TMD Friction position paper

“Air Disc and Drum Brake Compatibility and Auxiliary Retarders”

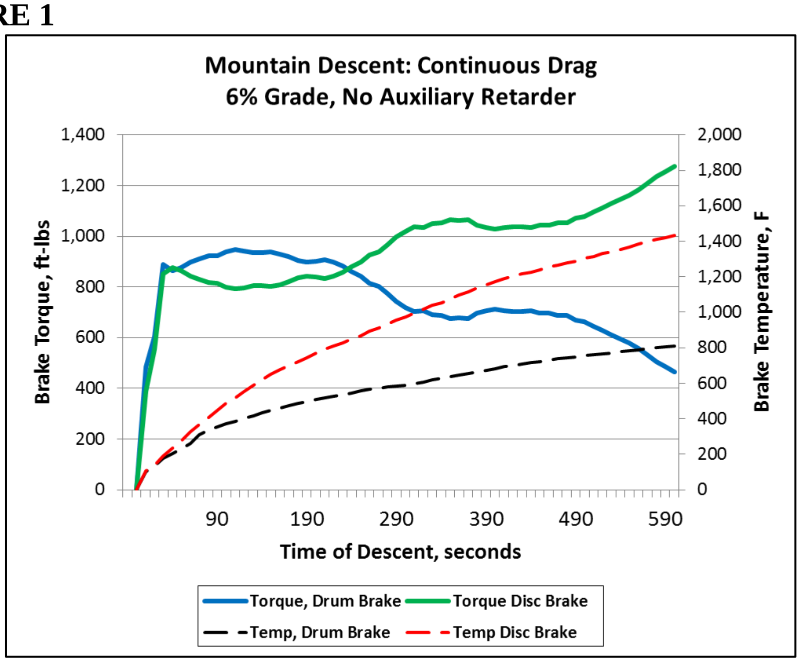
Disc brakes are the future of braking on heavy-duty vehicles in North America. They have less fade, more consistent torque output, and better in-stop characteristics. With air disc brakes becoming more common in North America, fleet operators however need to be aware that disc brakes, with their improved performance, should not be considered as a substitute for auxiliary retarders. Retarders are as important as ever, or possibly even more important, on vehicles that combine disc and drum brakes and operate on downgrades.

Disc and drum brakes react differently to elevated temperatures, because of how they mechanically apply the friction material to the rotor or drum. In addition, disc brakes use semi-metallic linings while drum brakes use organic linings. Because of these design differences, vehicles where discs and drums are both utilized on the major load bearing axles can encounter high brake temperature operating conditions that will cause the air disc brake to “take over” the braking workload from the drum brake.

An example vehicle would be a tractor/trailer with air discs on the drive axles, and drum brakes on the trailer axles. If not properly equipped with a retarder, the vehicle could see high-brake temperature differentials on long downgrades that can lead to excessive disc pad and drum lining wear and drum/rotor cracking. The exception would be when discs are installed only on the steer axle, as this axle generally has higher “crack” pressures, smaller actuating air chambers, and better cooling airflow that would reduce these concerns.

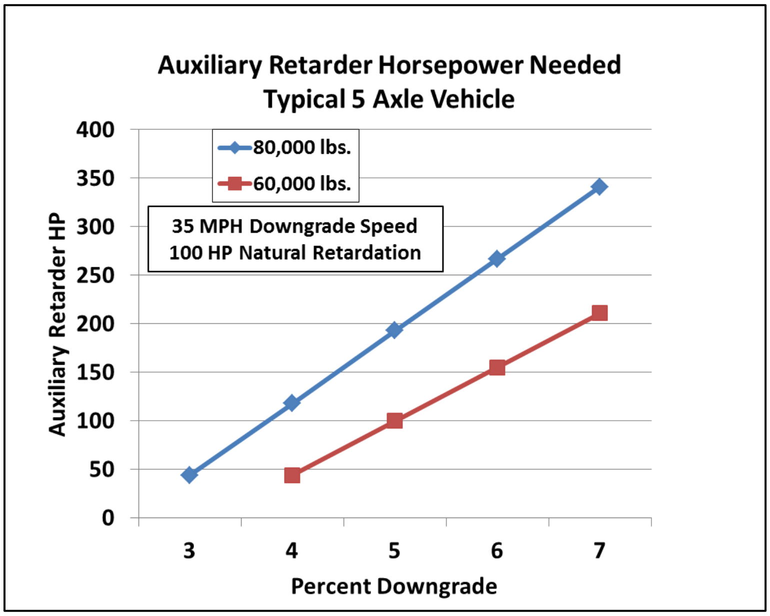
Recent testing by TMD has confirmed this issue of high temperature disc/drum compatibility in dynamometer simulations of an 80,000 lb. tractor-trailer. A vehicle, not equipped with a retarder, in descending a 6 percent grade will experience a workload shift from the drum brakes to the disc brakes as elevated temperatures are reached. The disc brakes are shown to reach temperatures of greater than 1,400˚F, while the drum brakes heat up to 800˚F (Fig 1). The semi-metallic linings used on disc brakes are made to work at high temperatures, but these temperature ranges are simply too high for reasonable operating conditions.

FIGURE 1



TMC's RP 636, "Specifying Auxiliary Retarders", is the best guide available for fleets to determine needed retarder horsepower for a vehicle. The total horsepower required to hold a steady speed on a downgrade is based on the vehicle's weight, speed, and the percent grade it is descending. An example would be an 80,000 lb. GVW, five axle tractor, descending a 5 percent grade at a posted speed limit of 35 mph. From the tables in the recommended practice, this vehicle needs a total of 373HP retardation to keep it from accelerating down the grade. Minus 180HP in "in-gear" engine retardation and retardation from the wheel end brakes, the size of the auxiliary retarder needed is 373 – 180 = 193HP. Figure 2 shows the calculation result for vehicles for various GVW's and percent grades.

FIGURE 2



Of course, these results are based on the performance of well-maintained wheel end brakes, with original equipment linings. If you degrade any of the vehicle's brakes by using poor quality aftermarket linings on either the disc or drum brakes, then the problem of shifting workload between brakes becomes much larger.

As always, any new component on a vehicle can have significant advantages. However, fleet operators need to understand how to use these new technologies so as to gain their full advantages while avoiding any potential problems. A properly spec'd retarder is the best guarantee a vehicle can have to assure acceptable high-temperature compatibility between disc and drum brakes.