TRAFFIC SIGNAL SUMMER CAMP

FINAL REPORT
NOVEMBER 2001

Budget Number KLK205
NIATT Report Number N01-18

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
UNIVERSITY TRANSPORTATION CENTERS PROGRAM

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EXECUTIVE SUMMARY

Background and Introduction

The Department of Transportation's new Intelligent Transportation System (ITS) program mandates that computing, communications, electronics, and other advanced technologies be applied to improving the capacity and safety of the nation's transportation system. In order to put these technologies into practice, new generation transportation engineers need a set of multidisciplinary engineering skills that are not typically included in a civil engineering-based education program.

In response to this need, NIATT developed Traffic Signal Summer Camp (TSSC), an intensive five-day experience in which twelve top transportation engineering students from the U.S. and abroad have the opportunity to work hands-on with the latest traffic signal control hardware and software. Each of the camp's five days focus on a specific aspect of advanced traffic signal systems, and includes a blend of lecture, lab, and hands-on exercises. NIATT conducted two TSSC camps, both held on the University of Idaho campus in Moscow, ID. The first was held in August of 2000 and the second in August of 2001.

Work Tasks

The development of TSSC involved nine major work tasks, which are described in detail in this report: Define needs; Recruit instructors; Develop course materials; Promote TSSC; Recruit students; Develop or upgrade NIATT's traffic laboratories; Develop a TSSC web site; Conduct Traffic Signal Summer Camp; Conduct post-camp evaluations by students and instructors.

Costs

Costs to conduct TSSC were approximately $32,000 for the first year, and approximately $15,000 for the second year. The majority of the differential is attributed to two one-time expenses: 1) salaries for developing supporting materials and, 2) upgrades to hardware and software for NIATT's two traffic laboratories, in which the camps were held.

Results

NIATT's Traffic Signal Summer Camp has proven to be a tremendous success, on many levels:

- It provides students with the hands-on experience in advanced traffic signal control technologies that is missing from today's transportation engineering curriculum.
- Students responded enthusiastically to its real-world, hands-on approach to the study of traffic signal technology, as well as the interaction with practicing professionals.
- It integrates technology that NIATT has developed during other UTC projects, such as the Controller Interface Device.
- In the process of developing TSSC, NIATT created a set of traffic signal technology course materials that is now available to others in the educational community.
- The summer camp concept will be expanded beyond traffic signal workshops for university students, to train professionals from the Idaho Transportation Department.
- In cooperation with Purdue University, we have had preliminary discussions with FHWA about developing a traffic signal workshop that can be delivered to practicing traffic engineers throughout the U.S.

Future Plans

Plans are underway for Traffic Signal Summer Camp III, scheduled for August 2002. The basic structure of the camp has proven to be very successful, so it will be repeated next year, with two minor modifications:

- Beginning next year, the camp name will be changed to "Traffic Signal Summer Workshop".
- The results of a current NIATT project entitled, "Development of Traffic Signal Training Materials Integrating Hardware-in-the-Loop Simulation" will be included in next year's curriculum. A portion of the training materials will address using NIATT's Controller Interface Device (CIDII) for hardware-in-the-loop simulation, and will be incorporated into TSSC's Day Five curriculum.

SECTION ONE - BACKGROUND AND INTRODUCTION

Traffic signal systems technology has changed dramatically over the past ten years. One of the major drivers of this change is the U.S. Department of Transportation's Intelligent Transportation Systems (ITS) program. Under this program, computing, communications, electronics, and other advanced technologies are applied to improving the capacity and safety of the nation's transportation system. To implement these technologies in practice, new generation transportation engineers need a set of multidisciplinary engineering skills that are not typically included in a civil engineering-based education program.

In response to this need, NIATT developed Traffic Signal Summer Camp (TSSC), an intensive five-day experience during which twelve top transportation engineering students from the U.S. and abroad have the opportunity to work hands-on with the latest traffic signal control hardware and software. Each of the camp's five days focus on a specific aspect of advanced traffic signal systems, and includes a blend of lecture, lab, and hands-on exercises.

NIATT has conducted two consecutive Traffic Signal Summer Camps, both held on the campus of the University Idaho, in Moscow, ID. The first camp, called Traffic Signal Summer Camp 2000, was held during the week of August 14-18, 2000. The second, called Traffic Signal Summer Camp II, was held during the week of August 13-17, 2001.

SECTION TWO - OVERVIEW OF THIS REPORT

This report describes the process of developing and conducting Traffic Signal Summer Camp. The first section of the report provides an Introduction and Background on the need for the camp. The third section, Project Tasks, describes the nine primary tasks required in order to develop and conduct TSSC. The fourth section, Costs, reports the specific costs for conducting both years of the camp**.** The fifth section, Findings and Conclusions, describes the success of the project, and the benefits of the camp concept to both the educational and

professional communities within the transportation industry. The sixth and final section, Future Plans, describes improvements that are planned for the next TSSC and also describes additional related projects that have grown out of the TSSC project. The Appendices include:

- Appendix A – TSSC Application
- Appendix B – TSSC Acceptance Letter
- Appendix C – Compilation of Camper and Counselor Evaluations TSSC 2000
- Appendix D – Compilation of Camper and Counselor Evaluations TSSC II
- Appendix E – TSSC II Student Handbook

SECTION THREE - PROJECT TASKS

1. Define Needs

The first step in developing Traffic Signal Summer Camp was to identify the specific competencies that are required of today's professional transportation engineer, and then determine which of these skills are not commonly included in transportation engineering programs. The following were identified as essential skills for the next generation of traffic engineers that are not currently being addressed adequately. Tomorrow's traffic engineers need to know how to:

- Use traffic signal system equipment.
- Use and program traffic controllers.
- Develop signal timing designs for fixed time and actuated traffic signal controllers.
- Use simulation software to test signal timing designs.
- Use a Controller Interface Device (CID) for running real-time hardware-in-the-loop simulation.
- Use video detection equipment.
- Use and construct loop detectors.

