Research Involving Students and Community Service
The Detmold Plan

Thomas R. Dion, Dennis J. Fallon, Robert C. Still, M. Shawn Seegers, and C.Ben Duke
The Citadel

Abstract

The Detmold Plan was the plan for establishing the street layout within the Town of Summerville, South Carolina. The plan was never laid out on the ground in a documented manner, resulting in confusion. As part of the Town's Sesquicentennial Birthday, **The Detmold Base Line Committee** was formed and empowered to investigate the relationship of the Town's physical layout and the layout proposed "on paper" depicted by the Detmold Plan.

Several senior undergraduate civil engineering students volunteered to participate since opportunities for research, learning, and community service existed. These students searched for old land records and also gathered field data using both Global Positioning Systems (GPS) and traditional instrumentation. These data are currently being compared with those from the Detmold Plan. Using least squares, a "best fit" relationship between the two sets of data will allow the Committee to assign state plane coordinate values to Detmold's control points where Detmold's points can be defined on the ground. Future property mapping efforts based on state plane coordinates would then be congruent with the Detmold Plan.

Student participation in a project such as this is important because current departmental goals and objectives include provisions for community service and student interaction with practicing professionals. Satisfying departmental goals is an important issue because future program accreditation is to be gauged using ABET 2000 and other criteria.

Introduction

The Town of Summerville, located in the low country of South Carolina, was incorporated 150 years ago with its original corporate boundaries being defined by F.C. Schultz's Plan of the Village of Summerville as shown in Figure 1. This "plan" contained no metes and bounds and showed only general features such as a few lanes, 20 residences, and the general topography. It was more like a sketch since it did not

