

OPEN SPACE DEVELOPMENT CLINIC

Carlos Sun¹, Kauser Jahan¹, and Ralph Dusseau¹

1. Faculty of Engineering, Rowan University, Glassboro, New Jersey 08028-1701

Abstract - Many areas in Civil Engineering often deal with large-scale and system-level projects. These projects cannot be packaged into a "canned" laboratory for educational instruction. Consequently, a real-world field experiment is a logical way of executing such a project. This paper describes an on-going real-world clinic laboratory that addresses both technical and non-technical issues. The real-world clinic involves the development of open spaces near Rowan University. The engineering aspects of this project involves (1) surveying and the use of Global Positioning Systems (GPS), (2) the use of graphical engineering tools such as Computer Aided Design (CAD) and Geographical Information Systems (GIS), (3) computer web design, and (4) environmental analysis. The non-engineering aspects of this project include (1) multi-agency partnership and interface, (2) dealing with real-world hazards, and (3) team building. The twofold purpose of this paper is to report the successful open space development effort and to encourage others to pursue real-world laboratory experiences that involve multiple agencies.

Introduction

The College of Engineering at Rowan University is a new college that seeks to provide unique multi-disciplinary engineering education. One hallmark of the college is the integration of real-world experiences into the curriculum. Therefore, the college is constantly seeking both industrial and public partnerships in developing projects for engineering clinics. The Junior/Senior Engineering Clinics provide students the opportunity to experience a real world project and the medium to apply and refine their engineering abilities as well as communication skills. Typical clinic teams are composed of students with different abilities. Thus, each team possesses students with different skills such as surveying, drafting, transportation engineering,

environmental analysis, and computer programming. Typical clinic project length range from one semester to multiple semesters.

One primary objective of the Open Space Development Clinic is to assist two public agencies in their efforts in developing multi-use trails for the public. The first agency is the Township of Carney's Point, and the project involves the surveying of three different trails with unmapped paths in a 100+ acre Carney's Point Recreation Center (CPRC). This recreation center was previously farmland that was donated to the township. This recreation center is located next to state wildlife areas. When the approximately one mile long trails were originally created by clearing trees, the paths were not surveyed and only approximate knowledge of the trail positions were known. The clinic team performed an engineering survey of the trails and documented the results on engineering drawings. The team also made recommendations for improving the trails and designed an informative Recreation Center web site for the public.

The second agency is the County of Gloucester, and the on-going project involves the topographic survey of a Rail-To-Trail (RTT) conversion site. The proximity of the Gloucester County trails to Rowan University makes this project site ideal for the university and its students. A third partner is the engineering firm of Fralinger, who will provide oversight and coordinate seminar speakers on the topic of state-of-the-art surveying technologies. The partnership impacts the county and the local community in many ways. The involvement of an academic institution expands the support base for the rail-to-trail project. This partnership can increase the trail project's relevance to federal and state goals for education and research. The clinic team is in the process of developing a topographical survey of the abandoned rail line and recording the data points on engineering drawings. The clinic team is also collecting soil samples in order to analyze the impact of the multi-use trail on neighboring wetlands. Figure 1 shows the rail-to-trail conversion site in Glassboro.

Since the nature of this project deals with environmental conservation and the beautification of neighborhood areas, this project has garnered support from various levels of government. This clinic also doubles as an outreach to the local communities as well as community service. The

relevancy of this project to the university has also resulted in special student interest in the participation of the trail creation.



Figure 1. Rail-to-Trail Site

Description of Methods and Results

Field Survey

The first outcome of this project is the valuable field surveying experience. The clinic team pinpointed the trail locations of the CPRC and developed the land survey. There were several surveying options available including Global Positioning System (GPS) and total station. After a physical site inspection, a large amount of standing water was detected on the trails. Because of the standing water, the team decided that the use of the total station would be difficult and proceeded to use GPS for the survey.

The Trimble Pathfinder GPS System was used. This system is an easy to use data collection and maintenance system that provides real-time sub-meter accuracy. The accuracy was improved further with the use of offline differential correction. This versatile system can be used in a wide

range of applications, including utility asset management, environmental monitoring and scientific research, hazardous waste clean-up, municipal asset management, and natural resource and land management. Feature and attribute data were inputted with Trimble's Asset Surveyor Software running on the TSC1 data collector. The GPS Pathfinder system provided a data flow from the field to the Pathfinder's GPS software. The GPS Pathfinder integrates real-time beacon and GPS capabilities into a single receiver and antenna. This integration means that there was less equipment to carry and reduced the need for extra cables and batteries.

