

Mountain Driving and Target Speed For School Bus Drivers

Mountain Driving

In mountain driving, the force of gravity plays a major role. The steeper the grade, the longer the grade, and/or the heavier the load, the more you will have to use lower gears to climb hills or mountains. In going down steep hills, gravity will tend to speed you up. You must select an appropriate safe speed (Target Speed), then use a low gear and proper braking techniques. You should plan ahead and obtain information about any long steep grades along your planned route of travel. If possible, talk to other drivers who are familiar with the grades to find out what speeds are safe.

You must go slowly enough so your brakes can hold you back without getting too hot. If the brakes become too hot, they may start to "fade." This means you have to apply them harder and harder to get the same stopping power. If you continue to use the brakes hard, they can keep fading (have less stopping power) until you cannot slow down or stop at all.

Going Downhill in the Correct Gear

Use the braking effect of the engine as the principal way of controlling your speed. The braking effect of the engine is greatest when it is near the governed rpms and the transmission is in the lower gears. Save your brakes so you will be able to slow or stop as required by road and traffic conditions.

Slow the vehicle and shift the transmission to a low gear *before* starting down the grade. Do not try to downshift after your speed has already built up. You will not be able to shift into a lower gear. You may not even be able to get back into any gear and all engine braking effect will be lost. Forcing an automatic transmission into a lower gear at high speed could damage the transmission also and lead to loss of all engine braking effect.

Brake Fade or Failure

When going downhill, brakes will always heat up. They are designed so brake shoes or pads rub against the brake drum or discs to slow the vehicle, which creates heat. Brakes are designed to take a lot of heat. However, brakes can fail from excessive heat if you try to slow down from a high speed too many times or too quickly. Brakes will fade when they get very hot and may not slow the vehicle.

Brake fade is the reduction in stopping power that can occur after repeated application of the brakes, especially in high load or high-speed conditions. Brake fade can be a factor in any vehicle that utilizes a friction braking system including automobiles, trucks, motorcycles, airplanes, even bicycles.

Brake fade is caused by a buildup of heat in the braking surfaces and the subsequent changes and reactions in the brake system components and can be

experienced with both drum brakes and disk brakes. Loss of stopping power, or fade, can be caused by friction fade, mechanical fade, or fluid fade.

Brake fade occurs most often when going down a long, steep hill.

Brakes also can fade because they are out of adjustment. To safely control a vehicle, every brake must do its share of the work. If some brakes are out of adjustment, they will not be doing their share. The other brakes can overheat and fade and there will not be enough braking available to control the vehicle(s). Brakes can get out of adjustment quickly, especially when they are used a lot; also, brake linings wear faster when they are hot.

Controlling fade through driving technique

Brake fade can be reduced through proper braking technique - when descending long downgrade that would require braking simply select a lower gear and a target speed.

Target speed is the desired speed of the vehicle, as determined by the driver that permits the vehicle to descend a grade under controlled conditions. The lower gear must be the proper gear for the target speed. This means a gear low enough to maintain or assist in maintaining the driver's target speed for the vehicle.

The **proper gear** is one at least as low as that needed by the vehicle to ascend the same grade; drivers of later model buses may need to select the next gear lower. It is better the driver select too low a gear rather than too high.

Drivers should be aware that selection of a lower gear may not be possible while descending a grade. Remember, the time to select the proper gear is before descending the grade and approaching a downhill grade at a speed slow enough to allow the target speed to be maintained.

Target Speed How Do Determine It?

Your most important consideration is to select a speed that is not too fast for the:

- Total weight of the vehicle and cargo.
- Length and steepness of the grade.
- Road conditions and weather.

If a speed limit is posted, or there is a sign indicating maximum safe speed, never exceed the speed shown. Also, look for and heed warning signs indicating the length and steepness of the grade.

Signs

Downgrade ahead

Trucks/buses use low gears

Percent of grade --- 7%, 9%, 10%, etc.

Curve speed limit signs

Curves next 3 miles

Truck speed limits

Target Speed

How Do We Find It?

Your visual experience

Descending in the same gear you used to climb the hill or one gear lower for automatic buses

Experiences of other drivers that have been in the same area (keep records).

Very light brake application pressure. (This is probably the most accurate way to determine if you are at the correct target speed and in the correct gear).

Dual air brake systems

Newer heavy-duty vehicles use dual air brake systems for safety. A dual air brake system has two separate air brake systems which use a single set of brake controls. Each system has its own air tanks, hoses, lines, etc. One system typically operates the regular brakes on the rear axle. The other system operates the regular brakes on the front axle. The first system is called the primary system and the other is called the secondary system.

