SCDOT

INITIATIVE TO INTRODUCE ENGINEERING TO HIGH SCHOOL STUDENTS

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STATE DOCUMENTS
SCDOT

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The South Carolina Department of Transportation is an agency comprised of approximately 5,400 full time employees. Of this number, approximately 550 are employed as engineers in one of the five engineering divisions; planning, preconstruction, construction, traffic, and maintenance; that are headquartered in Columbia. Additionally, SCDOT employs approximately 140 engineers in the seven engineering districts that are located strategically across the state. The majority of the engineers hired by SCDOT are Civil Engineers, who by definition design and construct public infrastructure projects. Of the 691 engineering positions at SCDOT, 70 require registration as a professional engineer. Professional registration requires a degree in engineering from an accredited school, at least four years of responsible experience, and satisfactory scores on two examinations. Collectively, these engineers form the backbone of the agency and perform the functions vital to its mission to “Build and maintain roads and bridges for the citizens of the state”.¹ This mission has become more and more technically challenging as environmental, seismic, and other infrastructure issues are introduced to the traditional design and construction processes. This requires the SCDOT staff to maintain a level of expertise and experience to address these and other issues as they arise on current and future projects.

SCDOT has traditionally had a difficult time attracting and recruiting graduate engineers. This can be attributed to lower starting salaries in state government and more

¹ South Carolina Department of Transportation, Strategic Plan (2002), p.2
attractive hiring packages offered by private companies. Strong economies spur a large amount of construction and development in the private sector, which increases the demand for engineers out of school. SCDOT has experienced a sharp increase in its road construction program in the last 5 years due to changes in federal funding laws and a new Transportation Spending Bill. SCDOT has met the needs of this program by outsourcing a large portion of the engineering work to consultants. SCDOT's internal hiring levels and recruitment tools have not changed to meet the demand for these engineers, and as a result, SCDOT has only hired 14 engineers in 2001, which is the average number hired per year during the 1990's. This downturn in the hiring of engineers comes at a time when South Carolina is facing an exploding new construction program and an aging infrastructure that is nearing the end of its design life and in dire need of upgrades and replacements. Nationally, the US Department of Labor projects that there will be a 20% increase in the number of engineers needed in this country by 2008. That is 300,000 more engineers than are practicing today.²

South Carolina Department of Transportation must develop tools and strategies to attract and recruit a large number of graduate engineers within the near future to sustain the current needs and to meet the future needs of the agency and the state.

SCDOT faces a challenge in attracting and recruiting new engineers. Several reports indicate that enrollment in engineering majors in college has declined 20% in the past 15 years.³ National enrollment figures show a steady decline in both the number of students enrolled in and graduating with engineering degrees from 1985/86 through

³ National Science Board, Science and Engineering Indicators, 2002, p.2.17
While some disciplines have increased their enrollments in the past two years, civil engineering continues to experience a decline in both enrollment and graduation. Within South Carolina, where SCDOT finds 85% of its graduating engineers, the numbers aren't any better. Enrollment figures at Clemson University show a peak in BS degrees awarded in Civil Engineering in 1993/94 (126 awarded). Since then, there has been a steady decline in the number of degrees awarded each year through 2001/2002 (83 awarded). The problem does not appear to be less people enrolling in college, however. While enrollment in engineering disciplines has declined 20%, overall enrollment has increased by 20%. More people are going to college, but fewer are choosing engineering as a major. In 1986, engineering majors represented 8% of all majors awarded. In 1998, that number was down to 5%. In fact, enrollment in natural sciences and engineering seem to be on a cyclic pattern that is opposite of enrollment trends in other sciences (psychology, sociology, computer science). The peak in engineering enrollment in 1985/86 coincided with a 2-decade low in enrollment in other sciences. While engineering enrollment has declined since then, other sciences (as a group) have experienced unprecedented growth.

An article in Business First of Buffalo relates the story of a high school senior looking for the chemistry building at a local university. By chance, he asked directions of a mechanical engineering professor. After a brief fifteen-minute conversation, the chemistry student had changed his major to chemical engineering, and is now an Engineering Dean at the University of Buffalo. Today, he supports a program in the

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5 Dr. Thomas Keinath, Clemson University, 2002
6 National Science Board, Science and Engineering Indicators, 2002, p.2.19
Buffalo area that uses practicing engineers to visit with teenagers in the area and present a practical view of engineering on a day-to-day basis. The goal is to create among teenagers an awareness of how engineers can contribute to society and puts a human face on something of an anonymous profession.  

If SCDOT is going to maintain and develop a staff capable of meeting the demands of its aging infrastructure and new construction, it must find ways to encourage and promote engineering as a career among future generations of college graduates.

The declining enrollments in Civil Engineering have not gone unnoticed by the national trade organizations. Many have developed and implemented programs that partner with elementary, middle, and high schools to introduce students to engineering. The American Society of Civil Engineers has an outreach program called “Building Big” which provides engineers with tools and programs to develop partnerships with local schools and promote Civil Engineering as a career choice. The National Alliance for Pre-Engineering Programs sponsors a program called “Project Lead the Way”, which is a curriculum based program marketed to schools and industry in an effort to establish partnerships and implement programs in schools that promote all engineering disciplines. This program also provides training and tools for teachers to help them present math and science in a positive manner. And AASHTO has a program entitled Transportation and Civil Engineering (TRAC) Program, which is also curriculum based and covers all aspects of civil engineering and other transportation issues. The National Society of Professional Engineers has also noticed the problem, and has developed the National

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Engineering Campaign, which is geared towards breaking some of the stereotypes that exist about engineers and emphasizes the exciting and innovative role that engineers play in improving the quality of everyday life for people. The current message is that one has to be good in math and science, which makes engineering come across as a dull, dry subject. A Louis Harris and Associates study done for the NSPE found that most Americans respect engineers, but don’t really understand what they do. These trade organizations have made it their mission to fill in the blanks for young people who are weighing different career paths.⁹

In 1994, South Carolina Legislature enacted the School to Work Transition Act, which did away with traditional core classes and encouraged schools to adopt “career clusters”, which include specific classes focused on developing skills and knowledge along one of several broad career paths.¹⁰ The basic concept was to encourage students to start thinking about career direction at an early age, and to reaffirm those choices with introductory classes that present basic concepts and hone specific skills of the students to better prepare them for the transition from “school-to-work”. The Act articulates three components that define school-to-work: school-based learning, work-based learning, and connecting activities, with the hope that these three components comprise a “coherent program of study that, upon graduation from high school, leads to further education and training at a Postsecondary institution and/or employment.” Very few schools have adopted this recommendation in South Carolina to date, but there are great success stories coming from the schools that have. Walhalla High School adopted this approach in 1996,

¹⁰ South Carolina General Assembly, 110th Session, Bill 4681, 1993-94
and graduated its first class in 2000. Walhalla begins the process in the eighth grade with career counseling. By the end of the eighth grade, students can choose one of six career areas that include Business, Engineering, Health Sciences, Trades and Technology, Arts, and Sciences & Human Services. Walhalla High School partners with the county Vocational Center, Clemson University, and local businesses and industry to provide the resources needed to complete the student’s experience. This program has branched out to include all four high schools in Oconee County, and 25% of all high school students are now participating, including 70% of 11th and 12th graders. Some of the early indicators show that 91% of college bound students met the state standards for gains in occupational competencies, compared to 82% state-wide, and 98% percent of the county’s career-bound students received their diplomas, compared to 94% state-wide.¹¹

According to the US Department of Education, there are nine primary issues that must be addressed in order to make career pathways successful. Key to success was a link with employers who provide learning opportunities in the workplace and participate in developing integrated curricula. Additionally, the DOE stated that career pathways require multiple connecting activities to connect students, educators, employers, and the community.¹²

Currently, no schools in the Midlands area of South Carolina have fully implemented a career clusters program in their high schools. However, there are schools in the Midlands who are presently working towards a career clusters program by adopting

¹¹ Southern Regional Education Board, High Schools that Work, “Cooperative Efforts of a Career Center and Four Area High Schools Brings Major Changes in What and How Students are Taught”, 2002
one or two career areas to focus on, and several other schools are looking at it very seriously. Lexington School District One Superintendent Karen Woodward chaired a committee of Midlands’s schools that studied the idea for 8 months last year, and says the program could be implemented in her District next fall. These schools will be looking for corporate partners to provide opportunities for learning. SC DOT should develop partnerships with these schools to assist in preparing curriculum and presenting engineering to students in the classroom and in the work place.

Irmo High School is actively involved in the “Career Clusters” concept of career development within the engineering discipline. Irmo High is utilizing the Project Lead the Way program to introduce engineering to its students. Project Lead the Way is a Non-Profit foundation that has developed a national curriculum that introduces students in the ninth through twelfth grades to all aspects of engineering. Engineering classes are offered at Irmo High School in the tenth, eleventh, and twelfth grades. In discussion with Mr. Bob Taylor, instructor responsible for the three classes, the eleventh grade class would be the optimal target for our pilot engineering curriculum.

Through meetings and correspondence with Irmo High, an itinerary has been developed for the 11th grade Engineering Class. This itinerary will serve as the pilot project for this program, and will be closely monitored for improvements to the program. It is anticipated that after this pilot class is completed, the program can be adjusted and refined so that it can be presented to several schools and at different grade levels. Appendix A includes the draft project outline. This draft is a generic document that is

intended to serve as a guide when preparing specific itineraries for schools. This draft includes sections on all engineering aspects as they relate to SCDOT. They include:

- Introduction
- Project Development
- Road Design
- Bridge Design
- Surveying
- Road/Bridge Construction
- Road/Bridge Maintenance
- Traffic Engineering

For the Irmo High class, the draft project outline was adjusted to include instruction in 5 areas:

- Introduction
- Road Design
- Surveying
- Road Construction
- Traffic Engineering

The pilot project is set up to meet with the 11th Grade class at Irmo High School one day a week from 2:00 to 3:30 for 6-8 weeks. Several instructors will be used for this pilot project based on the subject matter being reviewed. These instructors will be District Engineering professionals with an expertise in the areas being reviewed. Classroom activities will be used, as well as field trips to active construction projects, design centers, and other areas. A mock engineering project will be developed on the school property to simulate the engineering process. This project will follow the pilot project classroom itinerary by introducing hands on exercises to the class that are relevant to and support the classroom discussions. For instance, the classroom surveying segment will include a field exercise where the students will use surveying equipment on school property. The surveying exercise will collect field data that will be used in the subsequent segment,
Road Construction. Engineering tools, such as computers and software, surveying instruments, and testing equipment will be furnished by SCDOT for this program. All costs associated with this program will be indirect and absorbed by SCDOT.

