

## ENGINEERING OUTREACH

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This paper provides information on the activities of the American Society of Civil Engineers which encourage women and minorities to enter and remain in the engineering profession. It also discusses the reasons to perform Outreach visits to enlighten students about engineering careers. The following ideas from a 1960's Home Economics textbook for high school girls teaching them to prepare for married life illustrate how far women have come:

A wife should make her husband comfortable. She should arrange his pillow and offer to take off his shoes. She should listen to him. Although she may have a dozen things to tell him, the moment of his arrival home is not the time. She should let him talk first. She should make the evening his and try to understand his world of strain and pressure, his need to be home and relax. A wife's goal is to try to make the home a place of peace and order where the husband can relax.

Women have certainly progressed from here, but there is still a long road ahead. As long as there are phrases like "glass ceiling", engineers have a responsibility to encourage women and minorities to continue along that road.

I feel my background qualifies me to write about career guidance. I received my Bachelors in Civil Engineering from Union College in Schenectady, New York. I earned a Masters in Landscape Architecture from Harvard's Graduate School of Design, and have been working for HNTB Corporation in Boston for the last six years. I became active with the American Society of Civil Engineer's Boston Section Younger Member Committee when I started working and Chaired the Committee for two years. We received the ASCE Younger Member Group Award one of those years. I remain active with them as Outreach Coordinator. I serve on the ASCE Committee on Equal Opportunity Programs and work with the Committee on Career Guidance. Additionally, I am also on the Board of Directors of JETS (Junior Engineering Technical Society), a national engineering career guidance organization, as the ASCE liaison.

There are other reasons I have been so active in the crusade for career guidance, especially for women and minorities. I am the daughter of a Civil Engineer. I was unusual in that I grew up knowing what a Civil Engineer was. Although, it was not until many years later that I figured out that my dad did not spend all day Upstate with the cows when he was "in the field." He did, however, take me along on traffic counts and various site visits, which I am certain sparked my interest. After his third year of retirement, he has almost been able to erase the Matchbox car superhighway and city someone painted on the basement floor. When my Matchbox car interest graduated to an aptitude for high school math and science, I thought engineering might be a good profession. However, the guidance director, (a women who had a Ph.D. in education



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and guidance) told me flat out - "girls don't become engineers." At last check, I am not only a registered professional engineer, but a girl too. My parents didn't listen either, and we went off on that great odyssey to find the right college. We landed in Schenectady, at Union, where I went on to become the engineer I am today.

Outreach is a number of things - career education, engineering volunteers, enrichment, guidance, Boy Scouts, Girl Scouts, Science Fairs, tutoring, Coloring Books, Summer Institutes, field trips and tours. Engineers have skills they should not waste. They can use them to encourage those students who are facing guidance counselors like mine or don't realize the opportunity and excitement engineering can give them. Further, they can be the role models and mentors young girls and minorities need.

Unless engineers communicate to students what the profession is, many will never know. Students need to be able to make informed career decisions. Future civil engineering work will continue to demand a number of skills. Projects will require not only technical expertise, but the background to cope with social, economic and environmental issues as well. Practicing engineers need to sustain their own future by recruiting capable successors. They also need to continue to encourage those groups underrepresented in engineering. This includes women and minorities. The current obstacles these groups face will only be lessened with a conscious effort to increase the numbers of these individuals who become engineers. Many young engineers mention a lack of mentors on the job. This will lessen as more women and minorities enter the field. Until then, it is the responsibility of each person to assume that mentor role.

The rewards and benefits for a volunteer or mentor will vary at each age level. At the elementary level, it may be the widened eyes and look of awe when the seven year old gets to look through a transit. Or maybe the thank you note from a fifth grade visit that said "...Even though your line of work is very interesting, I don't think I would want to be a Civil Engineer. When I grow up I want to be the navigator or a captain. If that is successful, when I come out I would work for a Caribbean Cruise and be a happy man." Maybe its the high school student who decides to stick with algebra a little longer so he keeps the option of an engineering major. Maybe it's the college student who narrows his concentration to environmental or structural, based on the volunteer's information. Or the graduating senior who gets the job after a mentor helped him prepare for interviews. Or the beginning engineer who sees his name in the "Designed By" box on a drawing for the first time. Or the young engineer a mentor coaches during his study for the PE exam and finally passes.

The biggest reward for most is the personal satisfaction derived from a visit. If one student is inspired to try to become an engineer, be it in twenty years or one year after an Outreach visit, the visit was a success. One volunteer recalled hearing from a student who later became an engineer. The student referred to the engineer as "that person who did sewers, but made it sound much better."