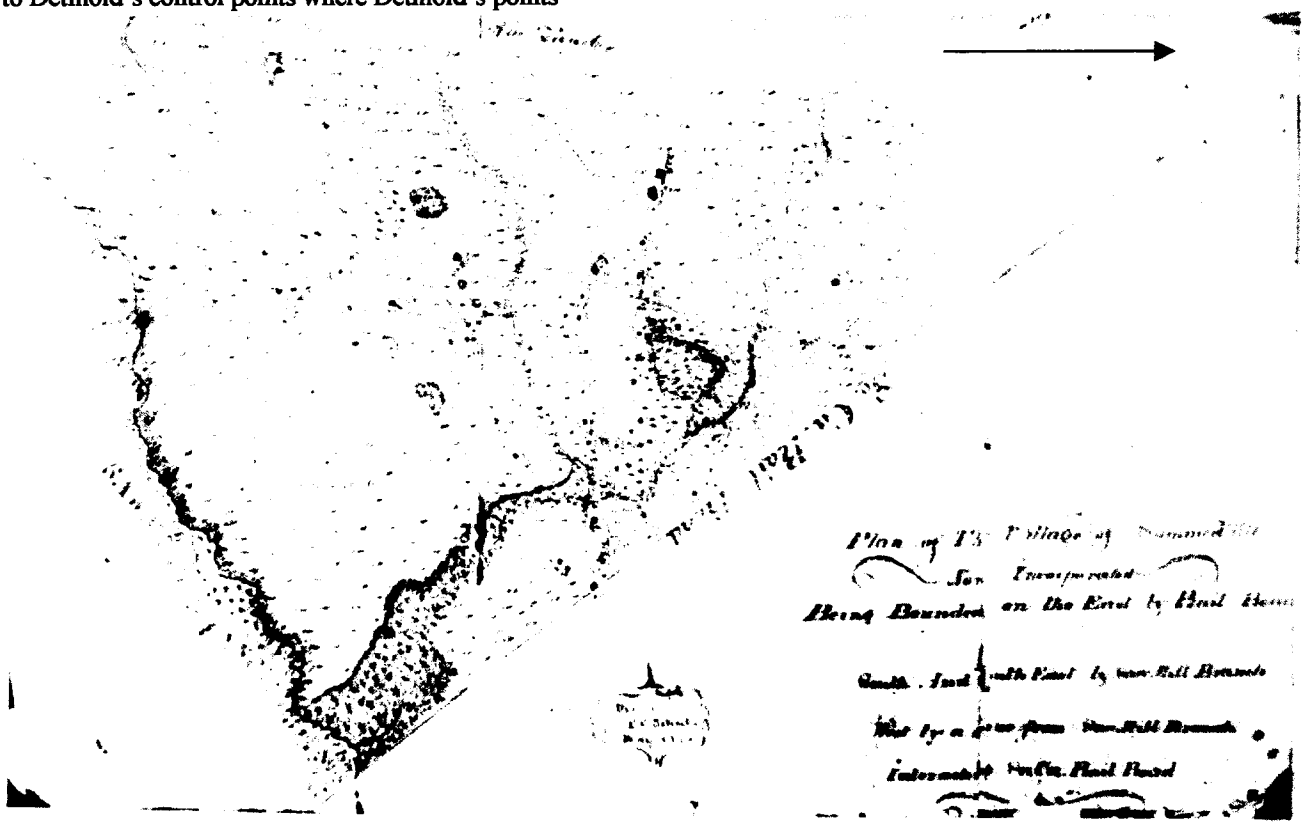

Figure 1. Schultz's Village of Summerville

appear to be drawn to any scale. A portion of Schultz's incorporated area, and contiguous acreage located to the north of the railroad tracks, was previously purchased by the South Carolina Canal and Railroad Company in 1830. A street layout for the railroad property was prepared by C.E. Detmold, a Civil Engineer located in Washington, D.C., during the year 1832 as depicted in Figure 2. There was no record that Detmold, or others, actually laid out on the ground any monumentation that would delineate Detmold's Plan to the terrain. Schultz's "plan", created 17 years after Detmold's Plan, provided strong proof which supported this idea since none of the streets or blocks were shown by Schultz. Other evidence showed that most railroad lots were conveyed by deeds referenced to Detmold's Plan without an independent survey being conducted as part of the transaction. For example, one transaction [4], which occurred on 3 November 1919 identified the property being conveyed as:

All that lot piece or parcel of land with buildings thereon situate lying or being in the Town of Summerville in the County of Dorchester and State of South Carolina measuring and containing four (4) acres more or less being the Square numbered Twelve (12) on the map of New Summerville made by C.E. Detmold in March 1832, and butting and bounding Northeast on First South Street—Southeast on Laurel Street—Southwest on Second South Street– and Northwest on Hickory Street as will appear by reference to said map.

Other records showed that it was only after the turn of the century when much of the railroad property had been sold that lot surveys were being performed and platted with any regularity, possibly because of the confusion that exists today. Many land surveyors used the "island concept," where the property surveyed was delineated using "lines of occupation" and not related to a common set of control monuments. Numerous property line conflicts have surfaced throughout the years as the result of various surveys conducted by well-intentioned surveyors, with many of the conflicts being rooted in this lack of survey control for the street system.

During the 1980's the lead author was involved with various municipal projects where the water and wastewater systems were being upgraded. These projects required utility easements within the area encompassed by the Detmold Plan. Efforts to relate various streets and blocks together using then current surveying field data and the Detmold Plan provided proof that horizontal survey control problems existed.

The lead author was asked during the summer of 1996 to conduct a property survey of the Timrod Library, located in downtown Summerville. Again, street right of way data and Detmold Line information conflicted. As a result, the lead author undertook a mission to locate in the field over a three week period as many control points as possible to compare various point ground coordinates with the Detmold geometry. Using "least squares" to rotate and translate the ground coordinates with the Detmold geometry, it was determined that