As with any project, there are potential obstacles and pitfalls to this program. Obviously, if schools are not interested in the career clusters approach to education in High School, SCDOT will have a difficult time finding a venue to present engineering concepts to students. The same principals would be applicable in a physics or natural sciences class, and SCDOT could contact these instructors for assistance in accommodating our program. If several schools are interested in the program at the same time, human resources could be an obstacle. SCDOT will be very careful to deliver only what the school wants, and this program will be presented as a very flexible tool for use in their engineering/science classes. It is our desire to make contact with as many students as possible. This program can be adjusted from a one-week introduction or a 15-week in-depth review of engineering. However, the District has a limited number of professionals to present these topics, and must be mindful of its agency responsibilities as well. The length and content of the program may have to be adjusted to meet demands. And lastly, without feedback and future contact from the students who participate in the program, it will be very difficult to assess the success of the program.

SCDOT will be closely monitoring the progress of this program. Meeting with school officials will be held periodically during the year and a follow-up review with instructors, officials and students will be held at the end of each year. Survey forms will be provided to all students at the end of the program, and will be used to track the career choices made by the students who participated in the program. These surveys, found in
Appendix B, will be voluntary and will ask for a mailing address so that they can be contacted in 2 years. Those 11th graders will be freshmen in college, and will have a general idea of their career choice by then. The follow-up survey will ask about career choices, and what impact, if any, the career clusters program in high school, and the role SCDOT had in the career clusters program had on their choice.

This program is designed to accomplish two things. Ultimately, this program will steer students towards a career in Civil Engineering with SCDOT. If one student per year were to follow this path, the program would be considered a success. However, there are other benefits to this program that can be realized without attracting civil engineers to SCDOT. As stated earlier, most Americans don’t understand what engineers do. This program should present a basic understanding of engineering to all students. If 99 out of 100 students who go through this program choose to be lawyers and doctors instead of engineers, at least they take with them some understanding of what engineers do and the role they play in society. This knowledge may help them in their chosen career, and may be passed on to future generations as they contemplate career choices, which in itself will help make this program a success.

The ultimate success of the project cannot be assessed for several years after implementation. There are several indicators that SCDOT will monitor during this time to assist in evaluating the progress of the program. One is enrollment trends at in-state engineering schools. Of course, national trends also affect local enrollments, so consideration must also be given to those. Ultimately, when the program reaches out to numerous schools across the Midlands and even into other areas of the state, we can begin to poll in-state applicants and new hires if they were exposed to this program and if so,
did it have any bearing on their decision to begin their career at SCDOT. While this information is not available for several years, SCDOT will have to rely on the exit surveys and feedback from students to implement changes and improvements to the program each year.

SCDOT has a great opportunity to attract and recruit Civil Engineers. This program’s objectives will help educate and prepare this next generation of Civil Engineers, who will be responsible for building the roads and bridges to this state’s future.
APPENDIX A
INTRODUCTION
INTRODUCTION

I. What is Engineering?

A. Engineering is the art of applying scientific and mathematical principles, experience, judgment, and common sense to make things that benefit society. Engineers design bridges and important medical equipment as well as processes for cleaning up toxic spills and systems for mass transit. Engineering is the process of producing a technical product or system to meet a specific need.

B. “Engineering is the application of science to the common purpose of life”. Count Rumford

C. "Scientists study the world as it is, engineers create the world that never has been." Theodore Von Karman

D. 72% of all astronauts who have traveled to space are engineers, not scientists.

E. Engineers are problem solvers, people who search for quicker, better, less expensive ways to use the forces and materials of nature to meet tough challenges. Throughout the ages, from the building of the pyramids to the landing on the moon, engineers have been the shapers of progress.

F. Engineering is organized by traditional academic fields of study. The five largest are chemical, civil, electrical, industrial, and mechanical.

II. What is SCDOT?

A. SCDOT is the third largest state agency in South Carolina.

B. SCDOT employs roughly 5,400 employees.

C. SCDOT is charged with building and maintaining the state’s highway system as well as providing mass transit services.

D. SCDOT maintains the nation’s 4 largest system of highways
   1. 42,000 miles or roadway
   2. 8,000 bridges

E. SCDOT employs roughly 700 engineers (mostly civil) to plan, design, construct, and maintain this system of highways.

F. SCDOT has over 1 billion dollars in construction ongoing at any time.

G. Civil Engineers at SCDOT currently hold positions of Director of Construction, Director of Maintenance, Director of Traffic Engineering, State Highway Engineer, etc.

H. SCDOT has had several Civil Engineers ascend to the position of Executive Director of the agency.
III. What is Civil Engineering?

A. The Past

1. Civil Engineers have, throughout history, designed and built facilities that have advanced civilization and have provided for a higher standard of living.
2. Egyptian Pyramids were built in 2980 BC and continue to awe and amaze visitors today.
3. The French contributed a great deal to the progress of this profession. One of the most innovative civil engineers of all time was Alexander Gustave Eiffel, best known for his ingenious design of the Eiffel Tower. He also designed the support structure of the Statue of Liberty.
4. The Panama Canal, one of the greatest engineering achievements in the world, links the Atlantic and Pacific Oceans to shorten a ship's voyage between New York and California.
5. The Hoover Dam was completed in 1935 and continues to generate unparalleled benefits to the nation through regulation of the Colorado River for water conservation, power production, flood control, recreation, and fish and wildlife enhancement.
6. The Golden Gate Bridge, designed by Joseph Strauss and Charles Ellis, was placed in service in 1937 and was the longest single span (4,200 feet) bridge in the world at the time. It remains today as an international symbol of civil engineering innovation.

B. The Present

1. Civil engineering is about community service, development, and improvement. It involves the conception, planning, design, construction, and operation of facilities essential to modern life, ranging from transit systems to offshore structures to space satellites. Civil engineers are problem solvers, meeting the challenges of pollution, traffic congestion, drinking water and energy needs, urban redevelopment, and community planning.
2. One of the most current and exciting civil engineering feats has linked Britain and France for the first time in 8,000 years. The Channel Tunnel (or "Chunnel") is among the largest engineering projects in history and the longest undersea tunnel ever built. High-speed trains are now crossing the English Channel on a regular schedule.
3. These are just a few examples which illustrate civil engineering as a lively and innovative profession. One of the greatest rewards of civil engineering is to see your own enduring creation helping to improve the quality of life.
C. The Future

1. Our future as a nation will be closely tied to space, energy, the environment, and our ability to interact with and compete in the global economy. Our nation also faces an aging infrastructure that is nearing its life expectancy. As a civil engineer, you will perform a vital role in linking these themes and improving the quality of life for the 21st century. As the technology revolution expands, as the world's population increases, and as environmental concerns mount, your skills will be needed. There is no limit to the personal satisfaction you will feel from helping to make our world a better place to live. Whatever area you choose, design, construction, research, teaching, or management, civil engineering offers you a wide range of career choices.

IV. Thinking about a career in Civil Engineering?

A. Questions to ask:
   - Do you enjoy solving problems and putting your ideas into action?
   - Are you curious about how things work and how to make them better?
   - Are you interested in improving the environment?
   - Are you socially aware and interested in helping people live better?

B. These are some of the qualities shared by all civil engineers. They also make sound decisions and are good communicators, using speaking, writing, and listening skills. If you share some of the traits, civil engineering may be the perfect career for you.

C. Any career begins with a successful, well-rounded education. To meet the challenges of civil engineering, you should prepare with a variety of high school courses. A solid high school preparation should include courses in: English, algebra plane geometry, trigonometry, advanced mathematics, chemistry, physics, and a foundation in history, social studies, or foreign language. Computer courses are also highly recommended.

D. After high school, you may choose from hundreds of institutions that offer accredited civil engineering or technology programs. Entrance into a civil engineering or technology program may be at the freshman level following high school, or at the junior level after completing an approved two-year junior college program. The programs offered by different schools vary in details and you should request a catalogue from each of the schools you may be interested in before applying for admission.
E. You can choose a program that best fits your needs. Most programs require at least four years of study for the civil engineering bachelor's degree. Some offer a five-year program leading to a bachelor's degree after the fourth year, and a master's degree after the fifth. A typical four-year program consists of: one year of mathematics and basic sciences; one year of engineering science and analysis; one year of engineering theory and design; and one year that includes social sciences, humanities, communications, ethics and professionalism, along with electives which complement your overall education. Typically, your first three years in college provide you with a solid foundation in science, with introductory courses in all of the civil engineering technical areas. This gives you an overview of the field, and helps you select an area in which to specialize. Generally, it is at this point, in your junior or senior year, that you choose your specialty. Since many of the specialty areas are closely interrelated, it is easy to move between different specialty areas as your career progresses. Regardless of your decision, your problem-solving and people skills will give you many career choices and opportunities.

F. After receiving your BS degree, you can choose to go to work or further your education with a MS or PhD degree in engineering.

V. Civil Engineering is FUN!

A. Suspension Bridge Activity (30-40 minutes)

1. **What's the secret of suspension?**
   A suspension bridge's cables are beautiful to look at, but they also enable the bridge to cross large spans. Make a model suspension bridge to see how it works.

