

**Civil Engineering Service Projects (CESP)  
CE 25600, CE 35600, and CE 45600**

**Course Description and Projects Descriptions---Fall 2008---Lloyd H. Ketchum, Jr.**

**Catalog Description:** CE 25600, CE 35600, and CE 45600. Civil Engineering Service Projects (Variable credit) Ketchum; Prerequisite: Instructor permission  
Weekly meetings: Tuesday 5:00 pm, typically for 30 minutes.

Civil Engineering Service Projects (CESP) is a course that partners teams of students with local community service organizations. Projects involve strong technical content, significant design, and multidisciplinary effort and a strong communication component. These projects have a civil engineering emphasis, but benefit from enrollment of most other undergraduate majors. CE 25600, CE 35600, and CE 45600, which are all entitled Civil Engineering Service Projects, bring first year and sophomore students (CE 25600), juniors (CE 35600), and seniors (CE 45600) together to form multidisciplinary teams across the curriculum, to assist local community service organizations. Students may enroll for variable credits in more than one semester. For example, a student may enroll for one credit per semester during the first three years and for two credits as a senior. It is unusual for a student to enroll for three credits for only one semester. Seniors and returning CESP participants assume leadership of the teams

**General Course Procedures:** Each CESP Team will meet during the first week to become familiar with the project, and to complete a written proposal to be approved by the instructor and the client, a cooperating local government and community service organization. The proposal will include well-defined project objectives; identification of tasks and assignment of project responsibilities; provide a schedule; and provide a procedure for reporting participant activities. During the semester, several team written progress reports are required, which includes a proposal during the second weekly meeting, and progress reports at the 6<sup>th</sup>, and 10<sup>th</sup> weekly meetings. A final written report is required for each team, and in most cases, one or more oral reports will be made to the client. Each student will submit an e-mail weekly progress report Monday evening before 6:00pm.

Remember, a typical 3-credit course meets three hours a week, and normally requires three to six hours of outside effort, and courses like this typically require more individual effort. Therefore, in this course you should schedule three hours per week for each credit. It is important to maintain your schedule each week, and not fall behind.

The instructor will assign the final class grade based on quality and quantity of participation. However, each participant will be required to submit weekly progress reports and a final semester evaluation of his or her own performance, and evaluate the other project participants. The final evaluation will include suggested grades and a ranking of team members based on their benefit to the final project.

**Student Participation**

If you are interest in learning about participation in these projects, please contact:

Lloyd H. Ketchum, Jr.: E-mail [ketchum@nd.edu](mailto:ketchum@nd.edu) Office 156 Fitzpatrick Hall.

CESP Web Site: <http://www.nd.edu/~cegeos/Service/Local.htm>

### **Descriptions of Possible Project ---Fall 2008---Administered by Lloyd H. Ketchum, Jr.**

In the past, the Department of Civil Engineering and Geological Sciences has coordinated service projects with several clients including, the City of Elkhart, the YMCA Camp Eberhart, the Potawatomi Zoo, and the City of South Bend. This fall, the City of South Bend Department of Public Works will be the focus of the CESP projects. The projects are cross-curriculum team projects that have a civil engineering emphasis, but often benefit from input by other engineering and many non-engineering majors.

### **CESP with the City of South Bend Department of Public Works**

The Department of Public Works Consists of Five Divisions:

- \* Division of Engineering
- \* Division of Environmental Services
- \* Division of Water Works
- \* Division of Equipment Services
- \* Division of Transportation

These divisions are described on the website:

[http://www.southbendin.gov/city/departments/public\\_works/about.asp](http://www.southbendin.gov/city/departments/public_works/about.asp)

The City website is:

<http://www.southbendIN.gov>

The following is a list of possible CESP projects. Student-originated projects also will be considered.

1. Comprehensive Land Use Plans. SimCity is a modeling program (<http://simcity.ea.com/index.php>) that allows users to assume the roles of Mayor and City Planner as you design and build the city of your dreams. This project will compare South Bend development for dense urban growth versus its approach over the last 20 years of suburban sprawl. The models will show the impact on tax rates and infrastructure costs under each model, and allow bracket assumptions of CLUP, Comprehensive Land Use Plans, and will show laypersons consequences of current low density suburban sprawl development approaches on well and septic as well as benefits of more dense urban development on common water and sewer with smart growth principles.
2. Bowman Creek Stream Ecosystem Restoration. Bowman Creek runs dry during droughts, floods during rainstorms, is little valued and often serves as a dump, and is fenced to help control dumping. This project seeks to find solutions to convert this liability into a local asset. It could become an area with attractive min-parks, hiking trails, wildlife refuge, and fishing. This project will require involvement of the nearby residents to assure that they

value and will aid in the restoration. The creek is over 2 miles long with 75 feet of vertical drop. It currently has significant reaches that are enclosed in storm sewer pipe. What if sections were reopened, deep refuge pools for fish to survive hot dry periods, riffles or small drops or boulders to introduce oxygen and visual interest were added. What if riparian tree canopy and erosion control ground cover was added to the banks of the creek. What if distributed embedded sensor real time control technology was used to monitor creek stage at key control points and communicated with smart actuated control valves at the AM General Test Track and other potential water impoundments. Such a system could be programmed in concert with City rain gauges to keep cool underflow supply managed through drought times and store backwater for programmed release to peak-shave raging flood inducing flows. Students can scope elements of a multi-year implementation plan and see a dramatic transformation through their efforts here.

