

## Rectangular Waveguides

1. Consider a car entering a tunnel of dimensions 15 m wide and 4 m high. Assuming the walls are good conductors, can AM radio waves propagate in the tunnel?
2. Consider energy transport in a  $TE_{mn}$  mode in a rectangular metal waveguide.
  - (a) Assuming that  $B_z$  is known, as calculated in class, determine the real parts of both

$$\vec{E} = \vec{E}(x, y)e^{i(kz - \omega t)}$$

$$\vec{B} = \vec{B}(x, y)e^{i(kz - \omega t)}$$

- (b) Determine a formula for the time average value of the power transported per unit area in the direction of the waveguide.
- (c) Suppose that the dielectric inside a rectangular waveguide undergoes breakdown (sparking) at 10kV/m. Calculate the maximum power that can be carried by the  $TE_{10}$  mode without breakdown if the dimensions of the waveguide are 5 cm  $\times$  5 cm. Assume the frequency is 2 $\times$  the cut-off frequency.