2. **What You Need**
   - 7 drinking straws
   - masking tape
   - dental floss or thread
   - scissors
   - 4 large paper clips
   - paper cup
   - pennies or metal washers
   - ruler

3. **Make a Prediction**
   After you test the strength of the beam bridge in Step 4, predict how many pennies your suspension bridge will support.

4. **Try It Out**
   1. Cut two short pieces of straw, each 3 centimeters (about 1.25 in.) long. For each tower, tape two straws on either side of a short piece of straw, as shown. Tape the long straws together at the top, too.
2. Tape one tower to the edge of a desk or chair. Tape the second tower to a second desk or chair of the same height. Position the towers 17 cm (about 7 in.) apart.
3. Place another straw between the towers so its ends rest on the short pieces. This straw is the bridge deck. Now you have a simple beam bridge.
4. Make a load tester by unbending a large paper clip into a V-shape. Poke the ends of the paper clip into opposite sides of a paper cup, near the rim. Use a second paper clip to hang the load tester over the bridge deck. Record how many pennies the paper cup can hold before the bridge fails.
5. Now change the beam bridge into a suspension bridge. Tie the center of a 100-cm (about 4 ft.) cable around the middle of a new straw. Place the straw between the towers. Pass each end of the cable over a tower and down the other side.
6. To anchor the bridge, wrap each end of the cable around a paper clip. Slide the paper clips away from the tower until the cable pulls tight. Then tape the paper clips firmly to the desks. Test it again.

5. **Explain It**
   Can you identify the forces acting on the loaded suspension bridge? Which parts of the bridge are in compression? Which parts are in tension?

6. **Build on It**
   Can you design and build a straw suspension bridge that spans a gap twice as wide and supports the same amount of weight? What parts of the bridge design need to change? Try it.

VI. **Conclusion**

A. Civil Engineering is a very rewarding career. It offers challenges that impact our everyday life. SCDOT relies upon Civil Engineers to accomplish its mission, which is to “Build and Maintain Roads and Bridges for the people of South Carolina.” For the next several weeks, SCDOT will be visiting your class to offer insights into the different areas of expertise one can develop within Civil Engineering, and how we, as Civil Engineers, use our skills and knowledge to improve your quality of life.
WHAT is Highway Construction?

Primary Highway System (9,410 miles)

$480,000,000

The South Carolina Department of Transportation awarded over $480 Million in road construction contracts in 1998.

WHAT is Highway Construction?

Secondary Road System (31,263 miles)

WHO is Highway Construction?

The Highway Construction TEAM is normally made up of two players:

• A Government Agency
• Federal Government
• State Government
• Local Government

WHAT is Highway Construction?

Interstate Highway System (829 miles)
WHO is Highway Construction?

**Government Agency**
- FHWA, SC DOT, County, and Local Governments have a responsibility to provide safe roads and bridges for the public.
- They plan, develop, and design most projects with their own staff.
- They manage construction and maintenance contracts awarded to contractors, and they maintain the highway system with their own forces.

**Contractor**
- Contractors are in the business of providing construction services for a profit. They specialize in grading, paving, bridge construction, etc.
- They are a business and must compete with other contractors to get Government contracts.

**Engineering Firms**
- Engineering Firms generally furnish engineering and surveying services.
- They can work for either the Government Agency or the Contractor.

**Career Areas**
- There are 4 stages in the life of a highway:
  1. Planning
  2. Project Development
  3. Contract Administration/Construction
  4. Maintenance

**Planning**
- During the planning stage, a Government Agency's short and long range highway needs are identified and prioritized. To accomplish this, the following tools are used:
  - Public Hearings

**WHO is Highway Construction?**

**FHWA**
- FHWA, Federal Highway Administration, works under US Department of Transportation.

**SC DOT**
- SC DOT, South Carolina Department of Transportation.
During the planning stage, a Government Agency's short and long range highway needs are identified and prioritized. To accomplish this, the following tools are used:

- Public Hearings
- Transportation Models
- Traffic Studies
- Environmental Studies
- Funding Forecasts

Project Development involves taking the information and recommendations of the planning group and developing projects that will meet those needs.

- All functions of Project Development can be performed by the Government Agency or a consultant group, such as an engineering firm.
Project Development includes:
- public hearings
- road and bridge design
- location surveys
- hydrology and environmental studies
Project Development

- public hearings
- road and bridge design
- location surveys
- hydrology and environmental studies
- research of properties and right-of-way acquisition for new roads and bridges.

Construction

- The government agency coordinates all activities associated with a project, including:
  - utility relocation
  - traffic control

Career Areas

- There are 4 stages in the life of a highway:
  - Planning
  - Project Development
  - Contract Administration/Construction
  - Maintenance

Right-of-Way Acquisition

- The construction of roads and bridges is usually accomplished under a contract between the government agency and the contractor
- The government agency is responsible for ensuring that the contractor builds each project in accordance with the plans and specifications for that project.

Traffic Control

- The government agency coordinates all activities associated with a project, including:
  - utility relocation
  - traffic control
  - project layout and inspection
The Government Agency may hire an Engineering Firm to do some or all of its work. The Contractor performs all work as specified in the contract.

Contractors
- Bridge Contractors
- Subcontractors: Concrete Specialists
- Subcontractors
- Pavement Markings Specialists

Construction
- The Government Agency coordinates all activities associated with a project, including:
  - Utility relocation
  - Traffic control
  - Project layout and inspection
  - Material sampling and testing
There are 4 stages in the life of a highway:
1. Planning
2. Project Development
3. Contract Administration/Construction
4. Maintenance

Maintenance of Roads and Bridges is the responsibility of the owner, usually the Government Agency. Maintenance is responsible for maintaining the existing system of roads and bridges in a manner that provides for the safety of its users.
Maintenance
- Patching Potholes

Maintenance
- Maintenance is responsible for most work on existing roads, including:
  - Patching Potholes
  - Cleaning Ditches and Pipes

Maintenance
- Cleaning Pipes and Ditches

Maintenance
- Maintenance is responsible for most work on existing roads, including:
  - Patching Potholes
  - Cleaning Ditches and Pipes

Maintenance
- Mowing Grass

Maintenance
- Maintenance is responsible for most work on existing roads, including:
  - Patching Potholes
  - Cleaning Ditches and Pipes
  - Mowing the Grass
  - Painting Lines

Maintenance
- Erecting Signs
Maintenance

Maintenance is responsible for most work on existing roads, including:
- Patching Potholes
- Cleaning Ditches and Pipes
- Mowing the Grass
- Painting Lines
- Erecting Signs
- Installing & Maintaining Signals

Maintenance

Maintenance is also responsible for maintaining its fleet of vehicles and equipment in their own repair shops. Maintenance also produces most of the signs it uses in its own sign shop.

Maintenance

Installing and Maintaining Signals

Maintenance

Repairing Sidewalk and Gutters

Maintenance

Vehicle Repair Shop

Maintenance

Sign Shop

Maintenance

Maintenance is also responsible for maintaining its fleet of vehicles and equipment in their own repair shops. Maintenance also produces most of the signs it uses in its own sign shop. Maintenance also repairs most traffic lights and signals through its signal shop.
Maintenance

- Signal Shop

Maintenance

- Maintenance regulates what is done within Highway Right of Way through Encroachment Permits.
- Maintenance regulates who uses the highways through Oversize Permits.
- Maintenance keeps a complete pavement evaluation program up to date and makes recommendations for resurfacing.

Where Do You Fit In?

- There are normally many opportunities for placement in "Entry Level" positions.

What Is an Entry Level Position?

- Entry Level positions are those that require a minimum amount of training, skill, or education to perform the job.
- All three members of the TEAM have opportunities in entry level positions.

Laborers

- Responsibilities of a Laborer might include:
  - Using hand tools to clean ditches, curb and gutter, and sidewalk, or cut down vegetation.
  - Operating small and large mechanical equipment, such as rollers, backhoes, and motor graders.

Laborer

- The Laborer may install or maintain traffic signals, signs, pavement markings, etc.
- The Laborer may repair vehicles and equipment in a Vehicle Repair Shop.
- The Laborer may manufacture signs in a Sign Shop.
- The Laborer may supervise others.

Laborer

- The Laborer must be able to perform manual labor in an outdoor environment.
- The Laborer should possess a valid Driver's License, preferably a CDL.
- The Laborer should be knowledgeable in the operation and repair of heavy equipment.
- Laborers may be asked to work long hours during construction season.

Laborer

- Salary Range for Laborers:
  - $6.00/HR to $15.00/HR
- Government Agencies, Contractors, and Engineering Firms hire Laborers
Truck Drivers

- Responsibilities of a Truck Driver may include:
- Operating a Dump Truck, Bucket Truck, Tractor Trailer, or other large truck.
- Performing any pretrip inspections as required.
- Performing any light mechanical work on truck, such as tire change, oil change, adjusting brakes, etc.

Performing any light mechanical work on truck, such as tire change, oil change, adjusting brakes, etc.

Truck Driver

- Truck Drivers may be asked to work in all types of driving conditions.
- Truck Drivers may have to work early or late depending on the work.
- Truck Drivers are required to have a Class A or B Commercial Driver's License.
- CDL Drivers are subject to drug and alcohol testing.

Truck Drivers

- Truck Drivers can expect to earn:
  - $6.00/HR to $11.00/HR
  - $0.25 to $0.35 per mile.
- Government Agencies and Contractors hire Truck Drivers

Technicians

- A Technician may be responsible for staking out construction work on projects. The Technician must be able to take the information from a set of plans and furnish it to the contractor in the form of stakes, etc. on the project.

Technicians

- Technicians should have a background in construction and engineering.
- Technicians perform most of their work in the field, but some office work is also required.
- Technicians must have good math and computer skills, and be able to negotiate the rough construction environment.

Technicians

- Technicians can expect to earn:
  - $6.00/HR to $20.00/HR
- Government Agencies, Contractors, and Engineering Firms hire Technicians.
A Draftperson can expect to earn:

$8.00/HR to $20.00/HR

Government Agencies, Contractors, and Engineering Companies all hire Draftpersons.