2. Recruit Instructors

The next step was to identify and recruit industry practitioners and university faculty to serve as instructors (called Counselors) for each day of the camp. The following experts were recruited to participate in TSSC 2000 or TSSC II, based upon their professional background, expertise, and research interests.

Zaher Khatib, University of Idaho

Zaher Khatib holds an Assistant Professorship in the Civil Engineering Department at the University of Idaho. He also serves as an Associate Group Leader for the Traffic Operations and Control Center at NIATT. He is involved in several multidisciplinary transportation research projects, such as: development of the Statewide Transportation Planning Model for the State of Idaho, development of a Traffic Signal Controller Interface, and development of control strategies for signalized systems under different traffic conditions.

Joseph Marek, Clackamas County

Joe Marek is the Traffic Engineer and Development Review Manager for Clackamas County, which is the southern county of the Portland metropolitan area. Prior to that he worked in the private sector for Kittelson and Associates in Portland. Joe holds a BSCE and MSCE from University of Idaho (1987 & 1988).

John Ringert, Kittelson & Associates, Inc.

John Ringert is a Principal Engineer and the Business Group Manager for Traffic Design for Kittelson and Associates, Inc. in Portland, Oregon. In this role, he oversees the day-to-day work performed on design projects to ensure that both the expectations of the client and the technical requirements are met. He has more than ten years of experience in traffic design and traffic engineering, working on a wide range of traffic design projects throughout the Pacific Northwest. John received his BSCE from the University of Idaho and his MSCE from Texas A&M University.

Mike Boydstun, Ada County (Idaho) Highway District

Mike Boydstun is Assistant Traffic Operations Engineer in the Congestion Management Division of Ada County (Idaho) Highway District. In this position, he develops and maintains traffic signal timing plans and signal system coordination programs for approximately 330 traffic signals within the county, and assists with signalized intersection design.

Dale Moore, Idaho Transportation Department

Dale has been with the Idaho Transportation Department for 17 years, currently holding the position of Traffic Signal Electrician Foreman. He holds a degree in Electronics from Lewis Clark State College Electrical Apprenticeship School. He is a licensed journeyman electrician, has taught special electrical-related classes at the University of Idaho and Lewis Clark State College, and has been an instructor for the State of Idaho Electrical Apprenticeship Program.

Darcy Bullock, Purdue University

Darcy Bullock is an associate professor in the School of Civil Engineering at Purdue University and a Registered Professional Engineer in Louisiana and Indiana. Darcy pioneered work on the Controller Interface Device (CID), which provides a real-time link between CORSIM and an actual traffic controller. He continues to play an active role in NIATT's development of the next-generation CID.

Ahmed Abdel-Rahim, University of Idaho

Ahmed Abdel-Rahim specializes in Intelligent Transportation Systems (ITS). He received his Ph.D. in transportation engineering at Michigan State University in 1998, and accepted a postdoctoral position with NIATT in August 2000. Ahmed’s research interests include ITS, traffic simulation and modeling, traffic flow theory and operations, public transportation issues, safety impacts of ITS technologies, and engineering education.

Michael Dixon, University of Idaho

Mike Dixon received his Ph.D. from Texas A&M University and his Master's in Civil and Environmental Engineering from Brigham Young University. His research interests focus on the use of existing and emerging ITS information technologies for improved traffic control, transportation modeling, and traveler information systems.

Kenneth Courage, University of Florida

Ken holds degrees in both electrical and civil engineering. His 39 years of experience include positions in government, industry and the academic environment. He has been heavily involved in traffic software development, and in the teaching and research aspects of advanced traffic management systems, traffic data collection and analysis, transportation system modeling, traffic safety and general traffic engineering. His contributions to the technology of traffic control are evident in many publications that appear in the literature and in a wide variety of traffic engineering software distributed by the McTrans Center at the University of Florida.

Eric Rasband, Ada County Highway District

Eric has spent the past six years working in the traffic operations field and is currently Assistant Traffic Operations Engineer with the Ada County Idaho Highway District. He has been trained in signal operation, timing, design, and other facets of traffic engineering. He has been certified by the International Municipal Signal Association as a Level II Traffic Signal Electrician and by Advanced Fiber Optics for proper fiber optic installation.

Michael Kyte, University of Idaho

Michael Kyte is Director of NIATT at the University of Idaho, a professor of Civil Engineering at the University of Idaho and a member of the Transportation Research Board's Committee on Highway Capacity and Quality of Service.

