

Outreach Program in Civil Engineering and Traffic Safety for Fourth and Fifth Grade Students

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Abstract – This paper describes an outreach effort to teach fourth and fifth grade students about civil engineering in general and specifically the highway safety aspects of transportation engineering. The program consists of two 30-minute sessions, the first on civil engineering and the second on the transportation subdiscipline, particularly highway and traffic safety. The first session introduces the school children to the various subdisciplines of civil engineering and how the work done by civil engineers shapes their daily lives, from supplying clean drinking water to designing bridges to carry us across bodies of water. In the second session, transportation engineering is introduced with a focus on highway safety and rules of the road. Most of this session is devoted to the meanings of key traffic control devices (signs, markings, and traffic signals). The main content delivery mode is a computer slideshow presentation. The picture-laden presentation is supported by a variety of visual aids and passaround items. Examples include samples of sign sheeting, pavement marking material, and asphalt concrete cores. The outreach program was delivered by student members of the Auburn University Student Chapter of the Institute of Transportation Engineers. At this time, it has been delivered to two of the six elementary schools in Auburn, Alabama. These elementary schools conduct bicycle and traffic safety courses with their fourth and fifth grade students; an attempt is made to schedule the outreach activity in conjunction with the bicycle and traffic safety program. Plans are being developed to reach the remaining schools and develop an instrument to measure the fourth and fifth grade students' understanding of the basic concepts and terminology. Key course objectives include creating an awareness of the impact that civil engineers have on the lives of schoolchildren and their families as well as presenting it as a career option.

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INTRODUCTION

The products of civil engineering are used daily by all people. Yet, particularly with youngsters, an awareness of this concept is lacking. An understanding of traffic safety and “rules of the road” is also particularly important for youngsters; in fact, traffic crashes are the leading cause of death in children ages 3-14 in the United States [NHTSA 2008]. Of the 1,347 traffic fatalities age 14 and younger in 2008, 20% of these were pedestrians and 6% were bicyclists. Both of these fatality categories are larger in the specified age range than are their corresponding shares of the overall population; therefore, pedestrian and bicyclist fatalities are overrepresented among children 14 and younger. As a service project and outreach activity, the Auburn University Student Chapter of the Institute of Transportation Engineers considered opportunities to address these issues. A program to introduce these topics and make important points (such as the role civil engineers play in their lives and rules pertaining to traffic safety and use of the road) emerged as the preferred option. The student chapter officers, assisted by their faculty advisor, developed a 60-minute program to accomplish these goals. This program has been presented by student chapter members to 4th and 5th graders at three of the six elementary schools in Auburn, Alabama, since the program’s debut in November 2008.

BACKGROUND AND MOTIVATION

The Student Chapter of the Institute of Transportation Engineers at Auburn University identified development of program to introduce upper elementary school (4th and 5th grade) students to civil engineering and traffic safety as a potentially valuable outreach activity. This age range was targeted for several reasons. One is the assumption that 4th and 5th graders are mature enough to take with them an understanding of the basic concepts involved and how these concept apply in their daily lives, yet young enough for the message to still be useful to them as pedestrians and bicyclists before driving would likely become the transportation mode of choice. Another reason was the convenience of working with them in relatively small groups among the six elementary schools in Auburn, Alabama. 6th and 7th graders attend one citywide middle school and the group sizes as well as scheduling issues would have made meeting with them much more complex. Another advantage to working with the 4th and 5th graders is that the city schools have a set of bicycles and a bicycle safety program that rotates among the elementary schools. Finally, the Alabama Section of ITE is carrying out a service project entitled Saving Alabama Teens (Salteens) to target teenage drivers about traffic safety, distracted driving, and related issues, so the topic of the outreach activity conducted by the Auburn University Student Chapter aligns well with the Salteens initiative.

Additional motivation for the effort was provided by the well-documented need to raise public awareness and understanding of what engineers do and to dispel common misconceptions of engineering [NAE, 2002]. For example, a study involving 504 schoolchildren in grades 1–5 found that repairing cars, installing wiring, and operating machines were more likely to be perceived as work done by engineers than were efforts to “design ways to clean water, design things, and improve machines” [Cunningham et al., 2005]. Therefore, there is a clear need for outreach from engineers and engineering educators to correct these misperceptions.

COURSE DEVELOPMENT

After discussions with physical education teachers and principals at a couple of the elementary schools, a format consisting of two 30-minute presentations was decided upon. In the first presentation, engineering was first introduced in general, after which the focus quickly shifted to civil engineering. All of the branches of civil engineering were to be introduced. The second module was focused exclusively on traffic engineering and safety.

Key principles to developing the outreach program included:

- Provide tangible examples of civil engineering works that the students may be familiar with.
- Make civil engineering and traffic safety relevant by providing examples of how these fields touch the students’ daily lives.
- Provide opportunities for students to touch and feel examples of civil engineering and traffic safety products.
- Present civil, and particularly transportation engineering, as a career choice.

Regarding course delivery, many modes of learning were used. While the predominant mode was the use of Powerpoint slideshows laden with pictures and occasional video clips, many question-and-answer exchanges were included. Additionally, many pass-around items associated with civil engineering and specifically traffic control were also utilized.