Before driving a vehicle with a dual air system, allow time for the air compressor to build up a minimum of 100 psi pressure in both the primary and secondary systems. Watch the primary and secondary air pressure gauges (or needles if the system has two needles in one gauge).

The warning system devices should come on before the air pressure drops below 60 psi in either system. If one air system is very low on pressure, either the front or the rear brakes will not be operating fully. This means it will take you longer to stop. Bring the vehicle to a safe stop and have the air brake system fixed.

Drum brakes

Drum brakes (foundation brakes) may be used at each wheel. The most common type is the S-cam drum brake (so called because of the mechanism that applies force to the brake shoes),

Brake drums are located on each end of the vehicle's axles. The wheels are bolted to the drums. The braking mechanism is inside the drum. To stop, the

brake shoes and linings are pushed against the inside of the drum. This causes friction which slows the vehicle (and creates heat). The heat a drum can take without damage depends on how hard and how long the brakes are used. Too much heat can cause brake failure.

Air supply pressure gauge

All air-braked vehicles have an air supply pressure gauge connected to the air tank. If the vehicle has a dual air brake system, there will be a gauge for each half of the system or, sometimes, a single gauge with two needles. These gauges tell you how much pressure is in the air tanks.

Application pressure gauge

This gauge shows **how much air pressure you are applying to the brakes** (some vehicles do not have this gauge). **When going down steep grades, increasing brake pressure to hold the same speed means the brakes are fading.** The need for increased pressure can also be caused by brakes out of adjustment, air leaks, or mechanical problems.

Mountain Roads 6% or higher

Any grade steeper than six percent is considered extreme and requires special attention.

This means that for every 100 foot of roadway, you are going to drop 6 feet. For each 1% of grade you'd descend 52.8 feet, since 5,280 feet equals one mile.

GRADE %	LENGTH	FEET DESCENDED	FEET DESCENDED PER 1%
4%	4 miles	844 ft	244 ft.
	5 miles	1055 ft	
	6 miles	1266 ft	
5%	4 miles	1056 ft	264 ft
	5 miles	1320 ft	
	6 miles	1584 ft	
6%	4 miles	1268 ft	317 ft.
	5 miles	1585 ft	
	6 miles	1902 ft	
	7 miles	2219 ft	
	8 miles	2536 ft	
	9 miles	2853 ft	
7%	3 miles	1110 ft	370 ft.
	4 miles	1480 ft	
	5 miles	1850 ft	

6% grade over 20 miles = you will descend 6,336 feet in 20 miles.

15% grade over 20 miles = you will descend 15,858 feet in 20 miles

When going down steep hills, gravity will tend to speed you up. You must select an appropriate safe or target speed, then use a low gear and enough braking power to hold you back without letting the brakes get too hot. Use the braking effect of the engine (lower gears) as the principal way of controlling your speed. Save your brakes so you will be able to slow or stop as required by road and traffic conditions. Slow the vehicle and shift the transmission to a low gear *before* starting down a grade.

Escape Ramps

Escape ramps have been built on many steep mountain grades and are used to stop runaway vehicles safely without injuring drivers and passengers. Escape ramps use a long bed of loose, soft material (pea gravel or sand) to slow a runaway vehicle, sometimes in combination with an upgrade.

Know escape ramp locations on your route. Signs show drivers where ramps are located. Escape ramps save lives, equipment, and cargo.

Proper Braking Technique

Remember: The use of brakes on a long and / or steep downgrade is only a supplement to the braking effect of the engine. Once the vehicle is in the proper low gear, the following is a proper braking technique:

- Apply the brakes just hard enough to feel a definite slowdown.
- When your speed has been reduced to approximately 5 mph below your "safe" (Target) speed, release the brakes. (This brake application should last for about three seconds.)
- When your speed has increased to your "safe" speed, repeat the steps above.

For example, if your "safe" speed is 40 mph, you would not apply the brakes until your speed reaches 40 mph. You now apply the brakes hard enough to gradually reduce your speed to 35 mph and then release the brakes. Repeat this as often as necessary until you have reached the end of the downgrade.

Other Braking Techniques

There are other braking techniques that work just as well as the one described above. Make sure to implement the braking technique that your employer or carrier recommends. Whichever braking technique that you use, make sure to use that technique all the way to the bottom of the hill as a supplement to the braking effect of the engine.