3. Develop Course Materials

Prepare Working Documents

The instructors began a collaborative effort to prepare working documents that described the topics, supplemental materials, and laboratory and material requirements for each day of the camp. In a series of telephone conference calls, they developed a detailed outline of the curriculum for the camp, based on the needs that had been identified at the outset of the project.

The working documents were then distributed to the members of NIATT's Traffic Operations and Control Center Peer Review Panel, for their comments and suggestions. The Peer Review Panel is comprised of transportation professionals representing federal and state government, industry and other universities across the U.S. The panel's purpose is to oversee and evaluate NIATT's projects, such as Traffic Signal Summer Camp, to ensure that they continue to meet federal and state transportation priorities.

When comments were received from all parties, a final version of the camp curriculum and requirements was prepared. Each day of the five-day camp was assigned a specific topic:

- Day One: Introduction to Traffic Signal System Design
- Day Two: Fixed Time & Actuated Signal Timing and Design
- Day Three: Actuated Signal Controller Operations
- Day Four: Video Traffic Detection and Loop Detectors
- Day Five: Hardware-in-the-Loop Simulation

Outlines for each day of TSSC II are presented in section eight of this report, "Conduct Traffic Signal Summer Camp".

Prepare Student Handbook

With the curriculum outlined and materials requirements defined, work began on the Traffic Signal Summer Camp Student Handbook (Figure 1), which was provided at no charge to students on the first day of camp. The Handbook includes slide handouts, reference materials and lab exercises for each day of camp, all supplied by the instructors. NIATT staff prepared introductory material for the Handbook, and coordinated production and printing of the document.

The Handbook was completely updated for TSSC II. It can be found in its entirety in Appendix E of the hard-copy version of this report. The electronic version of this report and the TSSC web site (http://www.its.uidaho.edu/niatt_tssc/index.htm) contain the majority of the Handbook materials as well.

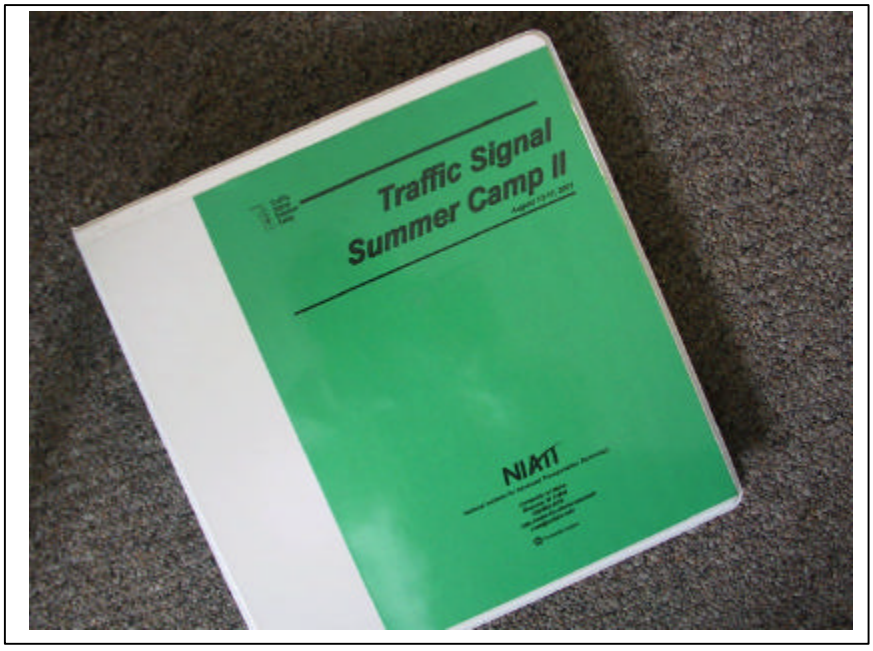

Figure 1. TSSC II Student Handbook.

4. Promote TSSC

Once the camp curriculum was developed and refined by the instructors and peer review panel, NIATT began to promote Traffic Signal Summer Camp to potential students and to the transportation engineering community at large. The same promotional strategies were employed for both TSSC 2000 and TSSC II.

Distribute Flier at TRB Annual Meeting

A 3-1/2" x 8" promotional piece was developed, describing Traffic Signal Summer Camp, and NIATT staff distributed it at the 2000 and 2001 annual meetings of the Transportation Research Board (TRB) in Washington, D.C. (Figure 2).

Ads in Professional Publications

The TRB flier was modified slightly, to become a 1/3-page print ad, and ads were placed in the *ITE Journal* and *Woman Engineer*.

Promotional Page on NIATT Web Site

A new page promoting TSSC was added to the NIATT web site (Figures 3 & 4).

Notice to ITE Educators Council List serve

An announcement describing TSSC was posted to the ITE Educators' Council List Serve, which includes approximately 120 transportation engineering educators.

Personal Emails

Finally, NIATT staff sent personal emails to transportation engineering faculty at colleges and universities nationwide, describing Traffic Signal Summer Camp and inviting them to spread the word to their junior or senior-level students who had an interest in transportation engineering.

