American Railway Engineering and Maintenance of Way Association
Letter Ballot

1. **Committee and Subcommittee:**

16 - Power Subcommittee

2. **Letter Ballot Number:**

16-20-1

3. **Assignment:**

New material: Drawbar Pull Description

4. **Ballot Item:**

Chapter 16, Part 3, Section 2, Article 4: Drawbar Pull Description

5. **Rationale:**

Info on tractive effort vs. train resistance, balance speed depending on track gradient

AREMA Chapter 16, Part 3, Section 2, Article 4
Drawbar Pull Description
FINAL DRAFT – 26 Mar 2020

3.2.4 Drawbar Pull

The actual pulling force that the locomotive can provide to move the train is referred to as drawbar pull. Drawbar pull is the force available at the coupler between the locomotive consist and the vehicle immediately trailing, typically the first car of the train. This force is determined by subtracting the locomotive resistance force (calculated using a resistance equation such as the modified Davis equation, see Chapter 16, Part 2) from the tractive effort at a given speed. The resulting drawbar pull curve is similar to the tractive effort curve albeit with reduced force values. On flat and straight track the locomotive resistance is very small and can be effectively ignored. However, on a 1% ascending gradient locomotive resistance becomes more significant due to the effect of grade resistance, as shown in Figure 16-3-6.

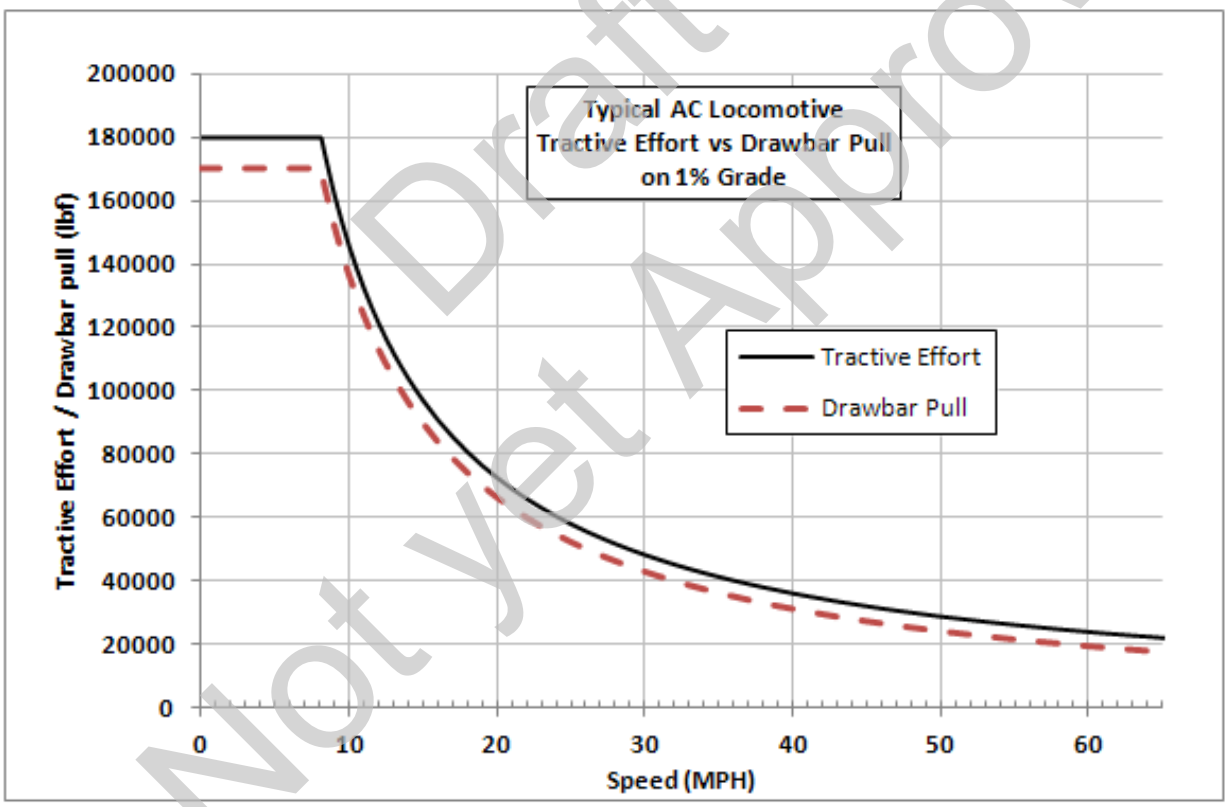

Figure 16-3-6. Comparison of locomotive tractive effort and drawbar pull on 1% ascending grade