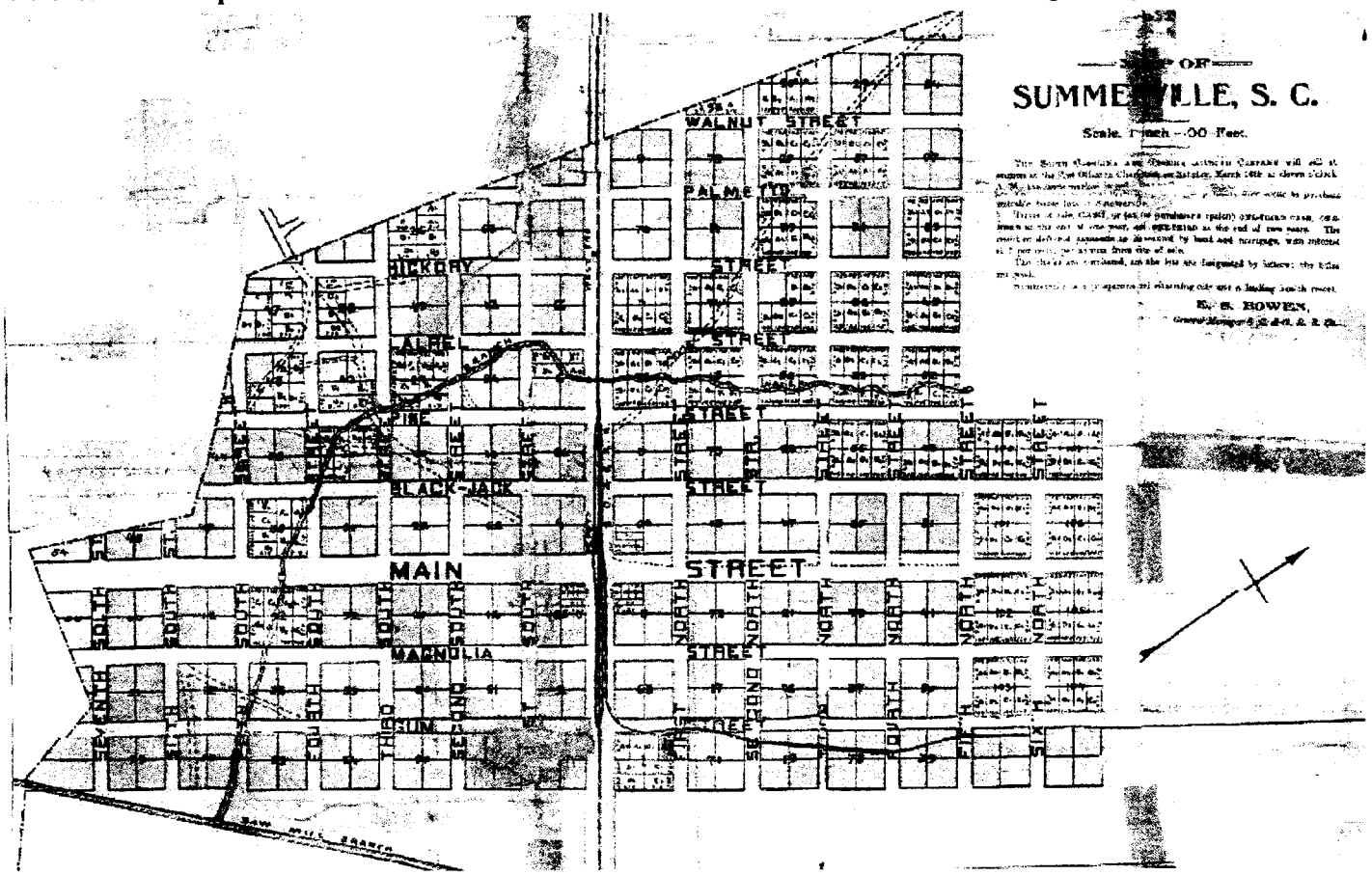

Figure 2. Detmold's Plan of New Summerville

the majority of error ellipses ranged between 2.85 feet and 9.36 feet.