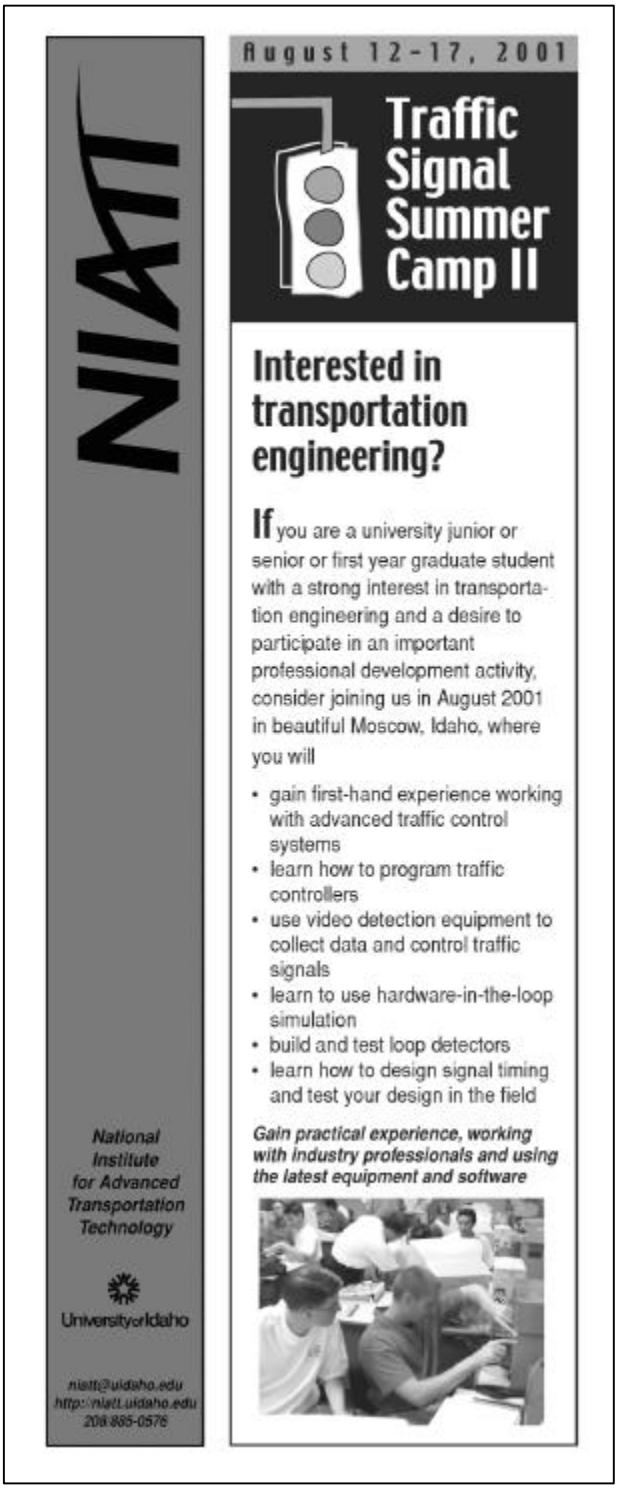

Figure 2. Flier distributed at TRB annual meetings 2000 and 2001.

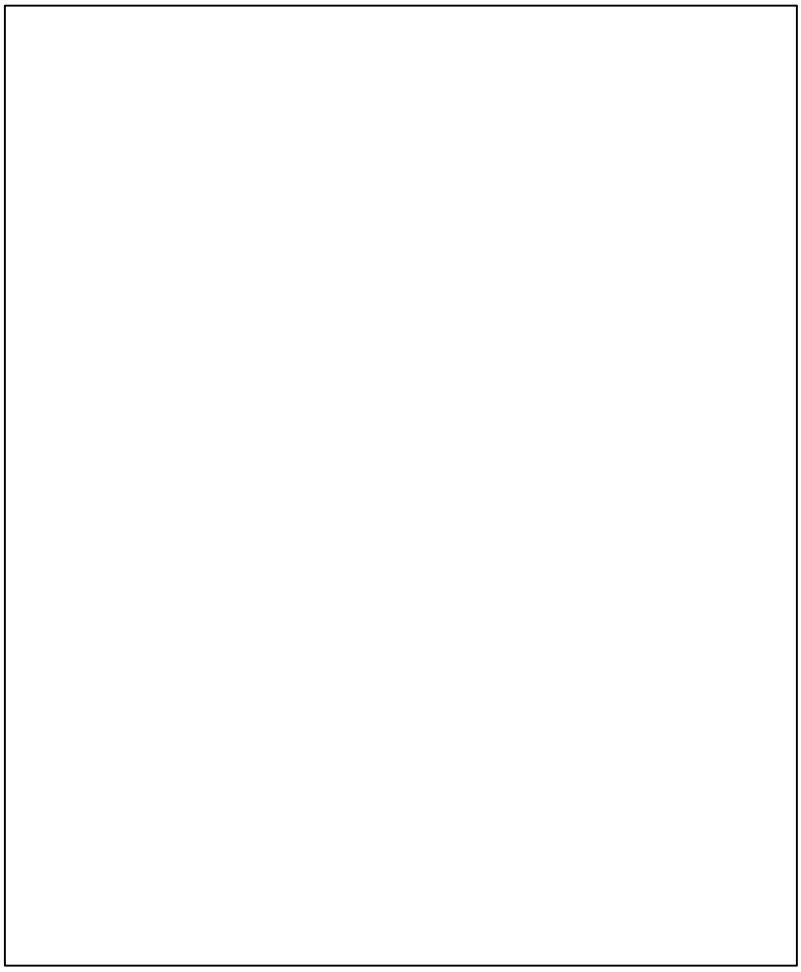

Figure 3. TSSC promotional material on NIATT web site, page 1.

