CALIFORNIA POLYTECHNIC STATE UNIVERSITY
Civil and Environmental Engineering

CE 522: Advanced Transportation Design
Spring 1999
E. C. Sullivan (Room 04-07, 756-1166, esulliva@calpoly.edu)
Office Hours: M & W 11:30-1:30, Th 3:00-4:00, by appointment

Course Objectives: To learn and practice the principles of geometric design for ground transportation facilities with particular emphasis on streets and highways, and to experience the working environment where such design activities occur. The course covers methods of design for rural and urban roadways, intersections, bikeways, and parking facilities. The lab portion of the course uses Softdesk computer-aided design software operating in the AutoCAD environment.

LECTURE TOPICS

1. Introduction; Review of Design Principles; Functional Classification; Types of Design Problems; Design Standards (G+H, pp. 649-658♣ ; AASHTO, Ch. 1♥)

2. Coordinate Geometry Conventions in Road Design; Terrain Representation (G+H, pp. 645-647♣; O+H, Ch. 6♥, G+H, pp. 613-628)

3. Principles of Highway Location (G+H, pp. 629-644♣, O+H, Ch. 6♥)

4. Geometric Design of Highways: Horizontal Alignment; Superelevation (G+H, pp. 684-703♣, AASHTO, Ch. 3 [pp. 117-226]♥; H+D, Ch. 2)

5. Geometric Design of Highways: Vertical Alignment (G+H, pp. 668-683♣; AASHTO, Ch. 3 [pp. 226-294♥)

6. Geometric Design of Highways: Cross Sections; Earthwork Calculations (G+H, pp. 658-666♣; AASHTO, Ch. 4♥); H+D, Ch. 4)

7. Geometric Design of Highways: Coordination of Horizontal and Vertical Geometry (AASHTO, pp. 294-319♥)

8. Geometric Design of Intersections; Layout of Signal Systems (G+H, Ch. 7 & pp. 281-295♣; AASHTO, Ch. 9♥; G+K, Ch. 1 & 2♥; ITE, Ch. 9♥; H+D, Ch. 5)

9. Geometric Design of Bike and Parking Facilities (G+H, pp. 703-715♣; AASHTO, pp. 399-412♥; AASHTO-Bikes; W+A, Ch. 16)

♣ Indicates required reading – may appear on exams (even if not covered in lecture).

♥ Indicates strongly recommended reading - may appear on exams <u>if</u> also covered in lecture).

10. Drainage Considerations (G+H, Ch. 17♥)

11. Legal Foundations & Institutions for Highway Design & Construction (G+H, Ch. 2♣; O+H, Ch. 2 or W+A, Ch. 2-3; H+D, Ch. 6)

Evaluation:

20 points - Two homework assignments.

10 points - Mid-term exam

20 points - Final exam

50 points - Lab work and reports

NOTE: Grades for unexcused late stuff may be penalized

Course texts:

[Required] Garber, N.J. and L.A. Hoel. Traffic and Highway Engineering (Second Edition). PWS Publishing Company, Boston, 1997. (G+H)*

[Highly Recommended] American Association of State Highway and Transportation Officials. A Policy on Geometric Design of Highways and Streets. Washington, DC, 1994. (AASHTO)

Other pertinent texts:

American Association of State Highway and Transportation Officials, Guide for Development of New Bicycle Facilities, AASHTO, Washington, DC, 1981. (AASHTO-Bikes)

California Dept. of Transportation. Highway Design Manual. Sacramento, CA. (Caltrans).

Giblin, J.M., W.H. Kraft, et al. Traffic Signal Installation and Maintenance Manual. Institute of Transportation Engineers. Prentice-Hall, Englewood Cliffs, NJ., 1989. (G+K)

* Symbols like (G+H) identify these texts in the topics list.

Homburger, W., E. Deakin, et al. Residential Street Design and Traffic Control. Institute of Transportation Engineers. Prentice-Hall, Englewood Cliffs, NJ., 1989. (H+D)

Institute of Transportation Engineers. Traffic Engineering Handbook. Prentice-Hall, Englewood Cliffs, NJ., 1992. (ITE)

Kell, J.H. and I.J. Fullerton. Manual of Traffic Signal Design (Second Edition). Institute of Transportation Engineers. Prentice-Hall, Englewood Cliffs, NJ., 1991. (K+F)

Oglesby, C.H., and Hicks, R.G. Highway Engineering. (4th Edition). John Wiley & Sons, New York, 1982. (O+H)

Transportation Research Board. Intersection Sight Distance. National Cooperative Highway Research Program Report 383. Washington, DC, 1996 (NCHRP).

Transportation Research Board. Geometric and Other General Design Issues. Transportation Research Record 1523. Washington, DC, 1996 (TRB).

Wright, P.H., and Ashford, N.J. Transportation Engineering: Planning and Design (3rd Edition). John Wiley & Sons, New York, 1989. (W+A)

Wright, P.H., and Paquette, R.J. Highway Engineering (5th Edition). John Wiley & Sons, New York, 1987. (W+P)

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LABORATORY ACTIVITIES

Overview: The CE 522 lab provides an opportunity to use professional CAD software to develop a complete geometric design for a simple roadway and intersection design problem.

Sequence of Activities:

1. Lab Introduction; Site Visit
2. Introduction to CAD Software
3. Entry of Survey Data; Terrain Modeling
4. Second Site Visit to Encode Site Details & Finalize Design Criteria and Constraints for Horizontal/Vertical Geometry Alternatives
5. Preliminary Project Report
6. Design of Roadway Horizontal Geometry
7. Design of Roadway Vertical Geometry
8. Design of Roadway Cross-Sections
9. Earthwork Calculations; Drainage Considerations
10. Layout of Intersection Horizontal Geometry
11. Layout of Traffic Control
12. Final Project Report

CASE STUDY PROBLEM STATEMENT

A great deal of Cal Poly's parking capacity is located in the remote lots H12, H14, and H16, on the north side of campus along Via Carta. The only access to and from these lots is by Via Carta, a two-lane roadway separated from the main campus roadways (Highland and Perimeter) by two all-way stop controlled intersections. Despite the recent realignment of the portion of Highland adjacent to parking lot H2, the bottleneck limiting access to the three remote lots continues to result in substantial delay. This traffic problem will probably be aggravated by the development of the new sports complex, now under construction beyond the parking lots.

Your lab project is to design a new access road to connect either Pinnacles Road or parking lot H12 directly to Rodeo Road, near its intersection with Highland, just west of parking lot H2. The project includes the geometric design of a new access roadway, the design of new intersections at Rodeo Road and Pinnacles Road, as well as the conceptual layout of appropriate traffic control measures at the two new intersections.

The lab objectives will be accomplished working in teams of two persons each. Each team is responsible for developing and elaborating their own design alternatives. Final designs will be expected to vary somewhat among the different teams. However, some activities (like site visits) will be performed by the entire group. In general, interaction and collaboration among the different teams is strongly encouraged.

Each lab team is required to submit a preliminary report about halfway through the quarter and a final report at the end of the quarter. Reports should be prepared in good professional form and will be graded based on BOTH technical content and writing quality. An oral presentation of your final design will be made near the end of the quarter.

The following map show the site location and a preliminary design concept for the new road. For the purposes of this lab, we'll assume that we can put the new road anywhere we like, without worrying about where the new sports facilities will be located. In addition, there is no constraint on where and how the new access road will hook up with lot H12.