Having determined the drawbar pull, it is now necessary to determine if the available force will exceed the overall resistance force of the train. Methodology to determine

train resistance values are discussed in Chapter 16, Part 2, Train Performance. As long as the expected drawbar pull force value exceeds that of the train resistance force value, the train will be able to move and accelerate. The train resistance force can be added to the drawbar pull chart in order to identify the 'balance speed' at which the train will no longer accelerate or to determine if an adequate value of drawbar pull is available to initiate movement. Figure 16-3-7 provides an illustration of the relationship between drawbar pull for an example train with three typical AC locomotives at maximum power (throttle position 8) and balance speeds resulting from a 15,000 trailing ton train operating on level and 1.2% grades.

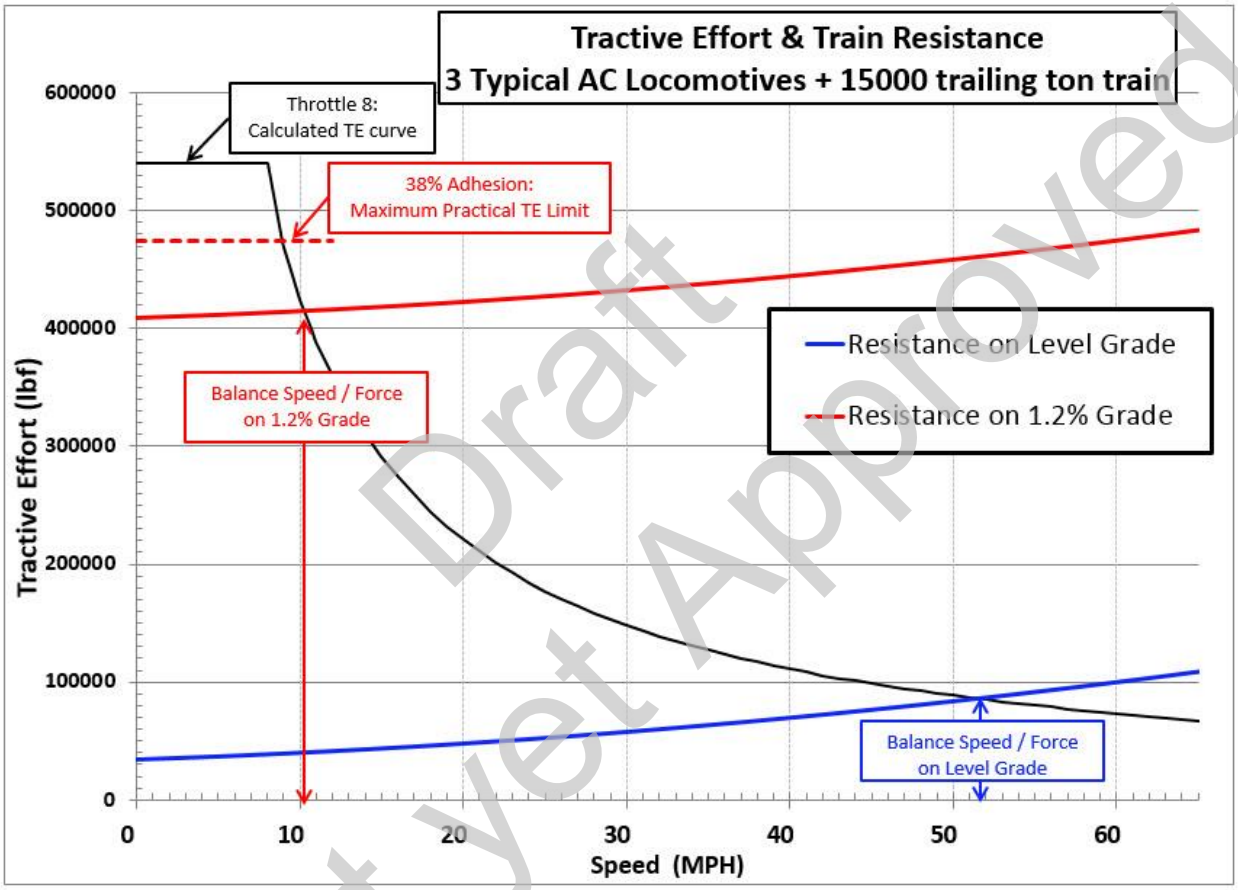

Figure 16-3-7. Tractive effort and train resistance relationship