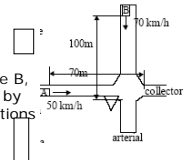


## Chapter 3 Vehicle Performance: Class Examples

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### Example 3 1 Application of Motion Equations

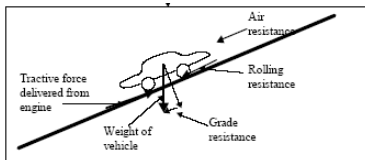
Vehicles A and B are approaching an yield controlled intersection with their current locations shown in the Figure.



1. If vehicle A decides not to yield to vehicle B, can it make it safely? Solve the problem by assuming the following three possible actions taken by the driver:
  - i). Maintains its original speed;
  - ii). Start to accelerate at a constant acceleration rate of  $1.0 \text{ m/s}^2$
  - iii). Start to accelerate with acceleration rate as a function of speed:  $a = 1.0 - 0.012 Vt$
2. If vehicle A decides to stop, can it stop comfortably? (Assume the comfortable deceleration rate is usually about  $3.0 \text{ m/s}^2$ )

### Example 3 2(Text: Example 2 2) Vehicle Resistance and Motion

- o An 8.9-kN car having a frontal area of  $2.0 \text{ m}^2$  is traveling at an elevation of 1500m on a paved surface. If the car is traveling at 110 km/h and the available tractive effort is 1135 N, what is the maximum grade that this car could ascend and still maintain the 110 km/h speed?



### Example 3-3: Vehicle Dynamics and Motion

- o A 1999 Volvo is travelling at 16 km/h on a paved road with a coefficient of road adhesion equal to 0.20. The car weighs 13.3 kN with a wheel radius of 36 cm. Its engine produces 190 horse power at 5,100 revolutions per minute ( $M_e = a n_e - b n_e^2$ ). The car is in a gear that gives an overall gear reduction ratio of 4.5 to 1. It is front wheel drive and has a wheelbase of 305 cm and a center of gravity 50 cm above the roadway surface and 127 cm behind the front axle. It is known that  $C_D = 0.30$ ,  $A_f = 2.0 \text{ m}^2$ , and  $\rho = 1.0567 \text{ kg/m}^3$  and assume no loss of effort in gear reduction. If the driver decides to accelerate to avoid an accident,

1. What is the max. acceleration rate that this car can achieve?
2. What if the road condition is very poor with  $\mu = 0.1$ ?
3. With the max. acc. rates, how far the vehicle will travel in 10 seconds?

### Example 3 4(Text: Example 2 7) Vehicle Braking Performance

- o A new 11-kN car is travelling at 145km/h down a 10% grade with  $C_D = 0.25$ ,  $A_f = 2.0 \text{ m}^2$  and  $r = 1.2256 \text{ kg/m}^3$ . The car has ABS with a braking efficiency of 100%. The coefficient of road adhesion is 0.7.

1. Determine the minimum stopping distance.
2. Think About:
  - o Effect of vehicle weight?
  - o Effect of human factor?
  - o Effect of technology?
  - o Variation of deceleration rate => stopping distance?

### Example 3-5: (Text: Example 2-9) Braking Distance

- o A car ( $C_D = 0.30$ ,  $A_f = 2.0 \text{ m}^2$ ,  $W = 14.0 \text{ kN}$ , and  $r = 1.1567 \text{ kg/m}^3$ .) is being used in a test on level pavement. The coefficient of road adhesion is 0.75 and the coefficient of rolling resistance is approximately 0.018 for all speeds. The braking efficiency of the vehicle is 90%. If  $V_0$ , the initial speed of the vehicle is 100 km/h and the tires are at the point of impending skid during stopping process, what would be the braking distance? And what value of  $f$  should be suggested for calculating braking distance (using the simplified formula) for this condition?

