

# Tutorial 1

Transportation Engineering and Planning

CIVE 3304 – GEOG 4304

Fall 2021

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## Example 1:

The total cost of freight for company A is defined as a function of the cargo load as follows:

$$C_A = 21 \times 10^6 + 0.5 x$$

The cost function for company B is defined as follows:

$$C_B = 1 \times 10^6 + 1.5 x$$

Where:

$C$  is the total annual cost (CAD)

$x$  is the number of tons transported per year.

Both companies are contemplating raising their annual shipping activities from 10 million tons this year to 20 million tons by the end of the next year. Assume that the parameters of the cost models remain constant.

- Which company, A or B, appears to enjoy stronger EOS at within this level of shipment (this year and next year)?
- Discuss analytically or using numerical examples the potential of both companies for achieving increased profit by increasing their shipping activities.
- Based on the above equations, what would you say about the transportation modes used by both companies?

## Example 2:

The accident investigator estimates that a vehicle hit a bridge abutment at a speed of 32 km/h. The investigator observes skid marks of 30 m on the pavement and 23 m on the grass shoulder. There is no grade. Estimate the speed of the vehicle at the beginning of the skid marks. Take the friction coefficient of the pavement and grass as 0.35 and 0.25, respectively.

## Example 3:

Consider a section of rural freeway with a design speed of 110 km/h. On a section of level terrain, what safe stopping distance must be provided?

What could happen, for example, if a section of this roadway provided a sight distance of only 150 m? Assume coefficient of friction = 0.35.

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## Example 4:

A student trying to test the braking ability of her car determined that she needed 5.6 m more to stop her car when driving downhill on a road segment of 5% grade than when driving downhill at the same speed along another segment of 3% grade.

Determine the speed at which the student conducted her test and the braking distance on the 5% grade if the student is traveling at the test speed in the uphill direction.

Assume coefficient of friction = 0.35.

## Example 5:

A construction area exists on a 100 km/h design speed highway. How far from this construction spot should the designer put a warning sign so the drivers can completely stop 25 m before reaching it?

The highway has a downgrade of 3.0 %. Assume that the driver can see the stopping sign 30 m before the sign. Assume  $f=0.29$ .

## Example 6:

For a highway with a 100 km/h design speed, determine:

- (a) The minimum radius for a horizontal curve is the maximum superelevation rate is 6%.
- (b) The minimum superelevation rate for a horizontal curve if the radius is 400 m.

Note: Assume  $f_s=0.12$ .