A Civil Engineer may be responsible for the overall design of a large bridge, with a staff of draftspeople, technicians, and other engineers.

Civil Engineers require a degree in engineering, or an extensive background in engineering and construction.

Civil Engineers must work in all environments, and often work long hours.

Careers

Civil Engineers

Careers

A Civil Engineer may be responsible for managing an entire Maintenance Unit with a staff of laborers, technicians, and other engineers.

Civil Engineers may be responsible for overseeing several large construction projects with a staff of technicians and other engineers.

Careers

Project Managers

Careers

Civil Engineers can expect to earn:

$30,000 to $100,000 per year

Government Agencies, Contractors, and Engineering Companies hire Civil Engineers.

Project Managers may be responsible for supervising the work, keeping up with costs, and scheduling equipment on several complex construction projects at the same time.

Project Managers may prepare bids on projects.
Careers

Project Managers can expect to earn:

$30,000 to $100,000 per year

Project Managers usually work for a Contractor, but may work for an Engineering Firm.

Careers

Careers with Contractors include:

Company Owner

Company Owners own or are partners in ownership of contracting and subcontracting companies.

Owners dictate the direction and magnitude of the work it performs.

Careers

Owners require extensive background in the construction industry.

Owners require extensive understanding of business laws.

Owners require $$$, but have the potential to make $$$

Careers

Programs to Assist Owners

DBE Program

Established to assist minority and female owned businesses establish themselves in the construction industry.

Offers assistance in preparing bids, scheduling equipment, submitting invoices, etc.

Careers

Applications are accepted at all Government Agency offices.

Want Ads are a good place to find opportunities with Contractors and Engineering Companies.

Sign Me Up!
PROJECT DEVELOPMENT
The Program Development Office is organized into two sections:

- Program Development West, Value Engineering and Preliminary Design
- Program Development East and "C" Project Development
II. MISSION

The primary mission of the Preliminary Design Section is to determine the preliminary design documents and prepare them for submission to the appropriate regulatory bodies. These documents include the Preliminary Design Report, Preliminary Environmental Impact Statement, and Preliminary Engineering Plan. The Preliminary Design Section is responsible for analyzing alternatives for the proposed project and determining the best design solution. They work closely with the construction and public involvement teams to ensure a smooth transition from preliminary design to construction.

III. 27-in-7

How is South Carolina building 27 years of road and bridge projects in just 7 years?

Simplified Project Development Process

<table>
<thead>
<tr>
<th>Milestones</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Initial Field Review</td>
<td>0%</td>
</tr>
<tr>
<td>2. Preliminary Plans Revised as Necessary</td>
<td>0%</td>
</tr>
<tr>
<td>3. Project Planning Report Submitted</td>
<td>0%</td>
</tr>
<tr>
<td>4. Environmental Studies Completed</td>
<td>0%</td>
</tr>
<tr>
<td>5. Environmental Document Submitted to FHWA for Approval</td>
<td>0%</td>
</tr>
<tr>
<td>6. Environmental Document Approved/Received From FHWA</td>
<td>0%</td>
</tr>
<tr>
<td>7. Public Hearings Conducted</td>
<td>0%</td>
</tr>
<tr>
<td>8. Revise Plans as Required</td>
<td>0%</td>
</tr>
<tr>
<td>9. Pre-Construction Activities Planned and Approved</td>
<td>0%</td>
</tr>
</tbody>
</table>

Simplified Project Development Process (cont.)

<table>
<thead>
<tr>
<th>Milestones</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. Pre-construction Activities Planned and Approved</td>
<td>0%</td>
</tr>
<tr>
<td>11. Pre-construction Activities Completed</td>
<td>0%</td>
</tr>
<tr>
<td>12. Pre-construction Activities Completed and Approved</td>
<td>0%</td>
</tr>
</tbody>
</table>

Project Cost Analysis

The project is comprised of Project Cost Analysis sections labeled I through IV. Each section provides an overview of the project's cost breakdown, including project costs, owner's costs, and contractor's costs. The sections also include detailed cost breakdowns for specific project components, such as design, construction, and environmental studies.
Accelerated Program Summary

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount (in millions)</th>
</tr>
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<tbody>
<tr>
<td>State Infrastructure Bank Projects (bonded)</td>
<td>$2.70</td>
</tr>
<tr>
<td>Metropolitan Planning Organization</td>
<td>$0.62</td>
</tr>
<tr>
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<td>$0.31</td>
</tr>
<tr>
<td>Statewide Implementation Program (bonded)</td>
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<tr>
<td>System Intermodal Connectivity</td>
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<tr>
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</tr>
<tr>
<td>Total</td>
<td>$5.90</td>
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</table>

*Debt service to be paid with federal funds.*

**SCDOT Facts**

- 4th largest state-maintained highway system
- 42,000 miles system
- 3,253 miles of interstate
- 8,100 state-maintained bridges
- 9,200 miles of primary U.S./SC roads
- 31,000 miles of secondary roads
- 65% of SC road miles are state-maintained; the national average is 21%.
- 60% of state-maintained roads do not qualify for federal aid.

**Construction & Resource Manager (CRM)**

- CRM selected to help manage and complete 200 programs in 7 years
- Fluor Daniel and Parsons Brinckerhoff LPA Inc will assist SCDOT Program Managers
- Each CRM will assist in approximately $750 million dollars, with 30 full-time employees.
- The partnership helps avoid hiring an estimated 500 employees to meet the additional workload.

**Construction and Resource Manager (CRM) Concept**

- The CRM is an extension to the Department's current staff
- Will not replace the current decision-making process
- The Department will make all final decisions, no responsibilities are being abdicated.

**Accelerated Programs**

- MPO, COG, SIB, Interstate and Connecting projects
- 27 years of work is being compressed into an average of 7 years
- Total of programs over next 7 years equals approximately $5 billion

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*Debt service to be paid with federal funds.*
SCDOT Revenue Sources

- SCDOT is funded primarily by motor fuel taxes.
- The agency has a few other small revenue sources, including the state highway fund created from earmarked federal funds.
- South Carolina is a 20-cent per gallon state, with a significant per gallon.
- The state has a 25-cent per gallon fee.
- SCDOT does not have a significant per gallon fee.

State Motor Fuel Tax

FY 2000-2001 Projections

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Motor Fuel Tax</th>
<th>Total Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2001</td>
<td>$10,000,000</td>
<td>$20,000,000</td>
</tr>
</tbody>
</table>

Gas Tax Return to South Carolina

- $1.00 return
- 73% return
- 26% return

Comparison of Southeastern States

<table>
<thead>
<tr>
<th>State</th>
<th>Motor Fuel Tax</th>
<th>Total Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>State 1</td>
<td>$5,000,000</td>
<td>$10,000,000</td>
</tr>
<tr>
<td>State 2</td>
<td>$6,000,000</td>
<td>$12,000,000</td>
</tr>
</tbody>
</table>

NO QUESTIONS
FUNCTIONS AND RESPONSIBILITIES OF ROAD DESIGN

Road Design’s Mission
Our mission is to prepare and maintain highway bid documents: such as designing road plans, preparing standard drawings, creating special provisions and determining the engineer's estimate for highway construction projects to be let to construction applying current design specifications and standards using the state of the art equipment in keeping with the Department's Mission Statement for the safe and efficient use of the traveling public.

Organizational Chart

Roadway Design Groups
Project Facilitators
Ned Joye
Bob Wicker
Peter Yeh
Plan Production

10 Roadway Design Groups of 6-8 Engineers and Technicians each.

Roadway Design Groups

Roadway Design Groups use state-of-the-art Computer Aided Design and Drafting (CAD) equipment to take a Roadway project from conceptual design phase through drafting, design, and calculations to produce plans for Right of Way and Construction.

Design Automation

During the plan development process, Design Groups coordinates with other design offices such as:
- Program Managers, Project Engineers, Preliminary Design, Budget Design
- Hydrology, Pavement Design, Pavement Marking, Traffic Control, and more

to ensure Project meets the AASHTO and SCDOT design specification.

Data Sharing Team Work

Road Design → Hydrology Design Automation.

Hydrology → Roadway Design Automation.
Roadway Design Groups

Other Duties of Design Groups:
- Review CRM's Plans (Coordinators)
- Provide Construction Support (SMI data)
- Visualization

Creating SMI Data for Construction

Benefits of using SMI files
- Being able to set up the instrument out of traffic & reduce the number of people needed in the roadway.
- By simply switching chains in the data collector, you may perform different layout tasks from the same setup.
Digital Terrain Model

3D Modeling

Visualizations

Visualizations

Visualizations

Visualizations

Geostructural Design Group

- Designs Box Culverts
- Designs Earth Retaining Systems
- Developing Specifications and Acceptance Criteria for Vendor-supplied Wall Systems
- Reviews project-specific structural items submitted by Contractors and Suppliers
Road Design

CADD Management

- Provide CADD Hardware and Software Technical Support to Road Design CADD operators and others.
- Provide Plotting Service to all CADD users in the headquarters building.
- Automate the engineering calculation and drafting.

Road Design was the first DOT office in 1995 to begin applying web technology to assist in plan production.
Scanning

Plans scanned through FY2002

- Approximately 281,796 individual sheets
- 98,000 sets of Interstate, Primary and Secondary Construction Plans are available in the Plan Library for all DOT statewide.

