

# Civil Engineering Senior Project Fall-08, Winter-09, Spring 09 Offering Project Descriptions

## Project Descriptions

### 1. Valley Generating Station Stormwater Capture Project

- **Advisor:** Mr. Jerry Gewe, PE ([gagewe@csupmona.edu](mailto:gagewe@csupmona.edu))
- **Disciplines:** Hydrology (surface & groundwater), geospatial (grading plan development), hydraulic design, and water quality
- **Additional prerequisites:** none

The City of Los Angeles owns a large parcel of land in the Sun Valley section of the San Fernando Valley which contains the Valley Generating Station. The Department of Water & Power & Los Angeles County Flood Control District desire to develop compatible uses of the property that will help alleviate localized storm water flooding in the area, recharge the groundwater basin, and improve downstream water quality in the San Fernando Valley.

The project team will build upon conceptual studies that have been prepared and develop a detailed plan for meeting these objectives. This will involve making a hydrologic study of the runoff adjacent to and on the property, designing a grading plan for the property that will better contain the precipitation within the property, designing hydraulic facilities for conveying the water and allowing it to percolate into the groundwater basin and developing an analysis of the impacts on the water quality of the surface runoff and the groundwater basin.

This project will be developed in cooperation with the Department of Water & Power and may involve interaction with staff of the Los Angeles County Flood Control District and the Los Angeles Regional Water Quality Control Board.

### 2. Golf Course Subdivision Design

- **Advisor:** Dr. Howard Turner, PLS ([hturner@csupmona.edu](mailto:hturner@csupmona.edu))
- **Disciplines:** Geospatial, environmental, transportation, & civil engineering
- **Additional prerequisites:** none

This project will focus on developing a subdivision associated with a golf course. The first two or three holes will be on Cal Poly Campus, and the remaining holes will be on Spadra landfill. The project will include lot design, grading, street improvements storm sewers, sanitary sewer and hydrology.

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## 3. Preliminary Design of a Tunnel

- **Advisor:** Dr. Ronald Yeung, PE ([mryeung@csupomona.edu](mailto:mryeung@csupomona.edu))
- **Disciplines:** Geotechnical and structural engineering
- **Additional prerequisites:** CE 327L

Project scope:

1. Collect and compile data for design.
2. Interpret and assess geotechnical conditions.
3. Develop tunnel alignment, profile, cross-section, and construction method.
4. Design initial and final tunnel support systems.
5. Design portals, portal structures, and any retaining walls or ground reinforcement required.
6. Document item 1 in 90% Geotechnical Data Report.
7. Document items 2 through 5 in 50% Geotechnical Design Report and 50% Drawings.
8. Compile all design calculations

## 4. Geoenvironmental Design for Development of Brownfield Site

- **Advisor:** Mr. Rob Trazo, PE ([rtrazo@csupomona.edu](mailto:rtrazo@csupomona.edu))
- **Disciplines:** Geotechnical and environmental engineering
- **Additional prerequisites:** none

This project involves analyzing and designing environmental and geotechnical solutions to support development of a multi-acre site within the city of Los Angeles, California. Significant subsurface contamination is known to exist at the site. Challenges include: a) identifying environmental hazards and designing environmental mitigation/remediation measures and b) identifying geotechnical issues and providing recommendations for foundation systems for the proposed development. Design must meet all applicable codes.

## 5. Intersection & Channel Improvements at MacArthur Blvd and Red Hill Ave, Irvine CA

- **Advisor:** Dr. William Kitch, PE ([wakitch@csupomona.edu](mailto:wakitch@csupomona.edu))
- **Disciplines:** Geotechnical, structural, and transportation engineering
- **Additional prerequisites:** At least some project members completed CE 424 by end of Fall 2008

Traffic studies of the intersection of MacArthur Boulevard and Red Hill Avenue in Irvine California indicate the need for improvements at this location to meet future needs. The needed intersection improvements will require modifications to the Orange County Flood Control District (OCFCD) Lane Channel and culverts carrying Red Hill Avenue over the channel.