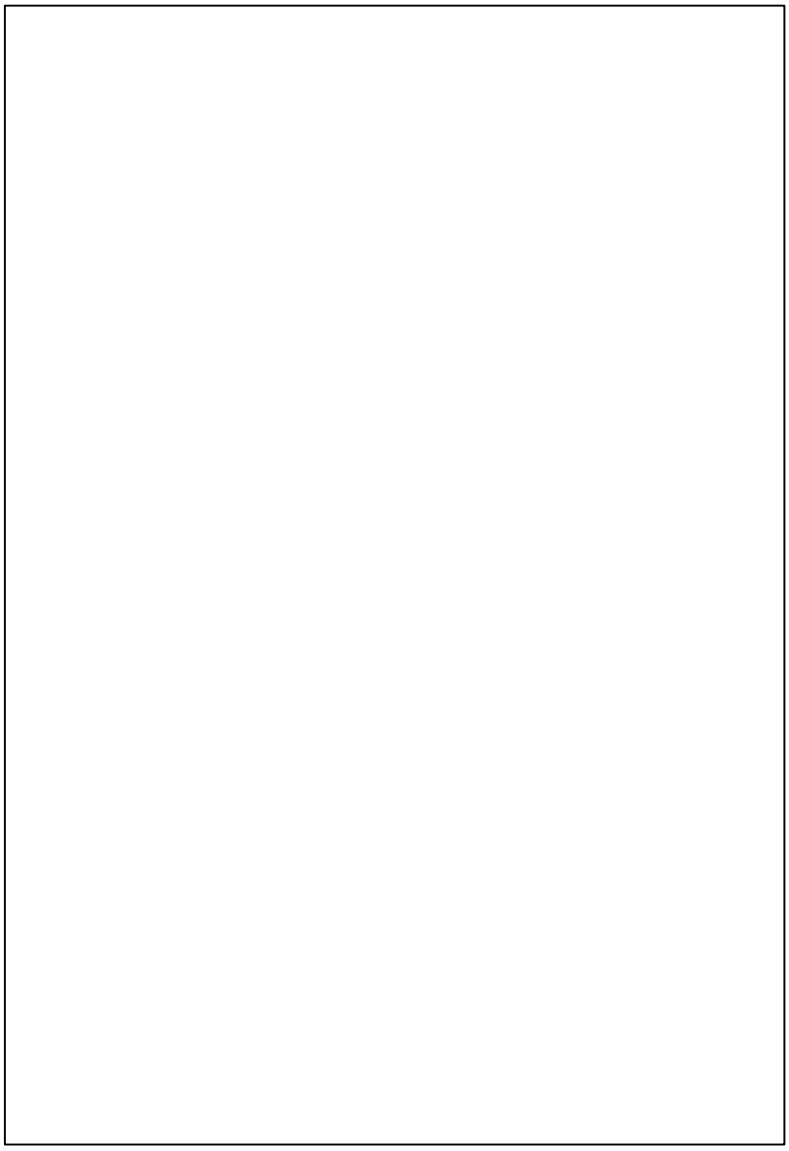

Figure 4. TSSC promotional material on NIATT web site, page 2.

5. Recruit Students

Prospective students (called Campers) were asked to apply to TSSC by submitting:

- An application form (see Appendix A).
- A letter describing the student's interest in transportation engineering and stating why he or she felt that TSSC would enhance their professional and educational career.
- A list of courses in transportation engineering already completed.
- Information about any professional experiences the student already had working in the field of transportation.

Twelve students were selected for each year of TSSC, based on their level of interest in transportation as a career choice and their previous experience in the field. The selection team also strove to achieve a balance between undergraduate and graduate students, and men and women.

Upon acceptance, each student was notified with a personal letter from the director of NIATT (see Appendix B). A small deposit was required of each student.

For TSSC 2000, twenty-four students from colleges and universities across the country applied, and twelve were accepted. For TSSC II, fourteen students applied, and twelve were accepted. Three of those had changes of plans before Camp began, so NIATT invited three of its graduate students to fill the available spaces.

Although the promotional strategy for TSSC was exactly the same in 2000 and in 2001, fewer students applied for TSSC II than had applied the previous year. It is possible that this decline can be attributed to the $250 fee that was instituted for the second year of camp (See Section 8, Conduct Traffic Signal Camp, for details).

6. Develop/Upgrade Traffic Laboratories

NIATT's existing traffic laboratories were upgraded substantially, in order to provide TSSC students with the latest traffic signal software and hardware. The two traffic laboratories are:

Highway Design Laboratory

The Highway Design Laboratory (Figure 5) includes twelve design workstations, with professional-level design and traffic operations software installed on every machine. Prior to the first TSSC, all of the software was upgraded to include:

- *Microsoft Office 2000*
- *Highway Capacity Software*
- *TSIS 4.3*
- *ITRAF 3.0*
- *Synchro 4.0*

The Highway Design Lab was built with funding from the Idaho Transportation Department (ITD), the University of Idaho's Civil Engineering Department, and NIATT. Days One and Two of TSSC are held in this laboratory.