Organizational Chart

Engineering/Consulting Services
Ray Amick
**Engineering Support**
- Researches Technical Manuals & Advisory Materials
- Prepares public hearing displays
- Coordinates the development and updating of engineering reference materials
- Creates and maintains Standard Drawings for Road Construction
- Provides Daily "on call" assistance with Standard Road Design Applications
- Prepares and presents Training Classes

**Design Services Group**
- Performs QA/QC on all R/W and Construction plans
- In 2000, developed Special Drawings and Plans for first Median Cable Barrier project in South Carolina.
- Prepares plans for RR Cable Barrier and Warning Projects for 35.5 miles.
- Checks proposal against final contract plans prior to the Letting.
- Performs QA review of CRM right of way and construction plans.
- Develops Interstate Rehabilitation plans

**Consultant Services**
Responsible for the coordination of Consultant projects requiring:
- Contract assistance,
- Scope of service reviews,
- Progressive estimate reviews, and
- Plan reviews

**Organizational Chart**

**Operations Center**
- Receives survey and assigns to squads
  - Received 53 surveys in 2002
- Prepares minor construction/maintenance project plans, such as, resurfacing, sidewalks, and/or drainage projects
- Coordinates reproduction of plans and submits to Right of way, Districts, Federal Highway Administration and Highway Lettings
- Performs final review of plans prior to Letting; then creates the contract file to be used by Specifications & Estimates, Contract Administration, & Preconstruction Management

**Contract Documents Group**
Jim Frick
Specifications and Estimates Group

➢ Prepares Contract Proposals for Monthly Letting (250 Proposals in 2002)
  • Special Provisions
  • Contract Completion Date
  • DBE Goals
➢ Computes Estimated Construction Costs for Projects in the Monthly Highway Letting
  • Estimated Cost - $405,013,531.21
  • Actual Low Bid - $380,749,049.63
  • Difference - 6.05%

Engineering Reproduction Services

• Provide necessary prints for Field Reviews, Right of Way, Districts and Highway Letting
• Provide prints to Program Managers, Bridge Design, Hydrology, Utilities, Traffic Engineering, Planning (maps) and Plans Storage

† In FY2002 printed 5,735,980 square feet including maps, road and bridge plans, and proposals.

Engineering Reproduction Services

Right of Way

Proposals 14,695
Maps 19,110 copies

ERS
Prints and plans for engineering publications

9,796 sets of Construction Plans for

Districts and Highway Lettings

Plans Storage

✓ Maintains plans for permanent archiving and retrieval for internal and general public use
✓ Scans to file stored plans in an attempt to minimize wear and tear to the old plans
✓ Printed 244,427 sq. ft. of scanned archived plan sheets for SCDOT employees, CRM's, the general public, other state agencies, federal agencies and city governments

Plans Stored at Shop Road

- 2,300 sq. ft. of space stores
- 2 million plan sheets

Organizational Chart
BRIDGE DESIGN
THE BRIDGE DESIGN SECTION HAS THE RESPONSIBILITY OF DESIGNING BRIDGES THROUGHOUT THE STATE OF SOUTH CAROLINA.

EVEN THOUGH WE HAVE THE EXPERTISE TO DESIGN BRIDGES IN-HOUSE, SOME ARE CONTRACTED OUT TO CONSULTANTS WHOSE WORK IS REVIEWED BY DOT STAFF.

THEM mission of the Bridge Design Section is to provide, through quality engineering service and the efforts of all personnel, safe and economical highway structures which are in harmony with their surroundings.
Design Capabilities

• STRUCTURAL
• GEOTECHNICAL
• SEISMIC & SPECIAL PROJECTS
• COMPUTER AIDED DESIGN AND DRAFTING

ASSISTANT BRIDGE DESIGN ENGINEERS & STAFF

• PROGRAM BRIDGES.
• ASSIGN PROJECTS TO DESIGN GROUPS.
• REVIEW PLANS DESIGNED IN-HOUSE FOR QUALITY CONTROL.
• WRITE SPECIFICATIONS AND SPECIAL PROVISIONS FOR BRIDGE ITEMS.
• SERVE ON VARIOUS COMMITTEES, DEVELOP BRIDGE DESIGN BUDGET, AND OTHER ITEMS AS NECESSARY.

Committees

• AASHTO BRIDGE SUBCOMMITTEE - THIS COMMITTEE IS NATIONAL AND WRITES AASHTO SPECIFICATIONS
• VARIOUS NATIONAL COOPERATIVE RESEARCH PROJECT (NCHRP) COMMITTEES
• TRANSPORTATION RESEARCH BOARD (TRB) COMMITTEES
• HITEC COMMITTEES (RESEARCH TYPE)
• SCDOT/AGC BRIDGE SUBCOMMITTEE

Committees

• JOINT PCI/SCDOT COMMITTEE
• QUALITY ASSURANCE PROGRAM FOR PORTLAND CEMENT IN SOUTH CAROLINA
• NEW PRODUCTS COMMITTEE
• DESIGN-BUILD COMMITTEES
• VARIOUS OTHER COMMITTEES FOR RESEARCH, CONSULTANT SELECTION, TOI, ETC.

Bridge Project Management

• MANAGE PROJECTS FROM PROGRAMMING UP TO LETTING FOR:
  ➢ FAST TRACK BRIDGE PROJECTS
  ➢ BRIDGE REPLACEMENT PROJECTS
  ➢ OTHER PROJECTS

Bridge Project Management

• ALSO REPRESENT BRIDGE DESIGN IN THE BRIDGE MANAGEMENT SYSTEM - INTEGRATED APPROACH WITH BRIDGE MAINTENANCE AND DESIGN - WILL COVER LATER.
Bridge Project Management
120 projects managed
- 116 bridge replacement projects
  - US 1 over Lynches River
  - SC 41 over Black River
  - SC 15/401 over Great PeeDee River
- 4 Interstate maintenance bridges
- Stono (Maybank)
- Limehouse (Managed by consultant group)
- These are under construction, support function

Bridge Consultant Management
CRM Coordination
- GENERAL CONSULTANT OVERSIGHT AND REVIEW
- CRM COORDINATION AND REVIEW AS IT RELATES TO BRIDGE DESIGN
- PROJECT MANAGEMENT FOR CONSULTANT PROJECTS

Bridge Consultant/CRM Management
- PROJECT MANAGEMENT FOR STRUCTURAL CONSULTANTS (WE PROJECT MANAGEMENT FOR MAJOR PROJECTS (MAYBANK, LIMEHOUSE AND SC 15/401).

Bridge Consultant/CRM Management
- SHOP PLAN MANAGEMENT
  - Approx. 190 Sets of plans handled and reviewed annually
- ARCHIVING ORIGINAL AND FINAL BRIDGE PLANS

Bridge Geotechnical Section
- DESIGN FOUNDATIONS FOR ALL IN-HOUSE DESIGNS
- REVIEW CONSULTANT DESIGNS
- Provide geotechnical guidance for walls includes mechanically stabilized earth (MSE) walls
- PROVIDE EMBANKMENT DESIGN AT BRIDGE ENDS

Bridge Geotechnical Section
- PROVIDE CONSTRUCTION SUPPORT INCLUDING PILE HAMMER ANALYSIS, AND DRILLED SHAFT INSTALLATION ANALYSIS
- WRITE SPECIFICATIONS AND SPECIAL PROVISIONS FOR GEOTECHNICAL ITEMS
- GENERAL GEOTECHNICAL SUPPORT
**SEISMIC/SPECIAL PROJECTS TEAM**

- Seismic design resource for both in-house and consultant projects
- Special projects such as composites, aluminum decks, stainless steel reinforcing, new products

**CADD Management**

- We have a CADD expert that supports bridge engineers with latest software and equipment

**Automation**

- Developing automated computer design and drafting programs to improve productivity
- Integrating the design and drafting programs

**Bridge Design Team**

- We have 5 design teams of 3 to 5 engineers each

**Bridge Design Team**

- Using state of the art computers, CADD equipment and software, bridge design teams take a bridge from the early concept phase through the design and drafting phase to produce a set of plans to be used in construction.

- Other responsibilities of the design teams:
  - Review shop plans
  - Provide construction support
  - Other design work as necessary
  - New duty - program managing for some projects
Bridge Design Teams

- THESE TEAMS CONFER WITH THE FHWA, OTHER DEPARTMENT ENGINEERS, ROAD DESIGN, HYDROLOGY, UTILITIES, TRAFFIC ENGINEERING, BRIDGE CONSTRUCTION AND OTHER DEPARTMENT PERSONNEL TO HELP PRODUCE THE BEST POSSIBLE PLANS AND STRUCTURE.

Brief History of Bridge Replacement

OR

WHERE DOES THE MONEY COME FROM?

Brief History of Bridge Replacement

- BRIDGES ARE REPLACED BY USING THE FOLLOWING FUNDS
  - Federal Funds - Approximately $50M per year from TEA 21 (STIP). This includes Bridge Replacement, Bridge Inspection and Bridge Painting
  - $60 Million in 2000 and $67 Million in 2001

Bridge Cost for 2002

<table>
<thead>
<tr>
<th>TYPE</th>
<th>COST/ SQ. FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Aid Highways</td>
<td>$73</td>
</tr>
<tr>
<td>Off-System</td>
<td>$67</td>
</tr>
</tbody>
</table>

Bridge Costs do not include P.E., ROADWORK, R.W. FIELD ENDOR OR CONTROLLORS. IT ONLY INCLUDES BRIDGE CONTRACT CONSTRUCTION COSTS.

Square Foot Cost Trends 1996-2000

- Federal-aid Highways
- Off-System

Bridge Replacements and Rehabs 1986 - 2000 (Including Maint.)

- NO. BRIDGES
- COST (MIL)
Bridge Replacement Needs
January 8, 2001

- State Owned Bridges in S.C.  8206
- Structurally Deficient Bridges  932
- Functional Obsolete Bridges  822
- Bridges Posted                189
- Bridges Closed (Structural)   16

Bridge Management System

- Leader in using bridge management system
  - maintenance using the PONTIS Bridge Management software

Bridge Management System

- Bridge maintenance produces a list of bridges that should be replaced
- Uses PONTIS Bridge Maintenance software
- Many variables considered:
  - USER COSTS (DRIVER COSTS FOR DETOURS, ETC.)
  - TRAFFIC COUNT
  - STRUCTURAL INTEGRITY
  - Estimated life of actual deterioration of bridge to point of required replacement
  - FUNCTIONAL GEOMETRY
  - Funding
  - COST OF REPAIR/rehab

Bridge Management System

- Prepared copies are sent to various districts
  - Input and recommendations
- District engineers return lists with recommendations/additions
- Review of this list by committee
  - Consist of bridge design and maintenance personnel
  - Determines which bridges to program
- Final list to State Highway Engineer for approval
Bridge Management System

The SCDOT "Bridge Management System" proposes and ranks bridge projects by analyzing bridges at the network level and individually by analyzing structural deterioration, maintenance (MR & R), improvement, and replacement needs. It then performs a benefit/cost analysis to rank projects. Engineering judgment is then applied in conjunction with the ranking scenarios.

