REVIEW TOPICS CEEN 2320 FINAL EXAM

Be familiar with all materials covered in class, your class handouts and the notes you took in class, your homework assignments, test questions, formulas, tables, figures. Be able to answer numeric problems, as well as questions about concepts. Be able to derive information from plan & profile sheets and cross section sheets. Be able to create these types of sheets.

Be able to draw simple, clear, meaningful figures to explain concepts (for example the Safe Stopping Distance).

Bring with you a straight edge with English gradations, a good eraser and a calculator. You may need to measure dimensions off your test. Please remember to turn off cell phones, pagers and other devices during the test. No hats or hoods please.

FOR FULL CREDIT:

For tables and figures indicate table/figure number and circle/show the chosen values. ***Use the straight edge to draw lines on provided figures.***
Show calculations and provide a few words to explain their meaning.
Show units.
Mark the answer clearly.
Draw a neat sketch of the situation where appropriate**. *Using a straight edge is not necessary as long as the figure is neat and dimensions are shown by arrows to their exact extents.***

3.1 INTRODUCTION

Be familiar with the use of Figures, Tables and equations (attention to units in equations).

Which publication (title, author) is the source of information on highway design used in the class?

What do the initials AASHTO mean?

3.2 SIGHT DISTANCE

What sight distance characteristics should the highway designer strive to provide for drivers? What driver actions should the provided sight distance be adequate for?

What sight distance provision is specific to two-lane, two-way roadways? What driver actions should this provided sight distance be adequate for?

Know all five aspects of sight distance considered in design and be able to provide an example and explain each (not just list definitions).

Know the Stopping Sight Distance (SSD) definition provided in section 3.2.2 (full sentences)

Know the components of the stopping sight distance (SSD) – explain each in full sentences.

What factors influence how long driver reaction time is? Know at least five factors that may contribute to longer driver reaction times.

Be able to provide an approximate average reaction time to an expected situation. Know how much additional reaction time is typical for unexpected situations. Be able to give two examples of unexpected situations mentioned in class.

What is the AASHTO-recommended driver reaction time? What percent of drivers is expected to react faster/slower (choose the correct option) that this time?

Know how to apply the equations mentioned in class.

Know the recommended typical deceleration value (in ft/s^2) for wet pavements by heart.

Know how to apply the deceleration formula for any given grade.

Know what is the Decision Sight Distance, when it is applicable (in what situations-with specific examples), what driver actions are expected within this distance, and how it relates to the length of the SSD.

Where is passing sight distance applicable (what types of roads?)

What goals should be accomplished through the proper design of a passing zone, if the passing driver is to avoid interfering with an opposing vehicle?

What assumptions do theoretical passing maneuver models make about passing drivers?

What should the **minimum** passing sight distance allow drivers to do?

Passing sight distance with two or more lanes in each direction—discuss.

3.3 HORIZONTAL ALNIGNMENT

"The design of roadway curves should be based on an appropriate relationship between…" (Provide which highway design elements and how they relate to each-other.)

Know how to use the equations relating e_{max}, $f_{s\,max}$, R_{min}, $V_{design.}$ Know the ranges of each of these variables in highway design.

Know the difference between f_f and $f_{s\,max}$.

What considerations limit the values of superelevation (explain in full sentences). Be able to provide a full explanation for each consideration.

What is the concern about superelevation when there is snow or ice on the pavement?

What concern about superelevation exists in relation to heavy vehicles?

What is the designer's goal when deciding the magnitude (value) of the radius of a horizontal curve? What motivates the designer to strive for this goal?

Know the typical ways that tangents connect to horizontal curves. Be able to demonstrate with a clear figure.

Know the terms for all elements of horizontal curves, their symbols and /or abbreviations (for example, PC, PI, PT, T, E, M, LC, L R) and know how to use the equations involving those curve elements.

Know the definition of Degree of curve; be able to say it in a full sentence; know its units; be able to apply it in a simple problem.

