1.2.1b and move it to follow "Twist-Off Tension Control Bolts" and Table 15-9-1]

F3125 Grade A490 Bolts: The use of …

- Grade A325 bolts …
- Grade A490 bolts …

There may be instances …

Use of Grade A490 and …

Twist-Off Tension-Control Bolts: ASTM includes two …

Grade F1852 and F2280 bolts …

Twist-off bolts control …

When properly performed …

Grade F1852 bolts …

Grade A490 bolts …

As a result …

[Table 15-9-1 unchanged]

[Edit re-numbered "Impact Test Requirements for Structural Steel" as shown:]

b. **Impact Test Requirements for Structural Steel:** Table **15-**9-2 and Table **15-**9-3 summarize provisions for materials with improved notch toughness. ASTM A709 Grade HPS 70W and Grade HPS 50W steels have such high toughness that when they were included in the ASTM A709 Specification, the Zone 3 requirements, which are the most severe, were specified for all zones. Because of ~~**their**~~ **the** high toughness **of HPS 50W and HPS70W,** ~~**it was decided to eliminate**~~ the need to choose ~~**the**~~ **an** appropriate zone ~~**when using HPS 50W or HPS 70W**~~ **has been eliminated,** and ~~treat~~ all zones **for these materials are treated** alike.

The service temperature zones defined in Article 1.2.1b(4) correspond ~~**with**~~ **to** those ~~**chosen by**~~ **defined in the** AASHTO **fracture control plan**. For guidance in determining the Lowest Anticipated Service Temperature for a particular location in the United States or Canada, **three methods are suggested that will provide the desired lowest anticipated service temperature: (a) use of temperature data to compute the desired service temperature, (b) use of state-required AASHTO temperature zones for the United States, or (c) use of existing isoline temperature maps. Each of these methods are described below.**

For method (a), the Lowest Anticipated Service Temperature can be computed using temperature data available from the National Oceanic and Atmospheric Administration (NOAA) for the given location. It is recommended that the computed temperature be based upon the lowest 1% of a thirty-year record of daily minimum temperature. This value will produce a 99% probability that the daily minimum temperature will be no lower than the computed value.

For method (b), the fracture toughness test zone (Zone 1, Zone 2, or Zone 3) adopted by the state transportation agency that corresponds to the desired location within the United States can be used. The test zone temperature encapsulates and indirectly corresponds to the Lowest Anticipated Service Temperature.

For method (c), Figure 15-9-1 and Figure 15-9-2 may be used. Both figures show temperatures in degrees Fahrenheit. Figure 15-9-1 (~~**U.S. and Alaska**~~ **United States**) shows isolines for which there is a 99% chance that the daily minimum temperature will be no lower than shown. Figure 15-9-2 (Canada) shows isolines for which the temperature during January will be no lower than shown for 99% of the time.

[Table 15-9-2, Table 15-9-3, Figure 15-9-1, and Figure 15-9-2 unchanged]

[Re-number existing 9.1.2.1b to 9.1.2.1c and existing 9.1.2.1f to 9.1.2.1g]

~~b~~c. Based on commonly accepted approximate values for E and μ obtained from test results, the approximate value for G is derived using the following theoretical Equation:

$$G = E/(2(1 + \mu)).$$

~~f~~g. FCMs (fracture-critical members) require additional consideration. This includes increased material toughness as specified in Section 1.14, Fracture-Critical Members.