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Traffic Study using a Video Camera and an Image Processing Software Lessons Learned

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Traffic Study Using Real, Local Field Data: Lessons Learned

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***Abstract* – Highway Engineering I – CVEN332, is a junior-level course in civil engineering that covers primarily traffic engineering and transportation planning. Traffic engineering topics include isolated intersection signal timing design, intersection capacity analysis and freeway capacity analysis. In fall 2015, students collected real life and local field data in two design modules and used a traffic camera compatible with the video processing software in one design module. The objective of this study is to assess if the usage of local, real life field data and introduction of a traffic camera have any impact on increasing learning, increasing feeling of preparedness and increasing interest. It is also expected that this activity will allow students to learn solve real life problems in a course in which no field data were collected and utilized before. Feedback regarding the study was solicited on the Course Objectives & Outcomes Survey at the end of the quarter. Highly positive student feedback (ratings and comments) were received and reviewed. This paper presents the lessons learned from using the real, local traffic data and the traffic camera in the first highway engineering course in first quarter of the junior year.**

Index Terms – Image Processing Software, Traffic Camera, Real Life, Local Field Data, and Students' Interests.

INTRODUCTION

Highway Engineering I – CVEN332, is a junior-level course in civil engineering that covers primarily traffic engineering and transportation planning. Traffic engineering topics include isolated intersection signal timing design, intersection capacity analysis and freeway capacity analysis. Previously, the course used a lecture-only format that left students frustrated. It is a course where students get excited at the beginning of the quarter but always complain at the end that "no actual real life data is utilized throughout the quarter".

The constraints for taking students to the road as for example to a busy intersection for capacity analyses or signal timing design are many. There are always safety and weather issues. Going to the field at morning or afternoon peak hour which is needed for analysis is very difficult to match outside the class hours. An intersection with 8 lanes (2 lanes/per approach for four approaches) needs a minimum of 24 students (6 students collecting 6 different types of data at each approach) which is a resource issue when an instructor needs different groups to work with different intersection in the area. Nonetheless, counting traffic continuously for at least an hour can be erroneous and often can be boring too.

Before the advent of the personal computer, video analysis of traffic from recording was also an illogical option for most traffic studies. All of the data would have been analyzed by humans watching the video. With the technological advances in the personal computer, this is now possible with an image/video processing software. Mounting the camera to the intersection at a convenient time before the peak hour and uninstalling it whenever time allows are all students need to do. Uploading the video data to the software does the rest of the data collection work. Even a single student is capable of collecting the data from an intersection for capacity and signal design.

In fall 2015, students collected real life data in two design modules and used a traffic camera compatible with the video processing software in one design module. Situated Learning theory emphasizes the importance of authentic context for learning to transfer to practice [1]. The objective of this study is to assess if the usage of local, real life field data and introduction of a traffic camera have any impact on increasing learning, increasing feeling of preparedness and increasing interest. It is also expected that this activity will allow students to learn solve real life problems in a course in which no field data were collected and utilized before. Feedback regarding the project was solicited on the Course Objectives & Outcomes Survey at the end of the quarter. Highly positive student feedback (ratings and comments) were received and reviewed. This paper presents the lessons learned from using the real, local traffic data and the traffic camera in the first highway engineering course in first quarter of the junior year.

BACKGROUND AND MOTIVATION FOR THE PROJECT

Civil engineering students at Louisiana Tech University typically are not happy with the quality of the equipment used in different courses. Whereas, students rate their experience in every other category very high, the rating is comparatively really low in equipment quality. The researchers observed this significantly low rating in three consecutive recent years for the question "How do you rate the quality of the laboratory equipment you used in the course of your studies?" in civil engineering program senior exit interview. This reflects a real need for introducing a technology-rich project

such as use of a traffic camera compatible with image processing software in a civil engineering course in this case, Highway Engineering I – CVEN332 in which no laboratory or field equipment were used previously. It is to be noted here that based on this need the author previously introduced quality equipment in Highway Engineering II – CVEN333 that improved students' interest and learning significantly. The other motivation of this project is to let students learn solve real life problems in a course in which no real life field data were collected and utilized before.

OBJECTIVES

The objective of this study is to assess if the usage of real life field data and introduction of the traffic camera have any impact on the following aspects:

- Increased Interest
- Better Preparation for Career
- Increased Learning

METHODOLOGY

There were 29 students in this class that was offered in the first quarter of the junior year. This is among the very first civil engineering courses the students take. There are 10 weeks in the quarter system. This class used to meet twice a week for 1 hr and 50 min for each class. After eight years of that schedule, the instructor changed it to two 75-min classes and one 3 hrs lab in this fall to introduce real life field data collection in to the design process.

The class typically has five design modules. This year it was increased to six to accommodate more real field data collection experience. In the following two design modules, the students divided into four groups went to different roads and highways of Ruston and collected real life field traffic data. Two of the following three design modules also needed pedestrian data along with traffic data.

1. Traffic Analysis of Uncontrolled (No Signals or Stop Sign) Pedestrian Crossings at La Tech Campus
2. Determine Level of Service (LoS) of Selected Locations of I-20 in Ruston

The students used the traffic camera for the following design module:

3. Isolated Intersection Signal Timing Design- Tech Dr. and W. Alabama Ave.

In design module 1, the instructor picked four uncontrolled pedestrian crossings at the LA Tech campus. The traffic analyses in these locations provided an understanding of the performance and safety of these crossings. These locations were selected to make the students excited about their design projects.