Thomas W. Bailey, a Town Councilman and land surveyor, had similar experiences over the years, as did other resident surveyors such as R. David Branton, R.B. Cuthbert, H.H. Foster, and D.L. Richardson. Over the ensuing year of 1996 Bailey, Branton, and Dion had various informal conversations about the lack of horizontal control and what the "best practice" should be to use when conducting surveys. The "best practice" followed by the Town's only full-time surveyors immediately after World War II, R.B. Cuthbert and H.H. Foster—both employees of the Southern Woodlands Division of the West Virginia Pulp and Paper Company, INC. (WESTVACO), were the block corners downtown which formed the park or square. It was noted that the orientation and location of these block corners did not exactly correspond to the Detmold Plan. For example the Detmold Plan called for the right of way of Main Street to be 200 feet. Physically the distance between the block corners on the Square measured 199.20 feet at one end and 199.65 feet at the other.

In March 1997 Bailey, Branton, and Dion informally communicated with town officials their concerns about the lack of survey control in Town and offered to assist the Town in resolving these problems. Summerville, being incorporated as a municipality in 1847, was celebrating its 150th birthday, and the group felt that any contribution to resolving these horizontal control problems would be a "present." A group of professionals who deal in real property were empowered by Town Council to research the Town's origins and seek clarification of any conflicting conditions with the sole purpose of improving the quality of mapping within the Town's jurisdiction. This group has been named ***The Detmold Base Line Committee*** of the Town of Summerville.

Background

A cursory review of Town Council's Minutes indicated that between 1892 and 1981 there were over 200 occasions where Council had to take some action to correct or amend street rights of way or alignment. As a result, Town Council passed a Resolution [5] at their 14 May 1997 meeting which states:

Whereas, it is in the best interest of the Town of Summerville and the property owners of Summerville to establish official adjustment lines for the Detmold plan and to relate that plan to ground survey data; and

Whereas, David Branton, Thomas Dion, and Thomas Bailey, registered land surveyors, have volunteered to form a committee to accomplish this task.

Now therefore be it resolved, by the Town Council of Summerville, South Carolina duly assembled that David Branton, Thomas Dion and Thomas Bailey are appointed as the official Town committee to establish the 1997 Detmold adjustment lines;
And be it further resolved, that this committee is empowered to:

1) **Select its chairman and as necessary to appoint up to four additional persons to assist the committee in its work.**
2) **Authorize to examine old records, minutes, ordinances and other available data searching for information relative to this project.**
3) **Receive help from all employees and department heads of the Town from time to time as may be needed to carry out the work.**
4) **Submit a recommended ordinance to Town Council establishing the baseline and official adjustment lines for consideration and adoption by Town Council And be it further resolved, that this committee is authorized to begin its work immediately.**

The three named individuals in the resolution met on 6 June 1997 and considered other persons who might be available to contribute to the Committee's success. As a result, four other persons were invited and agreed to serve on the committee. It was also recognized that there was a need for the Committee to have accurate field data to work with when considering actual street and block locations versus those planned for by Detmold. To this end, the committee invited three senior undergraduate civil engineering students at The Citadel to participate in collecting field data and also in reducing it. Town Council agreed with the committee's composition and instructed the Town's administrative offices to provide assistance as required.

Initial Committee Actions

The first action the Committee undertook was to review events that had led up to the formation of the Committee and the preliminary results of the lead author's findings from the Summer of 1996 activities. The Committee felt that additional data points defining as many block locations in Town would be necessary to provide a meaningful data base from which the final least squares adjustment could be based. The Committee decided that the most expeditious method to collect data of this magnitude would be to utilize Global Positioning System (GPS) technology. During the 1990's the U.S. Government established a constellation of navigational satellites called NAVSTAR where their orbit configurations would place four or five satellites overhead for GPS receivers to monitor under normal conditions. Satellite data collected using GPS receivers can be corrected and adjusted where point X, Y, and Z coordinate values are obtained. Some GPS mapping grade receivers, called roving units, can obtain point location data within ten minutes of operation, while survey grade units require at least an hour. The difference between these units is the roving unit can determine positions within a meter while the survey grade can position within two centimeters. Typical GPS units are shown in Figure 3.