Figure 5. NIATT's upgraded Highway Design Lab.

Traffic Controller Laboratory

The Traffic Controller Laboratory (Figures 6 and 7) includes six workstations, each accommodating two students, and an instructor workstation.

Figure 6. NIATT's upgraded Traffic Controller Lab.

Each workstation includes two computers, a video detection system, videotape player, Sony monitor, an LMD-8000 traffic controller, and a Controller Interface Device (CID II).

Figure 7. One of the student workstations in NIATT's Traffic Controller Lab.

Days Three, Four, and Five of TSSC are held in this laboratory. The Traffic Controller Lab was developed with funding and/or donations from the following partners:

- Econolite Control Products Inc.
- Northwest Signal Supply
- Ada County Highway District
- Idaho Transportation Department
- McCain Traffic Supply
- Peek Traffic
- U.S. Department of Transportation

7. Develop TSSC Web Site

NIATT staff developed a web site for TSSC (Figure 8), which can be reached through a link on the NIATT web site. The site serves two purposes:

- It provides students with an advance look at Traffic Signal Summer Camp before arriving on campus. The site includes photos, biographies when available, and email addresses of the instructors and the other students who will be attending that year. It also features the class schedule and social events planned for the week, course materials for each day of camp, and photos and details of the three intersections used as case studies throughout the week.
- It serves as a repository for electronic files that are used during classes.

The address of the web site is: http://www.its.uidaho.edu/niatt_tssc/index.htm.

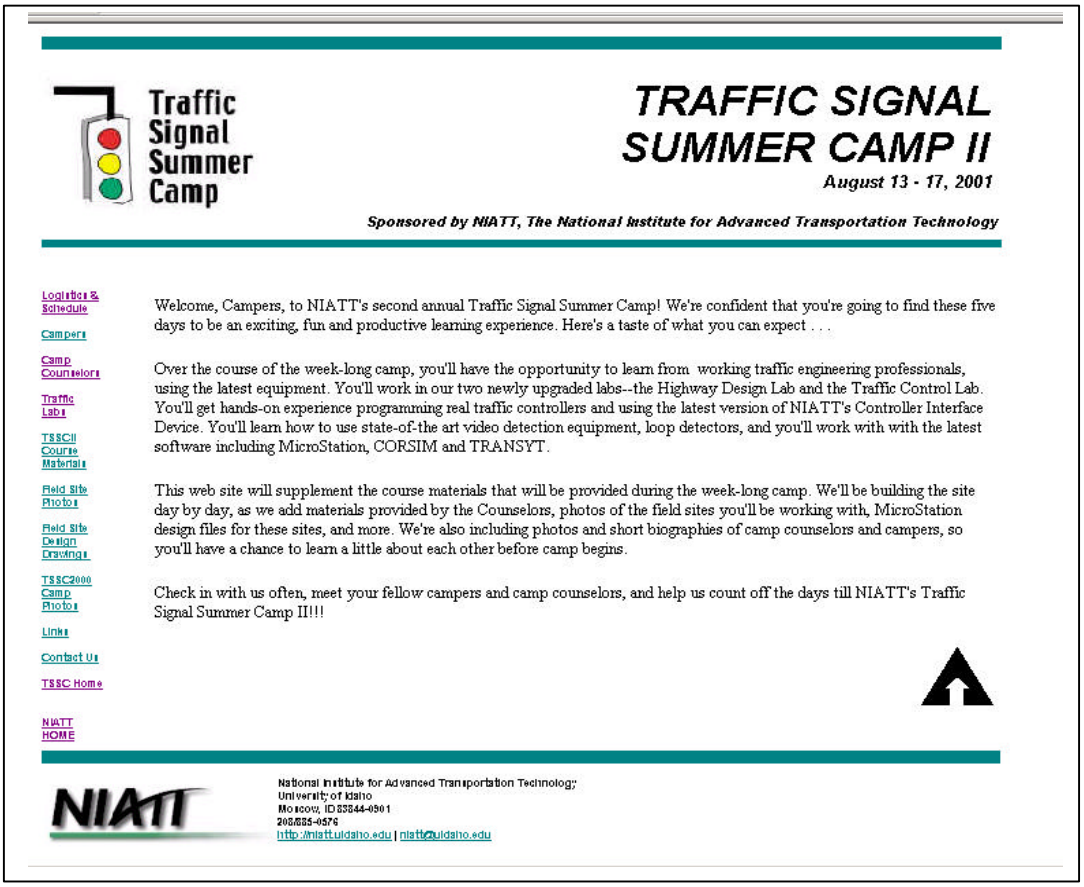

Figure 8. TSSC II web site main page.

8. Conduct Traffic Signal Summer Camp

Camp Schedule

Classes run Monday through Friday, 8am to 5pm. Each day covers a different topic related to traffic signal control (see Camp Curriculum below), and presents students with an enormous volume of information. In order to maintain student enthusiasm and energy level, instructors try to adhere to an ideal time schedule of approximately one hour of lecture, followed by two to three hours of lab or other active work in the morning, with the pattern repeated in the afternoon.

