Braking

Effect of Friction on Motion

- The greater the friction the better the ability to stop.
- If the friction is reduced, it will take longer to stop.

Weather and Road Conditions

- How do each of the following effect the ability to stop a car?
  - Icy
  - Wet
  - Snow-covered
  - Dry
  - Gravel
  - Dirt

Braking Distance

- When you put your foot on the brake of a car, the car starts to slow down and will eventually stop.
- However, there is a time between when you notice that you should stop and when your foot actually touches the brakes.
  - Reaction time

Factors that Influence Braking Distance

- Reaction time
  - Age of driver
- Friction
  - Weather and road conditions
- Condition of driver
  - Lack of sleep
  - Drugs and alcohol consumption
- Speed
  - Faster speeds mean longer braking distance

Calculating Braking Distance

- Braking distance can be calculated with the following formula:

$$\boxed{d = kv^2}$$

- *d* is the braking distance
- *k* is a constant representing road conditions
- *v* is the velocity of the car

The Constant *k*

- *k* depends on the friction of the two surfaces in contact with each other
- Surfaces with a lot of friction have a low value for *k*
- Slippery surfaces have a high value of *k*
- For example
  - Dry pavement: *k*=0.06 m/s
  - Snow and ice: *k*=0.15 m/s

Example

- Find the braking distance for a car with a velocity of 50 km/h on dry pavement (k=0.06 m/s).

d=11.6 m

Reaction Time

- In real life, there is a delay between when a driver sees that he or she needs to stop and when the foot actually hits the brakes.
- During this time the car continues to move forward
- The distance the car travels during the reaction time should be included in the stopping distance calculation.

Total Stopping Distance =
reaction distance + braking distance

Example 2

- A car is moving at 50 km/h on dry pavement (k=0.06). Suddenly, 34 m away, a small dog darts into the roadway. The driver's reaction time is 1.5 s. Calculate the total stopping distance of the car.