The trail was explored on various days and GPS points were taken at regular intervals or at locations where there were changes in the bearing. The locations of control points, such as monuments depicting property boundaries, were also recorded. The Pathfinder allowed the identification of the collected data by assigning a specific name or code to each of the points taken to further assist analysis of the findings. These specific points were at times followed by still-frame photography, which assisted in the recommendation process.

Upon completion of the fieldwork, the data was downloaded into the Pathfinder's software package. The software interpreted the data, applied differential correction, and then exported the data into CADD (Computer Aided Drafting Design). The findings were overlaid onto the existing engineering drawing of the CPRC and the control points were matched to accurately display the findings. The three nature trails are shown in Figure 2 which is a drawing of the select layers of the CPRC Drawing.

In addition to the survey of the CPRC trails, there is also the on-going survey and environmental analysis of the rail-to-trail site in Gloucester County. The pre-engineering survey tasks is performed concurrently by Rowan University and Fralinger. The bulk of the field work will be performed by the Rowan University clinic team, while Fralinger will provide field crews to check the work on an as needed basis. Fralinger will also be providing the Professional Land Surveyor (PLS) regular and effective supervision as required by the New Jersey Administrative Code.

Topography of the corridor is performed by conventional survey methods with a Leica Total Station utilizing baseline stationing and cross sections. The plan view will be mapped at a scale of 1" = 30' with one foot contour intervals. All physical features are to be located and shown on the plan. This will serve to facilitate the design phase of the project. The deliverables shall consist of two sets of drawings signed and sealed by a New Jersey licensed Land Surveyor and one electronic set of plans in Autocad version 14 format.

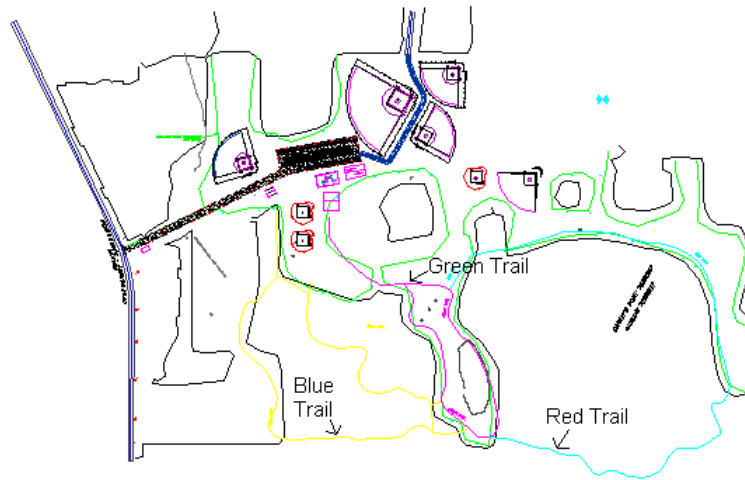


Figure 2. Select Layers of the Carney's Point Recreation Center Drawing

Real-World Environment

One of the most valuable experiences in this project from the student's perspective is overcoming real-world challenges. Because of the enormous amount of rain generated in a short time by Hurricane Floyd, the ground of the CPRC became saturated. Safety and health concerns were an issue because of the standing water. Some health considerations involve the overwhelming presence of mosquitoes from the stagnant water and the effects of the water on personnel and equipment. There was also the problem of significant natural obstructions such as bushes and trees. This was especially significant in the rail-to-trail site, which was abandoned over twenty years ago. Thus the clinic team experienced firsthand some unexpected issues related to work crew safety. The clinic team addressed these challenges by using appropriate waterproof work clothes, equipment backpack, clearing tools, netting, and insect repellent.

The clinic team has also developed recommendations pertaining to these problems. The CPRC blue trail housed a majority of the problems with the nature trails. The first problem site encountered occurs shortly after the split in the blue trail. After entering the blue trail and then proceeding right, a considerable amount of water was found. This water has been noticed several times and did not appear to be dissipating in any way. One way of rectifying this problem is to bypass the water site by cutting a perpendicular trail prior to the water site or to build a wooden foot-bridge across the site.

The second and most substantial water site is located in the middle right component of the blue trail. The water at this location was approximately one to two feet deep. Figure 3 shows the start of the water site. Again, this volume of water was not dissipating, and two possibilities to combat this problem were to either eliminate the part of the trail or to build a bridge across. The water was located in an area of the trail between two outlets. A possibility would be to create a bypass by directing the blue trail out to the green trail and re-entering the blue trail after the water. As suggested earlier, a wooden footbridge could also be built across the water. However, some concerns arise in bridge building due to the considerable amount of debris from trees and tree limbs.