The students were subsequently trained in using both types of GPS receivers and detailed to gather the necessary field data. Once gathered, the data would be corrected and placed in a data base for adjustment.

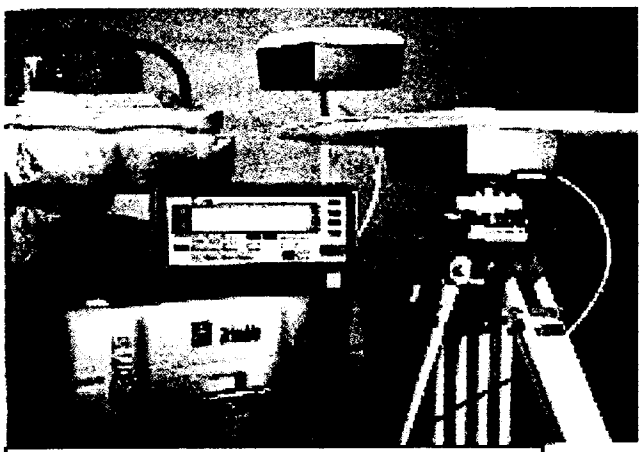

Figure 3. Typical GPS Receivers [2]

The Committee recognized early that their efforts would have to relate to an overall coordinate control system scheme if the quality of mapping was to truly be improved. A decision was made to contact the South Carolina State Geodetic Survey in Columbia, South Carolina to seek assistance and guidance where the Committee's results could be tied to the South Carolina State Plane Coordinate System (SCSPCS-3900). Through the efforts of Director Sidney C. Miller, the Geodetic Survey loaned for community service a Trimble GPS Pathfinder roving unit to the Committee for its field work and agreed to install additional control monumentation within the Town's jurisdiction that would be available for local surveyors to relate in the future their survey's to the overall control network.

The Committee also contacted the Norfolk Southern Railroad, now the parent company of the old South Carolina Canal and Railroad Company, to seek clarification of various right of way conflicts. Specifically, current "track maps" show the railroad right of way, which runs through the middle of Town, to be straight and consists of a width 100 feet each side of the track centerline. On Detmold's Plan, the railroad track is not show in the center of the 200 foot right of way. In other documents, the right of way is show being 50 feet each side of the track. These discrepancies coupled with the fact that the track is not physically straight have contributed to various problems with land surveys over the years. A number of land surveyors have measured from the center of the tracks, while others have projected tangents for property surveys. The track has migrated throughout the years because sidings have been added and removed and rails and ties replaced. This has also resulted in problems with property line surveys.

Office Related Activities

Office related activities were initially focused on gathering background information on the original land grants and maps that delineated the original Town Limits. Because of various discrepancies in these early documents, it was evident that uncertainty in land boundaries existed early in the Town's history. From these early documents, and copies of the Municipal Charter, and Amendments, and the Detmold Plan, a Baseline Map was put together as a guide to serve as a basis for conducting field observations using undergraduate civil engineering students. The Baseline Map then had Tax Map information superimposed over the other information, where current land owners could easily be identified.

The Baseline Map was then divided into four quadrants using the railroad right of way, running East/West, and Main Street (U.S. Highway 17-Alt), running North/South. Working copies of this Map were used by two survey crews, where each crew used distinct color coding to expedite data collection.

Since Trimble GPS Roving Units were utilized to locate as many of the Detmold block corners as possible, arrangements had to be made with other Detmold Committee members who had the capability of downloading the data for processing. At the time of this writing, data collection is not yet compete. Once these data are processed, a least squares best fit between actual points located on the ground and the Detmold Plan will be undertaken and the results will be used in preparing an Official Map showing the best-fit Detmold Lines. This map will then be used as a basis for future quit claim grants and as a guide if future right of way questions arise.