The **volunteer** is the greatest resource available. His knowledge of the field, the path to get there, and the satisfaction of the job are the most important pieces of information he can offer. Feedback also shows, the volunteers truly enjoy each visit. Engineers are all remiss if they do not share with students the opportunities available by entering Civil Engineering. These students and young engineers are the future.

Many programs and resources exist offering material for all age levels. Each can be targeted for women and minorities. Groups offering materials for Outreach include the Society of Women Engineers, the American Consulting Engineers Council,

the Society of American Military Engineers, the National Society of Professional Engineers, the Engineers for Education Program, and the National Engineers Week Committee. Each engineering society also offers their own brochures describing their specialty. Many engineers are members of the Tau Beta Pi or Chi Epsilon honor societies. Their publications often list additional resources, articles and statistics.

Some of the specific Outreach material available is very exciting. The National Action Council for Minorities in Engineering has a Spiderman comic book. The National Society of Professional Engineers has a video called "Bikes" that is the story of an engineering team told with an upbeat documentary about bicycles and bike racing. The Boston Society of Civil Engineers has "Dig It!", a rap video about the Central Artery Project. It gives a comprehensive study of all the phases of this large public works project. The Society of Automotive Engineer's A World in Motion is a two phase kit for teachers with projects, posters and videos that motivates students to study physical sciences and mathematics. Each year the Discover 'E' program from NSPE has a packet of projects to do with students.

Every visit to a classroom has a similar objective. Students are not aware of the extent of engineers and engineering in their life. Engineers are problem solvers, and individuals working to make everyday life better. An outreach volunteer can create a scenario to document Civil Engineering in everyday life. Engineers can relate to the students how engineering brought them water for their morning shower, designed the road they traveled to school on, heated their school building, designed their ballfield for after school practice, and even help bring electricity to their house for Nintendo at night. Showing the diversity of engineers and engineering, from bridges, to dams, to roads, to outer space will further excite the students.

During visits, image and dress are very important. Engineers should encourage female students that they can be in the profession and still have a family role (as can males!) One female engineer who divides her time between the field and office work has dressed for both. She will wear her skirt, boots, safety vest, and hardhat. Students are fascinated by the idea of working in the field and in an office. This same engineer also brings her 3 year old "helper" on some to the visits.

Engineering is for anyone and everyone. One only needs to accept the challenge it presents. It opens many career paths other than engineering. Engineering graduates go into the medical, legal, and countless other professions. Many diverse disciplines hire engineers including utility companies, pharmaceutical groups and toy and athletic equipment designers. Students are surprised to learn that an engineering career can lead to designing heart valves, electrical medical monitoring systems, even pins and plates for broken bones. Showing the diversity of engineering and opportunity afforded by engineering is very important.

One of the most rewarding visits is returning to a college alma mater to speak to the engineering classes. The presentation has a different focus than the grade schools. Students are more inclined to ask questions about the specific fields of engineering. Discussions of projects are very helpful. Students need to know what "real life" engineering entails. The volunteer is a role model to these students.

College is a financial burden for many students. Although the engineer's visit is not meant to be a substitute for school guidance counselors, the engineer can stress there are many scholarships available for college funding. Most professional organizations, honor societies and civic groups offer awards to worthy applicants.

Colleges often have specific scholarships for women and various minority groups. Organizations offering scholarships include the Bureau of Indian Affairs, National Action Council for Minorities in Engineering, General Motors, the National Society of Professional Engineers and the Jackie Robinson Foundation. ASCE offers 17 awards totaling \$70,000 to a variety of students. Each local area also offers a great deal of scholarship money. Students must only be investigative and resourceful using local libraries, colleges, firms and summer jobs to see the excitement, challenge, and opportunity an engineering education and career provides.

One group providing a significant resource for reaching our youth is JETS. JETS is a national, non-profit organization emphasizing understanding of engineering and technology and encouraging competency in mathematics and science for high school students. JETS sponsors various programs nationwide so students can make informed career decisions about engineering and technology careers. One of JETS most important functions is the dissemination of information about engineering. Over 35,000 students in all 50 states and Puerto Rico receive JETS flyers and brochures.

Three important JETS programs are the TEAMS competition, NEDC, and NEAS+. TEAMS, the Test of Engineering Aptitude, Mathematics and Science enables teams of high school students to pool their knowledge and learn team cooperation to solve exam questions. The groups participate in local competitions for a national ranking. TEAMS competitions were held in 45 states last year, with approximately 15,000 students.