This project will require the design of intersection improvements, reinforced concrete box culverts, flexible pavements, cantilevered retaining walls and temporary shoring.

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#### 6. Shake Table Demonstration of Structural Protective Systems and Comparison to Analytical Predictions

- **Advisor:** Dr. Lisa Wang, PE ([ylwang@csupomona.edu](mailto:ylwang@csupomona.edu))
- **Disciplines:** Structural and earthquake engineering
- **Additional prerequisites:** none

Representative prototype structures are built, and the seismic responses of such structures are evaluated experimentally using different historical earthquake records generated by the shake table. The shake table experiments are effective in illustrating the impact of earthquake ground motions. In addition to observing physical behavior of the prototype structures, students verify the experimental results with both theory and computer applications. Computer simulation through SAP2000 will be conducted for this shake table project.

The objectives of the project are to: 1) demonstrate concepts of earthquake ground motion; 2) expose undergraduate civil engineering students to the topics of structural dynamics and earthquake engineering, and; 3) demonstrate concepts of structural control with dampers and base isolators.

#### 7. Seismic Renovation of CPP University Library

- **Advisor:** Dr. Lisa Wang, PE ([ylwang@csupomona.edu](mailto:ylwang@csupomona.edu))
- **Disciplines:** Structural and earthquake engineering
- **Additional prerequisites:** CE 406 preferred

The project involves analysis and design of steel-framed buildings on both the gravity and lateral load resisting systems. The project is largely devoted to the issues of building renovation and strengthening for lateral loads. Practical issues in design and renovation of steel-framed structures will be addressed.

The emphasis of this project is the study of the new seismic design methods with protection systems to dissipate energy and reduce the lateral displacement, which improves the seismic performance of buildings. The study will be conducted on the renovation of the CPP University Library. A whole set of structural drawings have been provided by Brandow & Johnston Associates, which serves as the structural consulting engineers for the project.

As part of the renovation project, the seismic protection systems were added to address current seismic code requirements. Comparison will be made between the one with added damping and the conventional design in terms of structural responses. The study will include the cost-effective techniques for lateral-load retrofit of steel-framed buildings.

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## 8. Wood Pedestrian Bridge Between Buildings 9 & 17

- **Advisor:** Prof. Mikhail Gershfeld, SE ([mgershfeld@csupomona.edu](mailto:mgershfeld@csupomona.edu))
- **Disciplines:** Structural and foundation engineering
- **Additional prerequisites:** At least some project members completed CE 424, CE 433, & CE 406 by end of Fall 2008

The joint Architectural and Engineering Bridge Design Class have developed four different concepts for the pedestrian wood bridge connecting building 9 and building 17. The senior project team will evaluate two design concepts and develop a set of construction documents, set of structural calculations for one of the design concepts. The project will also involve evaluation of the effect of connecting bridge to the buildings.

### Bridge Concepts



Concept 1



Concept 2

## 9. Parking Structure Design Using Post Tension Concrete

- **Advisor:** Dr. Yasser Salem, SE ([ysalem@csupmona.edu](mailto:ysalem@csupmona.edu))
- **Disciplines:** Structural and foundation engineering
- **Additional prerequisite:** CE 421 completed by end of fall quarter 2008 highly desired

The objective is to design a multistory parking structure utilizing post tension concrete technology. Parking structures are unique in their design because floor slab and beams are required to cover long spans and carry substantial loads. Project will cover the following key design items:

- The use of high strength concrete in post-tension construction.
- The seismic provisions of the current building code (IBC 2006) as it relates to this kind of structures.
- Developing analytical model using a commercial software such as (SAP2000) for beams and column design
- Using SAFE program for slab design.
- The design of deep foundation system such as driven piles or caissons

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## 10. MSW Transfer Station and Public Works Operations Center Design

- **Advisor:** Mr. Algis Marciuska, PE ([Amarciuska@SGCH.ORG](mailto:Amarciuska@SGCH.ORG))
- **Disciplines:** Environmental, structural, and geospatial engineering
- **Additional prerequisites:** none

The project involves the design and solid waste facilities permitting of a low volume municipal solid waste transfer station with a public works operation center for the City of San Gabriel in the western San Gabriel Valley.

