Instructor:
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Homework 1: Road Vehicle Performance

Textbook Assignment

Problem	Value	Answer
2.2	10	Final weight = 2210.45 lb
2.7	10	185 ft-lb engine = 13.33 ft/sec^2; 215 ft-lb engine = 14.15 ft/sec^2
2.13	10	8.01 ft/sec^2
2.14	10	219.9 mph
2.25	10	About 207 ft
2.28	10	You figure this one out

Additional Required Work (40 points)

Your final write-up should concise and to-the-point. Key answers and assumptions should be clearly stated and supporting calculations should be included after the write-up and referenced in the write-up.

Part 1

Pick a vehicle of your choice. Using Microsoft Excel (or a similar program) plot this vehicle's theoretical braking distance (in feet) vs. speed (in mph) for speeds of 0 to 120 mph. Assume there are two people in the vehicle. Assume the following parameters:

- Braking efficiency = 95% for antilock brakes, 80% for non-antilock brakes
- Coefficient of road adhesion = 0.70
- Grade = 0% (flat)
- Air density = 0.0024 slugs/ft^3
  - note: 1 slug = 1 lb force / (1 ft/s^2 acceleration)
  - note also: 1 lb force = 1 slug·ft/s^2 = 4.448 Newtons
- Mass factor = 1.04 (accounts for moments of inertia during braking)

This assignment will require you to look up the following vehicle characteristics:

- Coefficient of drag
- Frontal area = (height – ground clearance) × width
- Weight (unloaded and with two people in it)

Part 2

On the same graph, plot practical braking distance (in feet) vs. speed (in mph) for speeds of 0 to 120 mph. Use the AASHTO braking distance formula:

$$d = \frac{V^2}{30\left(\left(\frac{a}{g}\right) \pm G\right)}$$

V = vehicle speed in miles/hour
a = deceleration rate in ft/sec^2 (use 11.2 ft/sec^2)
g = acceleration due to gravity (use 32.2 ft/sec^2)
G = grade in decimal form (e.g., 6% = 0.06)

AASHTO (2004). *A Policy on Geometric Design of Highways and Streets*, Fourth edition. American Association of State Highway and Transportation Officials, Washington D.C.