Bridge Design

Doug McClure, P.E.
SURVEYING
SURVEYS/UTILITIES

Surveys/Utilities Engineer

Surveys Office
- Bruce Lanham, P.E.
- Preconstruction Surveys Manager

Utilities Office
- Mary Smaracko, P.E.
- Utilities Manager

Subsurface Utilities Engineering
- Kevin Deatherage, P.E.
- Subsurface Utility Engineer

Surveys Headquarters Staff
- Coordinate with Preconstruction Staff on all Survey requests
- Supervise and assign work to Regional Survey Groups and GIS Unit
- Manage on-call Remote Photography and Photogrammetric Mapping team
- Set Policy and standard survey practices for SC DOT

Regional Survey Groups
- Conduct field surveys on all Preconstruction projects
- Prepares survey data for electronic transfer to Headquarters
- Receives property layouts, including site research
- Prepares boundary surveys where needed
- Assist District Office staff on surveying needs

Survey Timeframes
Average timeframes based on per-mile or per-project basis:
- Subsurface Investigation
- Aerial Surveys
- Remote Photography
- Photogrammetric Mapping
- Engineering Services
- Invoice

Timeframes affected by many factors: terrain, weather, traffic, density of topography, length of job, and any delayed start.

Survey Data Squad
- Transfer coordinate and elevation data to 2D and 3D CAD files
- Generate all alignment files
- Perform quality control checks on surveys
- Deliver final survey product to Road Design

Average Data Squad time - 1 week
GPS Unit

Establishes horizontal and vertical control monumentation based on State Plane Coordinates.
Determines coordinates and elevations of control points for proposed surveys mapping.
Conducts special surveys as needed.

Utilities Unit

Works with Subsurface Utility Engineer to identify utilities.
Coordinates with the project team to avoid/minimize utility impacts during design.
Recognizes and plans for unallowable relocations.
Identifies relocations that can occur prior to construction.
Reviews and authorizes all Utility Agreements and No cost relocations.
Issues utility relocations on highway contracts if appropriate.
Provides assistance in District Offices on Utility Enforcements.

Agreement Totals - 2002

Utilities Unit
- Authorized 169 Utility Agreements for $24.9 million
- Paid 137 invoices for $15.4 million
- Authorized all no-cost relocations on all federally funded projects.

Railroads Unit

Acts as liaison between SCDOT and all Railroad Companies.
Administers the Department’s Rail Highway Safety Program.
- Identifies railroad crossings.
- SCA 235 projects, All projects under the $2.4 million.
- Secures RR agreements for grade separation projects.
- Maintained by agreements for $1.5 million.
- Secures RR approval for all projects involving projects and longitudinal realignments onto RR right of way.
- Issued 115 crossing applications for $155,000.

Digitized by South Carolina State Library
Subsurface Utility Engineering (SUE)

Method for identifying the location of subsurface utilities at various quality levels (D, C, B, or A):
- Level D: Records research only
- Level C: Records research combined with surveyed above-ground utility networks
- Level B: Directing, Surface geophysical techniques yields X Y coordinates only
- Level A: Locating – Explores utility through varous methods yields X Y Z coordinates

SUE Funding

Fiscal Year 2023 – anticipate spending $1.5 million on SUE
- Since July 1, 2023:
  - Single responsibility for $1.5 million
  - Projects planned 1/2023 and 2/2023
- Expect SUE to cost 1.5% of the construction costs
- Expect savings to be in the area of 2% of the construction costs

For more information...

Surveys Office
- [Contact Information]
- [Contact Information]

Utilities Office
- [Contact Information]
- [Contact Information]

Subsurface Utility Engineering (SUE)
- [Contact Information]
- [Contact Information]
ROAD/BRIDGE CONSTRUCTION
District Construction Operations

The major purpose of the District Construction Offices is to manage contracts for the construction and rehabilitation of roadways and bridges and to ensure that these structures are durable, efficient and safe for the travelling public.

Major Areas of Construction

- Federally Funded
  - Interstate
  - Primary Routes
  - Bridges
- State Funded
  - Secondary Roadways
  - Bridge Replacement
  - C-Fund Projects
  - Maintenance
  - Resurfacing
  - Special Projects by Direction

Construction Statistics

- Construction Field Employees - 530
- Contracts Awarded in 1997
  - 235 Projects
  - $279,121,898
- Total Active Contracts
  - 469 Projects
  - $729,783,326

Phases of Construction

- Pre-Construction Phase
- Contract Management
- Post-Construction Phase

Pre-Construction Phase

- Public Hearings
- Perform Engineering Evaluations (P S & E’s)
- Assist in Right-of-Way issues
- Assemble List of Moving Items
- Identify Utility Conflicts and Initiate Relocation
Pre-Contraction Phase

- Public Hearings
  - Represent the Department
  - Provide Preliminary Plans for Review
  - Discuss Impact with Property Owners
  - Answer Questions

Pre-Contraction Phase

- Perform P & E's
  - Review Preliminary Plans
  - On-site Evaluation by Engineering Project Team
  - Make Engineering Recommendations

Pre-Contraction Phase

- Right-of-Way Issues
  - Meet with Property Owners to discuss:
    - Drainage
    - Access Points
    - Relocation Items
    - Other Impacts

Pre-Contraction Phase

- Assemble List of Moving Items
  - Establish and Verify Right-of-Way
  - Identify Encroachments
  - Make Recommendations for Relocation

Pre-Contraction Phase

- Identify Utility Conflicts and Initiate Relocation
  - Send Proposed Plans to Utility Companies
  - Represent Department in Utility Negotiations
  - Coordinate Relocations
  - Initiate Utility Agreements

Contract Management

- Conduct Pre-Contraction Conference
- Perform Engineering Survey and Layout
- Perform On-site and Off-site Quality Assurance
- Engineering Record Keeping for Payment
- Documentation
- Perform Field Engineering for Changes in Scope
- Perform Final Inspection
Contract Management

- Pre-Construction Conference
  - Utility Conflicts
  - Special Provisions
  - Construction Stages and Sequence
  - Contract Time
  - Subcontractor Approval

Contract Management

- Perform Engineering Surveying and Layout
  - Right-of-Way
  - Slope Staking
  - Horizontal/Vertical Control
  - Line and Grade for Drainage Structures

Contract Management

- Inspection - On-Site
  - Embankment
  - Pipe Installation
  - Asphalt Roadway
  - Concrete Placement
  - Bridge Field Engineering
  - Materials Quality Assurance

Contract Management

- Inspection - On-Site (Cont'd)
  - Traffic Control
  - Erosion Control
  - Special Conditions
    - Nigel Time Work
    - Inselement Weather

Contract Management

- Inspection - Off-Site
  - Provide Certified Inspectors for:
    - Asphalt Plant
    - Concrete Plant
    - Materials Suppliers

Contract Management

- Engineering Record Keeping for Contract Payment
  - Field Notes
  - Monthly Estimates
**Contract Management**

- Documentation
- Correspondence
- Daily Diaries
- Monthly Reports
- Environmental Permits
- DBE Quarterly Report
- Contractor Payroll
- Weekly Wage Reports
- Materials Certification

**Contract Management**

- Perform Field Engineering for Changes in Scope
  - Contractor Negotiations
  - Recommend and/or Approve
    - Supplemental Agreements
    - Contract Modifications
    - Force Work Accounts

**Contract Management**

**Post-Construction Phase**

- Compile and Prepare Final Construction Plans
- Prepare Final Estimate

**Post-Construction Phase**

- Compile and Prepare Final Construction Plans
- Prepare As-Built Plans

**Post-Construction Phase**

- Prepare Final Estimate
  - Materials Certification
  - DBE Certification
  - Recommend Final Payment
Construction Projects and Services
- Railroad Projects
- Intersection Improvement Projects
- Assist Consultants in Engineering Design
- Assist Other State Agencies with Engineering and Construction
- Assistance and Engineering Services for County Transportation Committees

Construction Projects and Services
- Provide Engineering Services for Other Divisions Within the SCDOT
- Provide Building Construction/Remodeling Inspection
- Assist Maintenance During Inclement Weather

Miscellaneous Construction
- Railroad Projects

Miscellaneous Construction
- Intersection Improvement Projects

Construction Innovations
- Design/Build Projects
- Contractor Layout
- Contractor Quality Control
- Total Station Equipment and Surveying Software
- Terramode Software
- Site Manager

Construction Innovations
- Design/Build Projects
**Recommendations**
- Continue Limited Contractor Line and Grade
- Field Input on Contract Completion Dates
- Expand Value Engineering

**District Construction Operations**

SIGN: END CONSTRUCTION

**District Construction Operations**

*QUESTIONS?*
ROAD/BRIDGE MAINTENANCE
District Maintenance Operations

The major goal of the Districts is to provide a road system that is maintained at the highest level possible through the effective and efficient use of the resources available.