NEDC, the National Engineering Design Challenge, is another team effort. Students work to design, fabricate and demonstrate a working solution to a societal need. The NEDC problem also begins at the local level, progressing to the national event in early Spring. Over 700 students participated in the NEDC last year with approximately 15 state winners progressing to the national level. NEAS+, the National Engineering Aptitude Search + is a self-administered academic survey enabling students to determine their current level of preparation for engineering subjects.

Perhaps the single best resource for guidance information is the American Society of Civil Engineers. Founded in 1852, the Society has over 114,000 members internationally. ASCE's Career Guidance Handbook documents the guidance material available from as many groups as possible. Materials available from ASCE and other groups include handouts, flyers, posters, books, videos, and project kits.

ASCE has begun a strategic planning initiative. It is developing a mission statement, goals and objectives for the society. Representatives of the entire membership have arrived at a list of draft goals, including one which presently reads "Transforming public perception of Civil Engineering to reflect its position as a highly respected profession that is regarded as a most desirable and rewarding career." The group has then further identified strategic objectives or measurable, attainable milestones to be achieved on the way to each goal. For this particular goal, one objective is developing a membership that reflects the full diversity of society. A diverse society obviously includes women and minorities and ASCE has recognized a need to have their membership reflect this. There are a number of ASCE programs already in place to help achieve this goal and objective.

Through it's Committee on Younger Members, ASCE has implemented a mentor program which can be tailored to a Section's needs. ASCE has guidelines for matching mentors and participants. The Society can identify recent college graduates within the

Section and provide mailing lists and labels. Each Section can get Certificates of Appreciation for the mentor. ASCE is aware of the value of a strong mentor and role model to help shape careers.

Another program for today's young engineer is ASCE's "Moving Up" video-based career development program. The program addresses the personal career development requirements of an engineer and the staff development requirements of an engineering organization. It helps each participant develop his own definition of success. The seminar can be presented in one 4 - 5 hour session or divided. An ASCE member with managerial experience acts as a facilitator. The program helps the engineer identify their own strengths and weaknesses, identify the expectations of management, set reachable career goals and strategize how to best use their ability.

The biggest resource for encouraging women and minorities to enter engineering is the engineer. ASCE's Committee on Equal Opportunity Programs is funded by a voluntary checkoff contribution on membership forms. This \$5 contribution has given CEOP a generous annual budget of \$90,000 to help further programs for students and engineers. Engineers continued support is the only way to ensure the growth of programs in this area.

ASCE's CEOP is investigating sponsoring a seminar at the San Diego national convention on the skills engineers felt they needed to move ahead in their careers. After conducting a survey, CEOP learned many women and minorities felt additional training in negotiation, communication and assertiveness would help them further their career. The Committee will acquire a facilitator for a session in this area. Women can be provided with techniques to improve these skills and confront management with issues they feel are preventing them from rising in their careers. Management (both men and women) can be shown how to best cooperate with their staff, be aware of the issues women feel they face as obstacles in their career path and help their staff further their careers.

The Committee on Equal Opportunity Programs has two programs for young students. The first program is a new initiative. CEOP has arranged with David Robinson of the San Antonio Spurs to produce a bookcover with his picture. Robinson is a minority civil engineer and will serve as an exciting role model for young students. CEOP already has another program to distribute coloring books entitled "Would You Like to be an Engineer?" to schools. The coloring book portrays a variety of engineers and their daily activities. Some schools also use the book as a coloring contest with team and individual winners. The bookcovers and coloring books are available through ASCE at a nominal cost.

One of ASCE's strongest programs specifically for minorities is the Summer Institute Program. With a 1995 budget of \$70,000, ASCE will help sponsor the program at 21 schools in 17 states. The Summer Institute Program was initiated to expose young high school age minority students to the engineering profession. Students explore the college environment and are given the exposure to engineering and intensive training they might otherwise never receive. Students live on campus during the program and attend classes and programs instructing them in the engineering area. Many programs also offer field trips and special events. Informal survey results have shown the Summer Institute to have a significant impact on the minority enrollment in engineering.

It is clear that there are a lot of programs for today's youth. What is needed most is a coordinated effort among all the groups. The Boston Society of Civil Engineers is

working to establish a Career Resource Center. Unmatched anywhere else in the nation, the CRC will serve as a clearinghouse for the educational material of each Outreach guidance program. It will also be a central source for volunteers, speakers and information. It is hoped to staff the Center and gain funding from professional societies, corporations and educational grants.

These are some of the resources available to engineers for Outreach. However, it all comes back to one thing. Engineers, groups of students, and hopefully, inspirations and future engineers. Engineers have a responsibility to their profession. It is their privilege to lead students to the opportunity they will be afforded by an engineering education and career. No one should be allowed to miss out on this chance.