3. Google Earth South Bend Flyover. This project will develop an enhanced Google Earth Flyover tour of major economic development & redevelopment & infrastructure investment projects in South Bend. This project will utilize the free Google Earth, which can be found at: <http://download.earth.googlepages.com/>
4. Zoo, Greenhouse and Park Planning. The Potawatomi Zoo, Ella Morris and Muessel-Ellison Botanical Conservatories and Potawatomi Greenhouse are near Ironwood. Ironwood is planned to be increased to four lanes in the Transportation Improvement Plan that can be found at the Metropolitan Planning Organization (MPO) for this area called MACOG- the Michiana Area Council of Governments at their website [www.macog.com](http://www.macog.com). With Greenlawn closed to accommodate Adams High School and IU South Bend pedestrian mall access to the zoo is more difficult. Ironwood is the high traffic volume north-south traffic corridor that could complement Mishawaka Avenue access and visibility for the park and zoo assets. The City has performed efficient 3-minute response Fire Station service territory planning and found that Fire Station 9 currently located on Mishawaka Ave is too close to Mishawaka (over 30 percent of the 3-minute response time coverage area is in Mishawaka). The station needs to move west somewhere close to Mishawaka Ave. and Twyckenham. A plan is desired that will make more visible these park facilities with the Ironwood expansion. Integration of the proposed Fire Station 9 relocation, IUSB campus development, and the CSO modifications in this area and Mishawaka Ave Commercial Corridor Plans is needed. This is an interesting real world challenge to preserve and improve environmental assets while synergizing transportation improvement plans, and public safety, and state university campus planning.
5. Neighborhood Traffic Calming. Local residents frequently ask for stop signs to reduce traffic speed. Stop signs may not accomplish the desired speed reduction---studies show unwarranted stop signs actually cause drivers to brake harder and accelerate more rapidly to make up for their perceived lost time at the unwarranted stop. This project will develop a list of alternative and more effective traffic calming strategies. The final report will be used to help bring Public Works engineers and community leaders to consensus solutions targeting

cost effective strategies that work for speed control and reduction of cut-through or short cut traffic on minor residential neighborhood streets. We need literature search on techniques that work, their costs, criteria for screening requests and fitting the appropriate traffic calming technique to each neighborhood. We need a traffic calming tool kit for City Engineers, and we need educational materials that explaining to the public what works in each type of traffic situation in our Northern Indiana climate. Help the City enhance awareness and voluntary compliance with the three *E*'s of neighborhood traffic safety. These are, *E*ngineering of street and traffic control devices (signals, signs and pavement markings), *E*nforcement by police of speed limits and moving violations (such as disregarding stop signs or red lights) and *E*ducation of drivers on their role in preserving/protecting neighborhood quality of life and traffic safety.

6. MUTCD Highlight Summary. The Manual of Uniform Traffic Control Devices (MUTCD) is an extremely comprehensive guidebook. Few users are able to read a very large document that governs design and placement of signs, signals and pavement markings. This project will select and summarize the top 10 excerpts that are most relevant to South Bend. An important element will be the chapter on safety planning and implementation near school zones.
7. Bike Path Web Page. South Bend uses a Geographic Information System (GIS) to map utilities roads and other features. An example of GIS is available at: <http://macoggis.com/> or <http://southbend.in.schneidercorp.com/gis/disclaimer.htm>. This project will prepare data necessary to construct a GIS layer for a bike path web page. The City's web page manager will work with students to add these data and make them readily available to the public. Mayor Luecke committed publicly that South Bend would plan and implement 50 miles of bike network within 5 years with 2007 as the first year of the program. The project will include working with the City and the Paint the Town bicycle advocacy group on planning for the 40 additional miles of bike paths as an integrated system that reaches most of the destinations people would want to bike to in South Bend. The network will include separate pedestrian and bike trails such as the Riverside Trail along the St. Joseph River north of Angela, marked bike lanes such as on Twyckenham and Mishawaka Ave., and in more congested areas will use "Share the Road" bike route signs.
8. River Trail Web Page. , Like the Bike Path Web Page, this map will provide stations, points of interest, trail historic and cultural interpretation, suggested priority maintenance or upgrade scope of work. We have riverfront trails in South Bend from Twyckenham near IUSB to Oakwood near Pinhook Park. Mayor Luecke publicly charged the Public Works department in 2007 with completing designs for the trail to span from Logan Street bridge where the St. Joseph River enters South Bend to Darden Road Bridge where it leaves the City by 2008 and implement those plans by 2012. Designs for Oakwood to Darden are complete and federal grant money to build this is pending with high priority assigned to local matching dollars. A contract for design of Twyckenham to Logan has been assigned to a local engineering consultant. Also in 2007, mid-level scrub vegetation that obscures views of the beautiful river resource (note trimming target is below the tree canopy and above the important root

mat ground cover vegetation) was removed to form river viewing vistas referred to by the City as “*Windows on the River*” in nine locations on the river in 2007. Scrub vegetation obscures many attractive river features, but the public often opposes removal of river front vegetation on the mistaken impression that the City will remove trees or denude bank ground cover leading to serious erosion issues. This project needs to include educational information and suggestions for locations of future windows on the river. Resources from Parks, Public Works Planning and Mayor's office collaborate on this effort.