Know how to use the Degree of curve-Radius formula.

Be able to explain and use a figure to describe at least three of the general controls for horizontal alignment (paragraph 3.3.13)

3.4. VERTICAL ALIGNMENT

Know the three AASHTO terrain classifications

Grades: typical max grades that have no effect on passenger car speeds; what two grade characteristics affect truck speeds on grades; be able to identify truck crawl speed on figure 3-24; know how to used figures 3-24 and 3-25.

Typical max grades for a design speed of 70 mph, 30 mph.

Typical minimum grade-numeric value and purpose—why is it needed (for what purpose) what highway element makes them necessary.

Vertical curves: be able to recognize and draw the three types of crests and sags of Figure 3-41.

What type of curve (geometric shape) is used for vertical curves?

Be able to show the curve length. Know the property that makes a vertical curve symmetric in relation to its length.

The major design control for a crest vertical curve is… (be able to explain with a paragraph and a figure).

Know all the terms shown on Figure 2.4.11

Know the terms and the corresponding symbols for: A, G1, G2, L, E, y, X. Be able to draw a vertical curve and correctly identify these elements on your drawing. Know the term and meaning of the K value (be able to explain the meaning in a full sentence).

Know how to apply the equations (they will be provided) for the elements listed above.

Know how to find the elevation of a point P on a vertical curve (use equation 2.4.14)

Review the example problem on pp 39-41

Be able to use the equations on page 44.

Be able to draw and interpret (explain in full sentences) the purpose and the relationship between the elements of the figure on page 44 —know the eye height and object height.

Be able to draw and interpret (explain in full sentences) the purpose and the relationship between the elements of the figure on page 47—know the eye height and object height.

Be able to interpret (explain in full sentences) the purpose and the relationship between the elements of the figure on page 48.

Know how to use the equations on page 49.

Know at least two of the general controls for vertical alignment on page 54.

Plan and Profile sheets

Plan: Be able to identify the PC, PT and PI stations; know how to find length of a horizontal curve; know how to find the length of a tangent. Be able to measure lengths along the centerline.

Profile: Know how to identify the existing ground profile and the roadway centerline profile; know how to identify areas of cut and fill. Be able to identify the type (crest or sag) and length of a vertical curve. Be able to identify the PVC, PVT, PVI and their stations and elevations.

Be able to provide the azimuth of a given angle.

Be able to provide the bearing of a given angle.

Contours: be able to identify the contour interval; be able to calculate the grade of a line drawn on top of contours; be able to draw contours when given point elevations; be able to identify the presence and direction of a stream; be able to draw the ground profile along an alignment when given a contour; be able to identify steep and smooth slopes on a contour map;

9.6 PROFILES

Know how to draw the ground profile along a given roadway centerline, when given a contour map. Be familiar with what is presented on page 66 and know how to create a profile in this manner.

Be able to identify a good path for a roadway connecting two end points on a contour map similar to the one on page 67 (using gentle grades).

Know that the horizontal and vertical scales are different—be able to draw profile information using given scales.

9.7 CROSS SECTIONS

Be familiar with all information present in a cross section sheet –see sample sheet provided with your cross section homework.

Be able to identify a cut and a fill cross section; be able to use the Volume formula on page 70.

Be able to calculate the total excavation or embankment volume when given cross section areas and be able to state whether waste or borrow are needed. Be familiar with which quantities are positive and which negative in volume calculations.

Know the meaning and the terms for all information presented on pages 71 and 73.

Be able to identify the original ground line, the roadway surface, the toe of slope line.

Be able to draw a cross section, if you are given a ground elevation a centerline elevation and a typical cross section that includes side slopes (similar to your cross section homework). Be able to provide the fill or cut width and the points where a fill or cut meet the original ground.

DESIGN OF A NEW HIGHWAY

- ✓ Four general considerations during the planning stage of a highway project
- ❖ Four specific considerations
  Four decisions that have to do with the **geometric design of the highway**

Available sources of information for route selection (p. 75)