Things Common to All Maintenance Activities

- Scheduled Maintenance
- Responsive Maintenance
- Establish Rights-of-Way
- Locate DRWlines
- Dispose of Waste Material
- Knowledge of Applicable Regulations

Major Areas of Maintenance

- Roadway Surfaces
- Rights-of-Way
- Drainage
- Roadside Appurtenances
- Bridge Maintenance and Inspection
- Miscellaneous Maintenance Activities

Major Areas of Maintenance

- Roadway Surfaces
- Rights-of-Way
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Roadway Surfaces

- Patching and Leveling
- Pavement seal
- Pavement with modifier
- Concrete operations
- Pavement repairs
- Pavement markings

Roadway Surfaces

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Roadway Surfaces

- Patching and Leveling
- Pavement seal
- Pavement with modifier
- Concrete operations
- Pavement repairs
- Pavement markings
Major Areas of Maintenance
- Drainage Systems
- Stormwater Management
- Culverts
- Roadside Appurtenances
- Bridge Maintenance and Inspection
- Miscellaneous Maintenance Activities

Roadside Appurtenances
- Driveways
- Turn Lanes and Crosswalks
- Pedestrian Facilities
- Guardrails
- Fences
- Signs
- Rest Areas

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Roadside Appurtenances
- Driveways
- Turn Lanes and Crosswalks
- Pedestrian Facilities
- Guardrails
- Fences
- Signs
- Rest Areas

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Maintenance Summary

The world of maintenance is very dynamic, which makes this field both interesting and challenging. We will continue to be expected to do more with less, so it is imperative that we continue to train and develop a work force capable of doing it into the 21st Century.
TRAFFIC ENGINEERING
Operating South Carolina's Roads

History
- Legislative act in 1937 required reporting of highway accidents to the Highway Department.
- This collection of data on the causes of accidents led to the creation of Traffic Engineering unit.
- First Director was Wilbur Smith.
- Emphasis on operations began with the publication in 1959 of the Uniform Traffic Control Devices Manual.
- First District Traffic Engineer - District 1 in 1944.
- District Traffic Engineers established:
  - District 2 - 1931
  - District 3 - 1932
  - District 4 - 1934
  - District 1 - 1937
  - District 2 - 1938
  - District 3 - 1939

Interaction: Planning
- Traffic Engineering projects funded through STIP:
  - Interstate Signing projects
  - Pavement Marking projects
  - Signal System projects
  - Intersection Improvement projects
  - Congestion Management / ITS Projects / SHEP.
- Work with Planning & MPO staffs on STIP.
- Serves on MPO Technical Advisory Committees.

Interaction: Preconstruction
- Program all projects through Preconstruction Management office.
- Provide signing, pavement marking, work zone traffic control, and signal plans and specifications for road construction projects.
- Conduct design review of major road projects to assure proper intersection design and need for traffic control.
- Recommend safety projects and coordinate design and implementation.
- Coordinate with Utility office for signal systems projects, intersection improvement projects, and railroad crossing protection.
Mission Statement

The mission of Traffic Engineering is to provide the safest and most efficient operations for all modes of transportation on South Carolina's roadways using uniform traffic control devices and state-of-the-art technologies with positive impact upon the environment.

Interaction: Construction

- Attend Preconstruction conferences for traffic projects and major road projects with extensive traffic control.
- Assist Districts with construction problems or questions related to traffic control.
- Attend final inspections for traffic projects.
- Provide recommendations for work zone traffic control changes.
- Provide technical advice for signal and other high-tech systems.

Interaction: Maintenance

- Establish traffic control standards for signing, signals, and pavement markings.
- Work with Districts on implementing traffic control changes or individual locations (intersections), as well as statewide (hurricane evacuation signs).
- Provide work zone traffic control for road and bridge maintenance projects.
- Establish standards for access and other roadside encroachments.

TE Personnel

- 78 Traffic Engineering Employees
  - 11 Professional Engineers
  - 34 Engineering Associates
  - 17 Engineering Technicians
  - 2 Planners
  - 6 Administrative
  - 7 Temporary Grant Employees (SHEP)
  - 1 Engineering Assistant (Temporary/Part Time)
Organization Structure

**Director of Traffic Engineering**

- State Traffic Operations
- State Traffic Safety & Systems


Traffic Engineering Section

**Rick Werts**
Director

- Don Turner
  Assistant Director
  State Traffic Operations
- Dick Jenkins
  Assistant Director
  State Traffic Safety & Systems

State Traffic Operations

**Don Turner**
Assistant Director

- Traffic Operations
- Traffic Control
- Special Projects & Operations
  - Intersection Improvement
  - School Site Planning
  - Risk Management
  - Work Zone
  - Interstate Signing
  - Pavement Markings

Special Projects & Operations

- Performs traffic studies and develops plans for
  - signing
  - marking
  - signal installations/rewires
  - geometric design improvements as necessary to
    provide for the efficient and safe operation of traffic
- Provides technical expertise for design and operation
  of signals interconnected with and preempted by
  - Railroad Warning Devices
- Performs Traffic Impact Analyses for large traffic
  generators, such as major commercial developments
  or recreational facilities, to determine what
  countermeasures can be provided to improve access.

Special Projects & Operations

- Provides assistance to other state agencies for statewide
  endeavors, such as the Wildlife Viewing Guide & the
  Heritage Corridor Signage.
- Provides supplementary review for the District offices,
  as requested, for encroachment permit applications,
  access control issues, and traffic engineering studies.
- Works with District Traffic Engineers to assure that
  traffic engineering principles are consistent statewide.
- Maintains a list of traffic studies, correspondence,
  and traffic plans to provide accurate information,
  admissible in court, concerning a particular location or
  issue.
Special Projects & Operations

- Reviews proposed revisions to the national Manual on Uniform Traffic Control Devices.
- Requests traffic engineering surveys from AASHTO and the Institute of Transportation Engineers.

Risk Management

- Maintains a shared database with the Highway Safety section of all locations reviewed, including:
  - date locations were reviewed.
  - a summary of the findings.
  - recommendations made.
  - date work was sent to District.
  - date recommendations were implemented.
- Supplements the Highway Safety section by reviewing locations identified by that section as having high accident and severity rates, which are not scheduled for reconstruction due to limited funding.

Risk Management

- Conducts thorough reviews of the identified locations:
  - reviews past operational history of the location both in-house and at the District level.
  - reviews the accident history for the past four years.
  - conducts a field review of the location if supported by accident data.
- Makes recommendations based on reviews to enhance the motorist public’s awareness and to improve the overall safety of those locations.

Intersection Improvement

- Provides a method for improving intersections where minor geometric changes would significantly reduce congestion and improve operations.
- Accomplishes spot improvements at intersections in a short time period with purchase order contracts. These projects are constructed with minimal plans and with very low preliminary engineering costs.
School Site Planning

- Established by the Headquarters Traffic Engineering office several years ago due to the rapid rate at which new schools were being built, many without adequate internal vehicle storage space or needed roadway improvements.
- Participates in the entire school site selection and review process with the State Department of Education's Office of District Facilities Management.

Work Zone Traffic Control

- Prepares traffic control plans, special provisions, and specifications for traffic control devices for road construction, road maintenance, bridge construction, and bridge maintenance projects.
- Conducts on-going reviews of work zones throughout the state, and conducts annual reviews on selected work zones in coordination with FHWA.
- Provides seminars and training for District personnel for work zone safety devices such as stationary and truck mounted attenuators.

Interstate Signing

- Prepares plans, specifications, and other necessary documents for sign contracts. Prioritizes needed improvements on various routes including upgrading of existing signs and traffic control to comply with the latest standards.
- Assists District personnel in administration of signing contracts, including reviewing contractor's submittals, preparing replies to questions from the contractor and District personnel, and participating in the final inspection upon completion of the work.
- Reviews new products involving signing materials, makes recommendations as to their potential use on projects, and works with the Research and Materials Lab to have them approved.
Pavement Markings

- Prepares plans, quantities, and special provisions for marking contracts to be let by Traffic Engineering.
- Prepares pavement marking plans for Interstate, Primary, and Secondary routes on a statewide basis.
- Prepares pavement marking plans for inclusion in road construction projects.
- Handles the following three broad categories:
  - Interstate marking upgrade projects.
  - Primary route marking projects.
  - Primary/Secondary route raised pavement marker projects.

State Traffic Safety & Systems

Dick Jenkins
Assistant Director

Traffic Support
Traffic Systems

Design Review
Rail Safety & Research
Highway Safety Systems
Advanced Traffic Systems

Design Review

- Conducts design reviews for road projects.
- Prepares preliminary designs for safety projects.
- Assures that designs adequately address operation and traffic control elements.
- Conducted approximately 100 design reviews in 1997.
Bicycle and Pedestrian

• Mandated by FHWA.
• Promotes and facilitates the increased use of non-motorized modes of travel.
• Assists in the development of facilities for pedestrians and bicycles.
• Aids in the design and construction of facilities to accommodate pedestrians and bicycles.
• Provides a focal point for information and resources regarding compliance with the Americans with Disabilities Act (ADA).
• Serves on the South Carolina Bicycle and Pedestrian Safety Committee.
• Fosters inter-agency cooperation by providing guidance on bicycle and pedestrian needs, ADA requirements, and geometric guidelines.

Rail Safety & Research

• Flashing lights and gates. Priority index: Program must be in place to ensure safety.
  - Begin on all rail lines for safety.
  - Identify significant public right-of-way crossings and establish requirements for avoiding impaired traffic conditions.
  - Ranks each crossing using such factors as:
    > train speed
    > presence of a fixed signal
    > train and traffic volumes
    > existing crossing
    > traffic volumes
    > number of tracks

• Multi-Disiciplinary Investigative Teams:
  - Planning
  - Implementation
  - Evaluate
  - Field investigation

Rail Grade Crossing Inspection Program

- The State of South Carolina mandates that SCDOT inspect every public railroad crossing.
- Inspections include checking for sight obstructions and the condition of the crossing and a stop sign.
- Deficiencies are reported to the proper authorities for correction.
- 3,000 public crossings are inspected on a 5-year cycle:
  - 2,250 on state maintained routes.
  - 750 on county maintained routes.
  - 750 on municipal routes.
Rail Safety & Research

Number of Rail Grade Crossing Accidents per Year in South Carolina

- Provides the only resource for accident information within SC DOT.
- Processes 300 accident requests in 1997.
- As a result, the Safety and Systems Engineer is frequently an expert witness in legal cases involving the highway system.