9. Adopt a Trail Program. River trails need to be maintained. The City constructs the trails, frequently using large construction equipment. The City Tree crew with Street department support did the heavy trimming workload initially to open Windows on the River where years of scrub growth clogged the view. However, annual maintenance requires more hand labor. This project will organize an "adopt a trail" program, and seek organizations to commit to short segments of the trails, which typically are 500-foot window segments.
  
10. Pavement Management Systems Improvement. The City utilizes accepted engineering approaches based on pavement condition ratings, to prioritize and select which pavements are improved and by which method. However, frequently the public mistakenly believe that political influence dominate engineering judgment. This project was started by a spring 2008 CESP Team and will be partially completed. The project objective is to provide an information system to help the public understand the pavement management systems improvement procedure. The educational unit might include a GIS layer of recent years paving history, 2008 pavement improvements, a forecast of City coverage in 5 year increments to 25 years, document of the approach to rating and prioritizing needed improvements, an explanation of which streets get what treatment and why, and an incorporation of vehicle and truck counts with a correlation with required treatment interval. Inlays, milling technique and purpose, overlay types, crack sealing and slurry seals, infrared repair, and alternative pothole patching methods will be explained and examples photographed. Types of pavement condition deterioration such as potholes, reflective cracking, rutting, raveling, and base failure as well as alligator cracking will be photographed and explained. Examples of streets that score representative of like-new condition, versus minor deterioration, versus streets that have been ravaged by water and weather, are beyond resurfacing, and require reconstruction that is much more expensive will be photographed along with the pavement condition-rating sheet.
  
11. Streetscape Design Guidebook. This project will include several phases, such as a current Streetscape element inventory and samples of the appearance and durability in an affordable pallet of choices. We should scour South Bend with cameras and visit other nearby communities or our student home communities on break see in South Bend streetscapes. This effort should culminate in compilation of a catalogue of best ideas for South Bend. Standards of three to five makes and models for streetlights, planters, trash receptacles, benches, literature racks, and bike racks should be recommended. Limiting types will help with a consistent quality look and some efficiency of training and inventory of replacement

parts. The guidebook will require different streetscape approach to historic areas, downtown, commercial corridors, and neighborhood arterial vs. minor streets, but the goal is to have the collection look related and consistently planned---a South Bend vernacular of streetscape elements. An example of consistency should be height and bracket hardware and poles designed for wind-load to handle standard full-sized rectangular public art banners, seasonal and holiday banners and community event banners. This guidebook will be given to all engineers, architects, urban planners, developers and landscape architects working on South Bend projects. Lacking this guidance, we get a wide range of different proposals on nearly every project from Spartan to over the top in all colors shapes and styles.

12. Environmental Engineering Initiatives. The City is open to a wide range of Environment and Energy related projects. We can use education oriented CESP efforts at Fredrickson Park—a former dump turned environmental education park in cooperation with Boy Scouts, South Bend Community School Corporation and Notre Dame. The City has Safe Drinking Water projects including wellhead protection. The City has opportunities for wastewater treatment improvement to save power, chemicals and labor. We can use engineering help to expand further use of methane generated in the anaerobic digestion process. Residuals management is greatly improved in South Bend, but future movement to Class A biosolids holds great potential to improve environmental perceptions of our product and economics of our program. The largest environmental infrastructure project in the history of the City has a default CSO Long term control plan, but we have the opportunity to find equally good or better environmental technologies and approaches to save money and improve the plan. EPA and IDEM will hold South Bend to a certain level of environmental benefit, but will be open to amending the plan to reduce cost or enable a faster timetable or convert some conventional hard pipe civil engineering solutions to green solutions like porous pavement or rain gardens or constructed wetlands. Notre Dame Students were instrumental in the conversion of all traffic signals in South Bend to LED from incandescent lights---we are saving \$2 million in electrical costs over the next decade from this change alone and avoiding many carbon emissions. There are many more opportunities for motivated environmental engineering students to help us make South Bend a more energy and environmentally enlightened community. We need student ideas, study of potential, economic analysis and enthusiastic advocacy to get it done---make a proposal and make a difference!

### **Course Registration**

Contact Lloyd H. Ketchum, Jr. for information and registration information:  
ketchum@nd.edu, 1-5380, Room 156 Fitzpatrick Hall.