

Physics

Lab - Road Rally (from Space?)

Name: _____

Objective:

To determine the maximum speed you could navigate a turn on the highway with using satellite data.

Procedure:

Using an internet browser find a website that provides satellite images of the earth. You may use <http://terraserver.microsoft.com>, Google Maps, or Mapquest.

Search for a location containing a highway or a large road with a curve in it. This is pretty much “catch as catch can.” One location that is good is the interchange between i-94 and US-23. You can “zoom in” and “zoom out” using the buttons on the screen. Once you have a viable picture take a “screen shot” using the following steps (be sure you get a SCALE with your picture):

Macintosh:

- Press the <shift> <apple> 4 keys at the same time.
- Your cursor will turn into a plus sign. Draw a box around the picture on the screen (be sure to include the scale!).
- When you let go of the mouse you’ll see a little camera appear and you’ll hear a “click”.
- To access your photo go back to the desktop and click on the file entitled “Picture 1”. You can print this or insert it into your lab document.

PC:

- Press the <Prnt Scrn> key. This takes a screen shot of your screen (you will not see or hear anything)
- Open a drawing program (like MSPaint) and select “Edit” “Paste”. Once your screen shot appears you can copy whatever part of it you want and paste it into your lab document.

Analysis:

Make a side view drawing of your car as it rounds the turn. **Draw a Free Body Diagram** labeling and resolving ALL forces. For the banked turn you can assume a 5° bank. You can assume the coefficient of friction is 0.700 for rubber on concrete. Determine the maximum speed *in miles per hour* for the following cases (show ALL work and ALL derivations):

- car on your turn with no bank, no friction
- car on your turn with no bank, friction
- car on your turn with a 5° bank, no friction
- car on your turn with a 5° bank, friction

Questions:

- 1.) What angle would be needed for a banked turn of 200m radius to be maneuvered by a car at 60 miles per hour with no friction?

2.) Does the maximum speed calculated in part (i) make sense? Explain in terms of Newton's Laws.

3.) How does the maximum speed compare for the four situations? Rank them from slowest to fastest. Does the order make sense?

4.) How would your answers for the four speeds differ if your road was on the moon?

XC.) Derive a formula for the banking angle needed to make a turn with friction in terms of v , r , and g .

Error Analysis and Conclusions...