COURSE CONTENT AND DELIVERY

The main topics to be addressed in the presentations were an introduction all subdisciplines of civil engineering and then a specific focus on transportation and traffic engineering, in two 30-minute sessions. The two modules were presented on consecutive days. The first session, by starting very broad (engineering in general), then narrowing to civil engineering, and finally examining each of the subdisciplines (concluding with transportation), set the stage for the second session. The second session provided a quick refresher of the previous day's discussion, then detail on transportation. Throughout both presentations, emphasis was placed on the role that safety plays in the decision process and products of civil engineers.

The purposes of the first session were to discuss subject knowledge that might be used in civil engineering, to place civil engineering in context within all branches of engineering and then introduce each of the subdisciplines. A typical opening question to ask the entire group of 4th and 5th graders was "what's your favorite subject in school?" While all subjects were mentioned, the presenter focused on science, math, and computers, then noted how engineers need to be strong in all three subjects. After asking for examples of different types of engineers (e.g., electrical, mechanical), the focus is narrowed to civil engineering. As the presenter describes each branch or subdiscipline of civil engineering, the slide presentation showed pictures of examples of civil engineering works. Most of the pictures used in this slideshow were of famous civil engineering works that would likely be known to the schoolchildren, both from afar (e.g., the Eiffel Tower, Hoover Dam, and the Golden Gate Bridge) and near (Jordan-Hare Stadium and Samford Hall). Examples of how civil engineers improve quality of life were also cited by opening discussion with questions such as "Who used water this morning?" to "Who rode across a bridge on the way to school today?". Questions of this type provide the presenter an opportunity to relate civil engineering to the daily activities undertaken by the audience and to underscore the general assumption that civil engineers have designed these systems with public safety in mind. With transportation (and specifically traffic control) being the last topic discussed, samples of traffic control materials, including sign sheeting, thermoplastic and tape pavement markings, were passed around the group.

The second session was intended to go deeper into transportation, covering aspects of how roads are designed, built, and operated. Basic concepts of traffic control as well as rules of the road with respect to bicyclists and pedestrians were also discussed. The concept of design was underscored by the presenter showing the schoolchildren examples of tools and products of this phase of the transportation facility life cycle, including relevant design manuals and a set of highway plans. The highway materials of asphalt and concrete were also discussed and differences in their properties highlighted. Key supplies for this part of the presentation include asphalt concrete cores that have been extracted from a highway, and a pan of asphalt cement, or binder, with which its viscoelastic properties are demonstrated. Finally, operations of highways were discussed, including the basics of traffic signal operations and how detection of vehicles can be accomplished. Rules of the road for pedestrians and bicyclists were then discussed and demonstrated. The final topic covered in the second session pertains to railways, specifically highway-rail grade crossings. Important points about the weight of a train and required stopping distance when compared with cars, as well as not trespassing on railroad tracks, were included in the discussion.

LESSONS LEARNED

Observing the Auburn University students conducting the presentations provides many insights into the 4th and 5th graders impressions of concepts about engineering and traffic and many ideas for potential improvements for future occasions. Confirmation of the assertion that many children indeed have misconceptions about what an engineer does, as found in the study by Cunningham et al., occurred many times. For example, when the audience was asked early in the first session, "What does an engineer do?", actual responses included "fix cars" and "drive trains". These responses appeared to be more common than "design bridges" and "build rockets" – examples that degree-holding, professional engineers would likely prefer to hear.

Another important point noted by some of the presenters for speaking with children of this age range included the interest piqued by asking questions and asking for volunteers. For example, when a presenter asked for a volunteer to “try on” safety apparel (vest) used in highway work zones, many of the schoolchildren nearly jumped out of their seats. As another example, many of the schoolchildren appeared to have strong feelings about which subject in school was their favorite. Fortunately, “math” was one of the most common answers. Finally, the value of hands-on learning cannot be overlooked. Unfortunately there is little time for individual or small group experiences involving creativity in two 30-minute sessions delivered to audiences of typically about 50 schoolchildren. However, there still are many opportunities to pass around items used by civil engineers for the schoolchildren to see up-close and touch and feel items that they otherwise would not.

Many resources exist for the creation of such an outreach presentation. As most of the development work was conducted by officers of the ITE student chapter, they were able to use concepts they had been exposed to in their classes. Having to then reorganize these concepts into a short course for elementary school students not only reinforced the university students’ own understanding of the material, but also force them to learn how to present the material, and in a manner appropriate for schoolchildren. Operating in a university environment also provided the presenters with a wide range of examples, from material samples to books and plans, that could illustrate the work done by civil engineers.

CONCLUSIONS AND FUTURE PLANS

A set of two 30-minute presentations to introduce civil engineering and traffic safety was developed and presented by members of the Auburn University Student Chapter of the Institute of Transportation engineers to 4th and 5th grade students in Auburn, Alabama. The first part included well-recognized examples of civil engineering works, with a focus on how civil engineers shape our lives. The second part focused on the civil engineering subdiscipline of transportation, particularly on traffic control, rules of the road, and railroad crossing safety. At this time, the presentation has been given to three of the six elementary schools in Auburn. Several letters thanking the presenters have been received from teachers and schoolchildren.

Future plans include reaching other nearby schools as well as implementation of an assessment tool. Plans include reaching the 3 remaining elementary schools in Auburn, as well as schools in nearby communities, over the next 1-2 years. In the future, with coordination effort from the schools, a simple assessment tool to focus on the schoolchildrens’ impressions about civil engineering and traffic safety, will be administered both before and after the presentations. If the schoolchildren came away from the course with a greater appreciation of what civil engineers do that affects their lives and a greater understanding of traffic safety issues that they can act upon, then the basic mission of the program will have been accomplished.

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