Field Related Activities

Initially, the students had to be instructed on how to use the roving GPS receivers. The students used the equipment to occupied various control points within the town to learn about the operation of the equipment and the limits of use, such as the effect of tree canopies on reception capability. To optimize satellite reception due to canopy obstructions, a number of Detmold block corners had to be located using a technique of cross taping between intersection points, and GPS points that were established in the road right of way where tree obstructions were minimized.

Next, the students learned how to use the handheld data collectors. Files were designed where input data consisted of Block Number, Block Quadrant, Description of Point, Tax Map Number, Town Quadrant, and User Name. Each GPS session or day was given a different file name, usually associated with an ascending file number.

Once these preliminary activities were completed, the exploration, searching, and recovery of the various town block markers began. Working with a tape, a Schondstat magnetic detector, and a "sure shot" shovel, many of the points were uncovered and located, while some were not recovered.

The two 2-man survey crews averaged five hours a day during the summer months and methodically worked their way through the various Basemap quadrants, where the four intersection points were located, rather than locating each block. These data were collected by setting a tripod with the GPS antenna attached over the occupied point, and data were collected for 10 minutes, which corresponds to 600 reading at one reading per second. If the 600 positions could not be obtained then at least 300 positions would be required to load the data. If 300 positions were not logged, the point would then

be located by cross taping. Upon completion of data collection for that session, the data collector was taken back to the office and downloaded as part of the project database for preparation of the Official Map.

Citadel Related Activities

The second author, Head of the Department of Civil and Environmental Engineering at The Citadel, became involved in the Detmold Base Line community service project as a result of various civil engineering students under his jurisdiction participating in data collection, adjustment, and interpretation. A unique opportunity for students to become involved on a professional level in solving a real world problem was recognized early. These students are not only being given an opportunity to interface with other professionals, they are also being afforded an opportunity to create work schedules, learn about the operation of state-of-the-art- equipment, and how to correct and adjust raw data observed as a part of their research efforts. These students will also be able to write a report on their findings, involvement, and experience as a result of participating in this research project.

From the perspective of administrating an academic department, this project offers a unique opportunity for evaluating outcome assessment of the Department's goals. Input from the various committee members concerning the students' knowledge of engineering related issues, competency, professionalism, reliance, and ethical behavior can be obtained and evaluated. In addition, a project of this nature offers the Department and Institution a unique opportunity of help surrounding communities and in turn improve the quality of life in the area.

Results

Although GPS data collection is still underway, the project appears to be coming together. Additional help has been obtained from students in the Department of Civil and Environmental Engineering to observe the positions of various control points that are key to defining the Town Limits. Sixteen students are assisting the two 2-man survey crews in using six survey grade Trimble 4000ST GPS receivers. Data collected with these units will be used to fit the Town Limits to the Official Map. This data collection effort is currently ongoing. It as anticipated that the project will be completed during the Spring of 1998 in time for the Town's 150th Birthday Celebration which will extend through 1998.

Summary

Engineering is a profession that has the opportunity to impact in a significant way the quality of life of people. Further members of the Civil and Environmental Engineering Department at The Citadel take pride in the fact that the civil engineering profession is a "people serving profession" As such members of the faculty promulgate this concept not only to students undertaking studies in the department but to the community outside the institution. Student participation, as well as an active and visible participation of members of the faculty, reinforces this concept in a way that words do not. Specifically, community service projects give the department the opportunity to "Walk the Talk".

The Citadel provides the student in engineering a unique co-educational, state supported military environment. In this time of learning setting, there are may competing demands on the time of cadets. They must balance their academic, professional, social, and military obligations. In fact the college prides itself in defining the 24 hours of a cadet's life. This leaves little time for students to undertake internships. Community service projects can be useful in allowing the cadet the opportunity to obtain invaluable experience that otherwise would not be available.

