

Emergency Stops

While driving in the mountains, you notice that when the freeway goes steeply down hill, there are emergency exits every few miles. These emergency exits are straight ramps which leave the freeway and are sloped uphill. They are designed to stop trucks and cars that lose their breaks on the downhill stretches of the freeway even if the road is covered in ice. You wonder how long an emergency exit should be to stop a 50 ton truck going 70 mph at the bottom of a ramp sloped at 30° to the horizontal. Assume the vehicle slams on the brakes so it is sliding. You remember that the coefficient of static friction for rubber on concrete is 0.8 and its coefficient of kinetic friction is 0.6. You also wonder how the length would change if the ramp were covered in ice.