Figure 9. Instructor Zaher Khatib, UI, helps students with a Synchro problem.

Figure 10. Instructor Dale Moore, ITD, explains the functions of a controller box to students during a visit to one of the case study intersections.

Camp Curriculum

The topic for each day of camp is listed below.

- Day One: Introduction to Traffic Signal System Design
- Day Two: Fixed Time & Actuated Signal Timing and Design
- Day Three: Actuated Signal Controller Operations
- Day Four: Video Traffic Detection and Loop Detectors
- Day Five: Hardware-in-the-Loop Simulation

For TSSC II, the Day Three and Day Four schedules were modified at the last minute, because one of the instructors had an unavoidable scheduling conflict. For that year, Video Detection was presented in the morning of Day Three, and Signal Coordination was presented in the morning of Day Four.

Outlines for each day of TSSCII are presented in the following pages. The course materials that are contained in the TSSC Student Handbook are available in Appendix E of this report and on the TSSC website at: http://www.its.uidaho.edu/niatt_tssc/index.htm.

DAY ONE: INTRODUCTION TO TRAFFIC SIGNAL SYSTEM DESIGN *Camp Counselors: Joe Marek, John Ringert*	
Introduction to Traffic Signal Summer Camp Welcome Introduction of Participants Administrative Overview Overview of the Week's Agenda **Introduction to Traffic Signal Design** Why do a traffic signal Benefits and drawbacks Needs analysis Warrants Funding **Traffic Signal Design Elements – Operational Requirements** Number of lanes LOS analysis Signal phasing options – 2,3,4…8 phases Protected vs permitted vs prot/perm turns Overlaps **Traffic Signal Design Elements – Intersection Geometry** Intersection alignment Lane widths, storage lengths Crosswalk locations Right-of-way Easements **Traffic Signal Equipment** Controller – type of controller and type of cabinet; NEMA vs 170/2070 Signal Poles – master arms vs strain poles; signal configuration; signal visibility; pole size Vehicle and pedestrian signals Design considerations – Illumination, wiring, detection	**Design Project Introduction** *Highway 95/Highway 8 Intersection* Walk through intersection *Highway 95/Lauder Ave. intersection* Review existing conditions Review proposed intersection geometrics Review/identify constraints Go through design checklist Students measure items, paint pole locations and loop locations, etc. **Lunch and Return to Campus** **Break** **Intersection Design for Highway 95/Lauder Ave.** Review of design constrains Controller location Poles/arms/signal head locations Wiring Loops Signal Timing Emergency vehicle preemption Pole orientation chart **Design Presentations** **Closing Remarks**

DAY TWO: FIXED TIME & ACTUATED SIGNAL TIMING AND DESIGN *Camp Counselors: Michael Dixon, Ahmed Abdel-Rahim*	
Stop Line Operations Introduction to CORSIM and stop line operations demonstration Class exercise Intergreen times Pedestrian signal timing Signalized intersection capacity Class exercise **Break** Signal Timing – cycle length Class exercise Signal Timing – green splits Class exercise Measures of Effectiveness and Optimization Level of Service (LOS) Evaluation of the improved signal timing plan Class exercise **Break** Optimization exercise Class exercise Signal timing design project Class exercise **Lunch**	**Actuated Signals** Type of signal control The concept of actuation Fully actuated signals – Basic definitions Volume density setting Single and dual ring operation Dual ring operations **Break** Fully actuated signals – Detector configuration Coordination Design **Break** Design Project Highway 95 and Styner Ave.

DAY THREE: VIDEO TRAFFIC DETECTION AND ACTUATED SIGNAL CONTROLLER OPERATIONS-ACTUATED SYSTEMS *Camp Counselors: Michael Kyte, Mike Boydstun*	
Video Traffic Detection Introduction to traffic sensing and data collection Field of view assessment Setting up and reviewing Autoscope detector files Collecting event data using Autoscope Collecting event data using Traffic Tracker Vehicle tracking **Break**	**Actuated Traffic Signal Systems** Actuated signal control settings Detection – Dilemma zones Exercise: Controller interval timings Coordinated signal control Exercise: Force Off/Permissive Worksheet

DAY FOUR: ACTUATED SIGNAL CONTROLLER OPERATIONS-SIGNAL COORDINATION AND LOOP DETECTORS *Camp Counselors: Zaher Khatib, Dale Moore*	
Signal Coordination Signal coordination introduction Factors affecting coordination Time-space diagram Example: Synchro – Building a system Example: Synchro – Analysis and evaluation	**Loop Theory, Operation, and Other Amazing Facts** Introduction Basic Theory of Electricity - Electron theory; current flow; resistance, current, voltage; Ohm's Law; basic circuit concepts; basic theory of magnetism; magnetic fields; attraction and repulsion; lines of flux; strength of field Electromagnetism - In a wire; field's strength; in a coil Magnetism lab - prove theories through experiments **Break** Loop Theory – operation; placement; types; installation; uses; future of loops Loop Lab - Design, build and test loops