One of the Department's major goals is to provide to the citizens in the Charleston area a sense of community awareness and service. Community projects are visible ways to satisfy this goal. The Department recently underwent an ABET review. As such, the Department is well aware of the criteria for the next scheduled visit—criteria set forth in ABET 2000. Important to the Department in preparing for this review are the development of goals and the establishment of means to measure these goals. This community service project will obviously satisfy this initiative. The measure of success will be an evaluation by leaders in the various communities. This should provide a way to gain meaningful assessment of the department's program.

Finally, this year The Citadel has experienced a change of leadership. The Institution's new President, Major General John Grinalds, has stated in his strategic plan an outreach of the institution in performing community service to the citizens of South Carolina. The Department's initiative is this direction fits well with his vision of where the Citadel should be heading.

In summary, there are significant advantages to the Civil and Environmental Engineering Department in performing community service projects such as this. The Department believes that with these initiatives, a win-win situation exists for the students, the Department, and the Institution, and most of all for the citizens of South Carolina.

References

1. Detmold, C.E. *Plan of New Summerville*, Washington, 1832.

2. Dion, Thomas R. *Land Development for Civil Engineers.* Wiley: 1993, p.128.

3. Foster, Clarice and Lang. *Beth's Pineland Village.* Summerville: The Summerville Preservation Society, 1988.

4. Reaves, Dora Ann. *Summerville This Week—Town to find spot on globe.* Charleston: The Post Courier, 20 November 1997, p.1.

5. Smith, Henry A.M., et.al. *Title to Real Estate—Detmold Square 12—Town of Summerville.* St. George: Dorchester County Court House, 1919.

6. Starnet Software, INC. *STAR*NET Version 5.1.* Oakland, California, 1996.

7. Town of Summerville. *Council Resolution of 14 May 1997.* Summerville, S.C.

8. Trimble Navigation Limited. Sunnyvale: Trimble Navigation.

Thomas R. Dion

Col. Dion graduated from The Citadel in 1968 with a B.S. degree in Civil Engineering. He earned an MS degree in Civil Engineering from Clemson University in 1973 and became a registered professional engineer and land surveyor in the state of South Carolina in 1976. He became a full time faculty member of the Civil and Environmental Engineering Department at The Citadel 22 years ago when he began teaching undergraduate students. Col. Dion is currently serving as Vice-Chair of the Research Division of the Southeastern Section of ASEE.

Dennis J. Fallon

Lt. Col. Fallon graduated from Old Dominion University in 1970 with a B.S. degree in Civil Engineering. He earned an MS degree in Civil Engineering from North Carolina State University in 1972 and his Ph.D in 1980. He became a full time faculty member of the Civil and Environmental Engineering Department at The Citadel nine years ago. Lt. Col. Fallon is currently serving as Past-President of the Southeastern Section of ASEE.

Robert C. Still

Cadet Still is a senior undergraduate student at The Citadel studying Civil and Environmental Engineering. He is a Dean's List and Gold Star recipient, and a member of Tau Beta Pi and Phi Kappa Phi. In addition, he is enrolled in The Citadel's Honors Program, and currently serves as Secretary to The Citadel's Student Chapter of the American Society of Civil Engineers

M.S. Seegers

Cadet Seegers is a senior undergraduate student at The Citadel studying Civil and Environmental Engineering. He is the First Battalion Executive Officer with the cadet rank of Major. He served as the Air Force ROTC Detachment logistics wing commander, and is included on Dean's List, the Commandant's List, and the President's List. Currently he is a member of The Citadel's Student Chapter of the American Society of Civil Engineers.

C.B. Duke

Cadet Duke is a senior undergraduate student at The Citadel studying Civil and Environmental Engineering. He is Golf Company Commander with the cadet rank of Captain. He is a Dean's List recipient and is enrolled in The Citadel's Honors Program. Currently he is a member of The Citadel's Student Chapter of the American Society of Civil Engineers.