Figure 3. Example of Standing Water on Trails

The on-going environmental component of the rail-to-trail portion of the project includes the preparation of an environmental impact statement for the rail-to-trail site. The clinic team is identifying endangered species (flora, fauna, aquatic organisms etc.), natural wetlands and contamination at the proposed sight. Soil samples are to be analyzed for EPA priority pollutants. The clinic team is identifying the soil sampling sites and is collecting the samples according to Standard EPA guidelines.

Non-engineering Benefits

Because there were multiple agencies involved with this clinic project, the clinic team had many opportunities to coordinate and interface with Gloucester County, Carney's Point Township, and Fralinger. The team had the experience of interacting with both the urban planners and the transportation engineers of Gloucester County. The clinic team also had experience in learning about the information flow between the various departments of Gloucester County.

For the CPRC portion, the clinic team had to coordinate its efforts with the Director of Public Works at Carney's Point. Initially, the team met with the director to discuss strategies in the development of the trail drawing. When the drawing was completed, the team had to prepare both a written report including the engineering drawing and an oral presentation at the township committee meeting. This provided the team a valuable written and oral communications experience as well as insight into the details of public government.

In order to produce PLS stamped drawings, there is a need for an engineering firm to provide oversight of the surveying tasks and to complement any equipment needs. In addition, professional land surveyors can have the opportunity to meet their continuing education requirements through seminars offered to Rowan students on surveying. This mutually beneficial arrangement between Rowan University and Fralinger provides students the opportunity to learn from expert practitioners of engineering and surveying. The engineering consulting firm of Fralinger has been supporting Rowan University in various ways ever since the inception of the College of Engineering. Engineers from Fralinger value the opportunity to educate students and

are amenable to performing their engineering oversight for a minimal fee. Another benefit from partnering with Fralinger is their participation in the local New Jersey Society of Land Surveyors and the ability to bring speakers to Rowan University from its membership.

The clinic team helped to develop a web site for the CPRC as shown in Figure 4. The web site contained the following information on the recreation center:

- Park rules and regulations
- Sports facilities information
- Trail maps of the red, green, and blue trails
- Playground information
- Fitness course description



Figure 4. Carney's Point Recreation Center Web Site (excluding background graphics)

Team building was another important element of the engineering clinic. The team of three faculty and seven students were divided into subgroups pertaining to particular tasks or skills. One student was chosen to be the project coordinator, while the others were divided into the tasks of surveying/GPS, GIS, CAD, trail recommendations, environmental analysis, web design, and

documentation. For the final deliverables, the team had to synthesize all the relevant components into a coherent final report and presentation.

Conclusion

The Open Space Development Clinic was a valuable clinic experience for students, faculty, engineering consultants, and county and municipal agencies. The partnership involved in this project benefited all parties in different ways. First, the clinic team had an opportunity to participate in a field project that presented real-world challenges. The clinic team was faced with overcoming obstacles such as mosquitoes, flooded trails, and vegetation growth. The team also had to deal with challenges related to multi-agency coordination and team building. The opportunity for engineering design in the surveying and creation of engineering drawings was also valuable.

The public agencies benefited from this partnership by fulfilling its goals of research and education. The deliverables also are helpful in the continual development of the Gloucester County trails and CPRC trails. In addition, this project provided the venue where Fralinger engineers and land surveyor associates can offer seminars to fulfill their continuing education requirements. Such Civil Engineering project lends itself well to real-world clinic implementation involving public/private partnerships.

The topic of open space development was an important factor in the success of this on-going clinic. Since public concern for environmental issues have been increasing in recent years, topics dealing with nature preservation and open space development is popular with all levels of government as well as the public. This project also fulfills the mission of community service to the neighboring regions of Rowan University. As a result, this topic can easily attract student interest and commitment to the project.

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Biography

Carlos Sun is an Assistant Professor in the Department of Civil and Environmental Engineering at Rowan University.

He received his Ph.D. from the University of California at Irvine and was a Visiting Postdoctoral Researcher at the University of California at Berkeley in the California PATH program. He has worked previously as an electrical engineer with Airshow and GMM Research Corporation.

Kausar Jahan is an Associate Professor in the Department of Civil and Environmental Engineering at Rowan University. She completed her Ph.D. studies at the University of Minnesota, Minneapolis in 1993. She holds a B.S. degree from the Bangladesh University of Engineering and Technology and an M.S.C.E. from the University of Arkansas, Fayetteville. She has also worked as an environmental engineer for the Nevada Division of Environmental Protection (NDEP).

Ralph Alan Dusseau is the DRBA Professor and Chair of Civil and Environmental Engineering at Rowan University. He received his bachelors, masters, and doctoral degrees from Michigan State University. Dr. Dusseau's masters thesis and doctoral dissertation both involved finite- element analysis of steel arch bridges. He spent 10 years as an Assistant and Associate Professor of Civil and Environmental Engineering at Wayne State University.