The second design module was based on I-20 in Ruston, Louisiana. Two groups analyzed I-20 East and two groups did I-210 West. The locations include one three lane section of I-20. The Level of Service (A through F) defined by the performance of a freeway based on traffic speed, density and volume were determined during afternoon peak hour 4:15pm to 5:15pm. Peak hour factor was determined based on 15-min interval traffic data. Students primarily worked with three parameters: traffic volume, density, and speed. This exercise using real field data helped them visualize the concept how Level of Service of a highway can reduce during peak hours. In the third design module, students collected data in a busy eight-lane four-way intersection in Ruston. All the four approaches allow left turns. Students were asked to design signal timings of all the phases (green, red and yellow) of all the four approaches. Students were divided into four groups to collect data from the four approaches. Each of the four groups were subdivided in to six sub groups to collect different types of data. Students also installed a traffic camera that collected the traffic data. Before installation, each of the four groups was trained about the operations of the camera in the class. Figure 1 shows students installing a traffic camera by attaching it to a traffic signal post. It is to be noted that a permission from the City, University or the Department of Transportation is needed for installation. The instructor was responsible to get permission. The instructor uploaded the traffic data for image analyses. This allowed the instructor cross check the data that the twenty four subgroups of students (24 students) collected for signal design. Based on the highly positive and enthusiastic feedback received from the students, moving forward no manual traffic count will not be necessary for this design module. Moreover, different student groups will be able to design and analyze performance of different traffic signals in Ruston.

FIGURE 1
STUDENTS INTALLING TRAFFIC CAMERA AT AN INTERSECTION

SURVEY RESULTS

At the end of the quarter a survey was conducted to assess the efforts made by addition of a weekly 3 hr lab session, inclusion of one additional design module to accommodate three real life field data collection modules, and purchase of a traffic camera compatible with image analyses software. Table 1 shows that the survey was conducted in three primary areas: increased interest in transportation engineering (from

beginning of the quarter and overall), increased learning and better preparedness.

TABLE 1
SURVEY RESULTS

Prompt	Response (value)	N
Interest-Quarter: My interest in transportation engineering has:		
	increased substantially since the beginning of the quarter (5)	12
	increased a little since the beginning of the quarter (4)	7
	not changed since the beginning of the quarter (3)	2
	decreased a little since the beginning of the quarter (2)	0
	decreased substantially since the beginning of the quarter (1)	0
	mean	**4.48**
Preparedness: Using real, local, traffic data instead of just examples from the book helped me feel more prepared for a career in transportation		
	strongly agree (5)	10
	agree (4)	11
	neither agree nor disagree (3)	0
	disagree (2)	0
	strongly disagree (1)	0
	mean	**4.48**
Learning: Using real, local, traffic data instead of just examples from the book helped me learn more about traffic signal design		
	strongly agree (5)	12
	agree (4)	9
	neither agree nor disagree (3)	0
	disagree (2)	0
	strongly disagree (1)	0
	mean	**4.57**
Interest-Overall: Using real, local, traffic data instead of just examples from the book increased my interest in transportation engineering		
	strongly agree (5)	13
	agree (4)	6
	neither agree nor disagree (3)	2
	disagree (2)	0
	strongly disagree (1)	0
	mean	**4.52**

At total of 21 out of 29 students in class responded to the survey. A five-point Likert scale was used to analyze data. It is to be noted here that out of 29 students, 8 students received 'A', 9 received 'B', 7 got 'C', 4 obtained 'D' and 1 withdrew. Several students made comments in the survey and all were very positive. As can be seen in Table 1, overall, the feedback was highly positive. In response to the learning question, more than half of the respondents said that they 'strongly agree' that they learned more due to the inclusion of the real life field data collection process. 13 out of 21 said that their interest in transportation engineering increased due to this fact. In case of preparedness, 10 students strongly agree that they feel better prepared and 11 students agree.

LESSONS LEARNED

In fall 2015, students collected real life and local field data in two design modules and used a traffic camera compatible with the video processing software in one design module. The objective of this study is to assess if the usage of local, real life field data and introduction of a traffic camera have any impact on increasing learning, increasing feeling of preparedness, and increasing interest. It is also expected that this activity will allow students to learn solve real life problems in a course in which no field data were collected and utilized before.

At the end of the quarter a survey was conducted to assess the efforts made by addition of a weekly 3 hr lab session, inclusion of one additional design module to accommodate three real life field data collection modules and introduction of a traffic camera compatible with image analyses software. The survey responses show that the efforts made increased interest in transportation engineering (from beginning of the quarter and overall), increased learning of materials and increased preparedness, all in substantial manner.

From instructor's perspective, the course used a lecture-only format in previous years that left students frustrated. However, the constraints for taking students to the road as for example to a busy intersection for capacity analyses or signal timing design are many including safety, weather, time, etc. Nonetheless, counting traffic continuously for at least an hour can be erroneous and often can be boring too. Introducing the traffic camera will need mounting the camera to the intersection at a convenient time before the peak hour and uninstalling it whenever time allows. Uploading the video data to the software does the rest of the data collection work. Even a single student is capable of collecting the data from an intersection for capacity and signal design. Moving forward, different groups will be able to analyze different roads and pedestrian crossings. Students' interest, learning and preparedness will continue to grow in next few years when the camera and the software will be used in more and more traffic design modules.

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