Highway Safety

- Provided for in the Federal Aid Policy Guide in 1975 and receives specially earmarked funding.
- Highway Safety and Rail Safety share 10% of all STP funds.
- Aims to reduce the number and severity of crashes at identified high-accident locations.
- Prioritizes locations based on an accident rate.

- Identifies cost improvements for high priority locations.
- Determines the benefit to cost ratio.
- Programs qualifying projects.
- Projects not ranking high enough for construction are referred to the Traffic Engineering Risk Management team for examination.
Highway Safety

- SHEP provides support to incident response agencies such as law enforcement and emergency medical services at accident scenes.
- Assists motorists who are experiencing mechanical problems with their vehicles.
- Currently, SHEP operates in Columbia and Spartanburg. The development of a Greenville area SHEP program is underway, and implementation is scheduled in mid-1998.

Highway Safety

- Carries emergency fuel, water, the equipment to make minor repairs to vehicles, and a variety of traffic control devices. These devices enable SHEP responders to protect the incident scene and direct the motoring public around the incident by providing a traffic control setup similar to a work zone.

Advanced Traffic Systems

Signal Systems

- Plans for the installation of closed loop traffic signal systems inside cities and on arterials outside cities.
- Establishes remote monitoring of signals to facilitate timing changes and progression from personal computers via telephone lines for use by District Traffic personnel.

Advanced Traffic Systems

- Writes, maintains, and updates all traffic signal specifications for SCDDOT. These specifications are provided to South Carolina municipalities developing their own signal systems.
- Works closely with the signal systems supply inventory to assure equipment necessary for signal installation and maintenance is available for traffic signal maintenance and new construction.

Advanced Traffic Systems

Intelligent Transportation Systems (ITS)

- Uses advanced technologies in order to improve traffic flow and more efficiently utilize the existing infrastructure.
- Includes such technologies as:
  - Closed circuit television (CCTV)
  - Electronic detection devices
  - Coordinated signal systems
  - Variable message signs
  - Highway advisory radio
Advanced Traffic Systems

ITS Under Development
- Currently procuring color CCTV camera systems for Columbia, Greenville, and Spartanburg. These cameras are a very important component of ITS projects. This is being done with the full endorsement of the DOT (all ITS and SHEP funding comes from Gileshared) and in coordination with the cities in those metro areas.
- Portable variable message signs have already been installed along I-85 in Spartanburg and are currently being procured for installation along the interstates surrounding the Columbia metropolitan area.

Future Traffic Management
District Traffic Engineering

Purpose

- Receive and respond to requests for improvements to intersections and sections of roadways, exploring options to best improve the safety and efficiency of the present and future SCDOT Highway system. Work closely with and provide Traffic Engineering guidance and support to other SCDOT personnel.

Traffic Study Requests

- Stop and Go Traffic Signals
  - Conduct Turning Movement Counts
  - Research Collisions History

Traffic Study Requests

- Stop and Go Traffic Signals
  - Conduct Turning Movement Counts
  - Research Collisions History
  - Vehicle Delay Study
Traffic Study Requests

- Stop and Go Traffic Signals
  - Conduct Turning Movement Counts
  - Research Collisions History
  - Vehicle Delay Study
  - Observations of Pedestrians
  - Observations of the Intersection Operation
  - Traffic Signal Warrant Analysis

- Multi-way Stop Intersections
  - Obtain Traffic Count Data
Traffic Study Requests

- Multi-way Stop Intersections
  - Obtain Traffic Count Data
  - Research Collisions History
  - Vehicle Delay Study
  - Observations of the Intersection

Traffic Study Requests

- Multi-way Stop Intersections
  - Obtain Traffic Count Data
  - Research Collisions History
  - Vehicle Delay Study
  - Observations of the Intersection

Traffic Study Requests

- Addition of Left Turn Phases at Existing Signals
  - Conduct Turning Movement Counts
Traffic Study Requests

Addition of Left Turn Phases at Existing Signals
Conduct Turning Movement Counts Research Collisions History

Traffic Study Requests

Addition of Left Turn Phases at Existing Signals
Conduct Turning Movement Counts Research Collisions History Left Turn Delay Studies

Traffic Study Requests

Addition of Left Turn Phases at Existing Signals
Conduct Turning Movement Counts Research Collisions History Left Turn Delay Studies Observations of the Intersection

Traffic Study Requests

Speed Limit Reduction
Spot Speed Study

Traffic Study Requests

Speed Limit Reduction
Spot Speed Study Research Collisions History
Design and Prepare Plans CADD

- Traffic Signal Installation Plans
- Traffic Signal Revision Plans
- Geometric Improvement Plans
  - For County Transportation Committees
  - Intersection Improvement Program
  - For Improvements Recommended after Traffic Studies
- Pavement Markings Plans

Design and Prepare Plans CADD

- Traffic Signal Installation Plans
- Traffic Signal Revision Plans
- Geometric Improvement Plans
  - For County Transportation Committees
  - Intersection Improvement Program
  - For Improvements Recommended after Traffic Studies
- Pavement Marking Plans
- Signing Plans

Preparation Detour Plans for Bridge and Road Closures

- Review Proposed Pavement Markings
- Consider the Need for New Traffic Signals
- Consider Traffic Signal Revision Needs

Upcoming Construction Projects
Special Projects
- Meetings of Metropolitan Planning Organizations (MPO's) and Council of Governments (COG's)
- County Transportation Committee Meetings
- Members of MAIT Teams

Special Projects
- Raised Markers and Thermoplastic Markings Contracts

Special Projects
- Expert Witness Testimony

Special Projects
- Periodic Inspection of Railroad Crossings

Special Projects
- Periodic Reviews of Traffic Signals for Appropriate and Efficient Signal Timings

Special Projects
- Test and Evaluate New Products
  - Use of Strobes in Signal Heads
  - LED Signal Heads
  - Video Detection of Vehicles
Summary of 1997 Studies in District 1

- District 1 Traffic completed 1122± various traffic studies.
- 141 of these required turning movement count data.
- Generated 1220 pieces of correspondence based on these studies.
  - 820 Workorders
  - 800 letters written to citizens, politicians or other DOT personnel

Summary of 1997 Studies in District 1

- Developed 37 new signal plans and modified several existing plans
- 10 new pavement marking plans
- 26 detour plans
- The Whitstopping plans were designed, including typicals
- Assisted with landscaping plans.
APPENDIX B
Civil Engineering in High Schools Program

Exit Survey

Thank you for participating in the SCDOT District One “Civil Engineering in High Schools Program”. SCDOT appreciates the opportunity to meet with high school students and to talk about the field of Civil Engineering. SCDOT hopes that you have found this program interesting and informative.

To be sure the program is delivering the proper content and meeting the objectives of the program, SCDOT is asking all participants to complete this survey. This survey is completely voluntary. Please feel free to express your opinions and comments regarding this program.

SECTION A.

1. The objectives of the class were clearly communicated to me.

☐ Strongly Agree ☐ Agree ☐ Disagree

2. The content of the program was in line with the objectives.

☐ Strongly Agree ☐ Agree ☐ Disagree

3. The content of the class was taught so that it was easily understood.

☐ Strongly Agree ☐ Agree ☐ Disagree

4. The program promoted an informal and fun learning environment.

☐ Strongly Agree ☐ Agree ☐ Disagree

Comments: __________________________________________________________

________________________________________________________

________________________________________________________
Civil Engineering in High Schools Program

Exit Survey

SECTION B.

1. The instructor(s) appeared knowledgeable in the areas taught.
   - [ ] Strongly Agree
   - [ ] Agree
   - [ ] Disagree

2. The instructor(s) seemed interested in teaching the subject matter.
   - [ ] Strongly Agree
   - [ ] Agree
   - [ ] Disagree

3. The instructors presented the material in a manner that was easy to follow.
   - [ ] Strongly Agree
   - [ ] Agree
   - [ ] Disagree

4. The instructors encouraged class participation at all times.
   - [ ] Strongly Agree
   - [ ] Agree
   - [ ] Disagree

Comments: __________________________________________________________
__________________________________________________________________
__________________________________________________________________

SECTION C.

1. Rate your understanding of Civil Engineering before this class. (1-complete understanding to 5-had no understanding)
   - [ ] 1
   - [ ] 2
   - [ ] 3
   - [ ] 4
   - [ ] 5
Civil Engineering in High Schools Program

Exit Survey

2. Rate your understanding of Civil Engineering now. (1-Completely understand to 5-still have no understanding)

☐ 1  ☐ 2  ☐ 3  ☐ 4  ☐ 5

3. Rate your interest in a career in Engineering prior to this class.

☐ Very Interested  ☐ Interested  ☐ Somewhat Interested  ☐ Not Interested

4. Rate your interest in a career in Engineering after this program.

☐ Very Interested  ☐ Interested  ☐ Somewhat Interested  ☐ Not Interested

5. Did this program positively influence your career goals?

☐ Yes  ☐ No

Comments: ________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

SECTION D.

Please provide us with any additional comments you may have regarding this program. Include ideas for improving the program.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
Civil Engineering in High Schools Program

Exit Survey

SECTION E.

In order to accurately gauge the impact of this program, SCDOT would like to follow the career paths of the students who have gone through this program. If you are interested in participating in this phase of the survey, please provide a mailing address in the space below. SCDOT will contact those students who volunteer for this portion of the survey in 2 years to get updated information on career paths and choices. Students will be mailed a voluntary follow-up survey at that time.

If you desire to participate in this phase of the program, please provide name and mailing address below.

________________________________________

________________________________________

SECTION F.

Thank you for taking the time to complete this survey. SCDOT appreciates your interest and involvement in this program. If you have any questions or concerns about SCDOT or Civil Engineering, feel free to contact the person listed below or visit the SCDOT Web Page. SCDOT would be happy to answer any questions you may have.

James B. Cagney, PE
District Engineering Administrator
1400 Shop Road
Columbia, SC 29201
(803) 737-6660
CagneyJB@SCDOT.org

SCDOT Web Page
http://www.scdot.org