Design of a bridge over Rubio Wash, retaining walls, masonry buildings, utilities, pavement, and drainage facilities are involved. The facility will include solid waste handling, equipment and materials storage, vehicle service garage, warehouse, offices, and parking facilities for Perris Wash. The City of San Gabriel, County of Los Angeles Flood Control District, State of California Integrated Waste Management and Regional Water Quality Control Boards will be reviewing the plans, specifications, estimates, design reports, and joint technical solid waste permitting documents prepared for the project by the Cal Poly design team.

## 11. UPRR San Gabriel Railroad Trench Design

- **Advisor:** Mr. Algis Marciuska, PE ([Amarciuska@SGCH.ORG](mailto:Amarciuska@SGCH.ORG))
- **Disciplines:** Transportation/Traffic, structural, and geospatial engineering
- **Additional prerequisites:** none

The San Gabriel Trench will lower the Alhambra Subdivision Track of the Union Pacific Railroad (UPRR) and eliminate at-grade crossings at four locations; a second track linking Los Angeles to El Paso will be included. Project requires design of bridges, retaining walls, track, utilities, and flood control facilities in and adjacent to the UPRR right of way. Assessment and studies for environmental impacts such as traffic, noise, and emissions from the construction project and the ultimate facility are included. Design of a tunnel cover to create a park/greenbelt in the UPRR right of way within the historic Mission District is also included. Comprehensive traffic control plans will also be developed for the construction phase of the project.

## 12. Design of a New Interchange on I-215 and State Route 74

- **Advisor:** Dr. Xudong Jia, PE ([xjia@csupomona.edu](mailto:xjia@csupomona.edu))
- **Disciplines:** Transportation engineering
- **Additional prerequisites:** none

Caltrans District 8 (San Bernardino) has already identified a real design problem for AY 08-09 senior project. We will work with Caltrans senior engineers to design a new interchange on I-215 and State Route 74 in the City of Perris in Riverside County. One of the design alternatives for this project is to design a roundabout at the southbound off-ramp of the interchange.

Students will learn real life design experiences from Caltrans engineers. Caltrans standards and best practices will be applied to this project. It is expected that students will present the completed design work to Caltrans engineers.

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## 13. Residential Land Development

- **Advisor:** Dr. Peter Boniface, PLS ([prboniface@csupomona.edu](mailto:prboniface@csupomona.edu))
- **Disciplines:** Geospatial, environmental, and civil engineering
- **Additional prerequisites:** none

A site will be selected for the purpose of developing residential properties. The stages will include the following:

- Initial boundary plan research
- Search for property monuments
- Boundary survey
- Preparation of Tract Map
- Mapping of site
- Design of roads/lots
- Grading plans
- Design of infrastructure such as roads, sewer, water, retaining walls etc.
- Preparation of final maps

This senior project will require students from all 3 options.

## 14. Study and Design of a Walking Path to a Highly Elevated Zone

- **Advisor:** Dr. Francelina Neto, PLS ([faneto@csupomona.edu](mailto:faneto@csupomona.edu))
- **Disciplines:** Geospatial, geotechnical, & structural engineering
- **Additional prerequisites:** none

The objective of the project is to design a pathway (eg. Stairs) for access to an elevated area. Study area will be the hill and current dirt path leading to the CPP letters on the northwest area of campus. Photogrammetry, GPS and surveying techniques will be used to create a 3D model of the area. Studies and design of a stable structure such as the need of stairs and retaining walls for safer access to the top of the hill will complete the project.

## 15. Traffic Impact Analysis for a New Commercial Development

- **Advisor:** Mr. Shirjeel Muhammad, PE ([smuhammad@rialtoca.gov](mailto:smuhammad@rialtoca.gov))
- **Disciplines:** Transportation engineering
- **Additional prerequisites:** none

The objective of this project is to prepare a Full Traffic Impact Analysis Report for a new commercial development in your city.

The project is a 500,000 square-foot Wal-Mart Supercenter. The area is a suburban with at least one major arterial fronting the development. You as a registered Traffic Engineer are asked by your City Council to respond to the citizens who are opposed to the development because it will clog their streets and add hundreds of seconds of delays during their commute hours.

Students will prepare a Traffic Impact Analysis Report using 4-Step Transportation Demand Modeling procedures.

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## 16. Structural Design of a Wood/Concrete Building

- **Advisor:** Mr. David Zhao, SE ([dxzhao@csupomona.edu](mailto:dxzhao@csupomona.edu))
- **Disciplines:** Structural engineering
- **Additional prerequisites:** none

The building is two or three story in height. It is either a residential housing of wood framing or an office building of concrete tilt-up structure. The wood structure has wood trusses and rafters/joists/stud walls as gravity framing and plywood horizontal diaphragms and shear walls as lateral force resisting systems. The concrete structure has open web steel joists/girders/steel beams/concrete bearing walls as gravity framing and horizontal diaphragms consisted of metal deck with or without concrete topping and concrete tilt-up shear walls as lateral force resisting systems. Either building will have shallow foundations. The building is to be designed to comply with 2006 IBC and it's referenced codes and standards, such as: Minimum Design Loads for Buildings and Other Structures (ASCE7-05), Building Code Requirements for Structural Concrete (ACI 318-05), National Design Specifications (NDS) for Wood Construction with 2005 Supplement (AF&PA NDS-05).

The objectives of the project are to: 1) Learn to design the gravity framing of a building structure; 2) Learn to design the lateral force resisting system of a building structure; 3) To understand the seismic and/or wind load provisions of the 2006 IBC and apply them to a building structural design.

## 17. Ecuadorian Land Development

- **Advisor:** Dr. Hany J. Farran, PE ([hjfarrran@csupomona.edu](mailto:hjfarrran@csupomona.edu))
- **Disciplines:** Geospatial, transportation, environmental, geotechnical, and structural engineering
- **Additional prerequisites:** none

The project deals with land development in a parcel of land located in Quito, Ecuador. The land plots are available. There are several alternatives to be considered. The maps are in Spanish and all measurement units are expressed using the International System. The project shall consider all required developments related to the Civil Engineering infrastructure including streets, buildings, etc.

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## 18. Groundwater Recharge in Claremont, California

- **Advisors:** Prof. Coduto, PE ([dpcoduto@csupomona.edu](mailto:dpcoduto@csupomona.edu))
- **Disciplines:** Geotechnical and environmental engineering and geology
- **Additional prerequisites:** CE 456 (no later than Winter 2009)

This project will consist of a preliminary feasibility study of a proposed engineered wetlands near Thompson Creek Dam in Claremont. We will have six civil engineering students and may possibly have about six urban planning students with one of their faculty members as an advisor. The civil engineering portion of the project will consider surface water hydrology, groundwater hydrology, a possible water reclamation plant, site design, and other technical features. The urban planning portion will consider various land use issues.

We will be seeking advice from a wide range of on-campus and off-campus experts. The project also will involve interactions with the various interested parties, including the Los Angeles County Department of Public Works, the City of Claremont, Three Valleys Municipal Water District, the Pomona Valley Protective Association, and others. Professor Coduto will be contacting you to schedule a kick-off meeting to be held sometime in July.

## 19. Combined with project 18