DAY FIVE: HARDWARE-IN-THE-LOOP SIMULATION

Camp Counselor: Darcy Bullock	
Review of Synchro Times for Hardware-in-the-Loop Simulation Transferring Synchro phase splits Checking phase splits for errors **Design of Traffic Signal Timing Parameters for Isolated Intersections** Calculating controller timing parameters Checking coordination parameters Making detector assignments Understanding controller and CID numbering **Configuring an Intersection (Node 12) in Econolite Controllers** Controller configuration using the keypad Setting the time clock Testing the controller with the *CID Suitcase Tester* Running a single intersection hardware-in-the-loop simulation **Introduction to Econolite Aries Closed Loop Management Computer Software** Uploading, modifying and downloading a controller database Setting up intersection graphics to view real-time status Viewing a hardware-in-the-loop simulation simultaneously with the intersection graphics	**Configuring a 3-Intersection Closed Loop System** Controller configuration using Aries Setting the time clocks Testing the controllers with the *CID Suitcase Tester* Setting up the intersection graphics to view real-time status **Hardware-in-the-Loop Simulation of a 3-Intersection Closed Loop System** Setting up the controllers and CIDs Generating .CID file for the simulation Running the hardware-in-the-loop simulation Fine-tuning the US95 network for competition **Extracting Measures of Efficiency from Simulation** Using the Strip.exe utility to extract output data Inserting the output data into Excel for viewing graphs **Traditional Procedures for Estimating Arrival Type** Procedure used to estimate arrival type Impact that arrival type has on level of service calculations

Logistics of Camp

Costs to Students

TSSC 2000 was provided to students completely free of charge, and included room and board. TSSC II students were required to pay a $250 fee, to help defray expenses, but room and board were again provided at no charge. In both years, students were responsible for their own transportation to and from Idaho.

Graduate Student Hosts

NIATT graduate students served as hosts for each camper for the entire week. Hosts contacted their students by email prior to camp, to make themselves available for questions and offer advice. They picked up their students at the dormitory on Sunday evening and escorted them to the welcome barbecue at the opening of camp. Throughout the week, hosts helped students orient themselves to campus and the Moscow area, and often chaperoned trips to the countryside or the movies. This one-on-one contact gives students an exceptional opportunity for networking, and to see first-hand the life of a NIATT grad student.

Figure 11. TSSC students, instructors, and NIATT grad student hosts mingle at the Sunday night welcome barbecue.

Ample Opportunities for Student/Faculty/Student Interaction

In addition to the time spent in the labs and classrooms, social activities throughout week offer opportunities for students to interact with TSSC faculty as well as the other students (Figures 11 and 12). This begins with the opening barbecue on Sunday night, continues with a pizza party mid-week, and concludes with a closing ceremony and banquet on Friday evening.

Figure 12. A mid-week pizza party gives students an opportunity to get to know the instructors in a relaxed setting. Here, instructors Mike Boydstun (left) and Zaher Khatib (right) chat with a student.

Certification of Completion

At the closing ceremony on Friday evening, students are presented with a Certificate of Satisfactory Completion of Traffic Signal Summer Camp. Continuing Education credits are also available through the University of Idaho, for a small additional registration fee.

9. Conduct Evaluation by Students and Instructors

TSSC 2000 Evaluation

At the end of each class day, the students were asked to respond to a set of questions evaluating the day's activities. Instructors were asked for their evaluations at the end of the week. One year later, in July of 2001, students were asked to provide a second evaluation of the camp.

Once all student and instructor responses were received, NIATT staff compiled the evaluations in a comprehensive document, and distributed the document to all instructors for analysis. The compilation is included in Appendix C of this report.

In analyzing the student and instructor comments, several trends became apparent. Positive responses included the following:

- All of the students were enthusiastic; they felt that the week was an excellent experience overall, and presented information that they could not have obtained anywhere else.
- Many also expressed appreciation for the exposure the camp afforded them — exposure to hardware and software being used in current practice, exposure to working professionals in the field of transportation engineering, and opportunities for networking with other students.

> *"This experience has been a perfect transition for me, going into graduate school in traffic engineering. I particularly appreciate the networking opportunity that personal interaction with experts and professionals with real-world experience affords us, as well as the practical perspective those professionals bring to our educational process. This experience has started me out on the right foot for graduate school, both in my classes and in my research. It has increased my desire to be a traffic engineer and do traffic engineering"*

Suggestions for improvement included:

- Most students suggested that, although every class did include hands-on exercises, even more hands-on work would enhance the learning experience.
- Some students felt there was overlap in the material that was presented day-to-day. They suggested that the case study that was used in some classes be developed further, so that each day's exercises could be focused around the case study and build upon the previous day's work.
- Many of the students criticized the choice of names – Camp, Campers, Counselors, citing that the names sounded unprofessional. Some said they had trouble getting time off work to attend a "summer camp," and some felt that the name would not add credibility to their resume once they graduated.

NIATT's Response to Evaluation Comments

In meetings and conference calls over the following winter, the instructors resolved to address the major criticism of TSSC2000 leveled by students, which was "not enough hands-on experience". To that end, instructors carefully crafted the schedule for each day of TSSCII, to fit as closely as possible an ideal schedule of approximately one hour of lecture, followed by two or three hours of lab or other active work in the morning, with the pattern repeated in the afternoon.

The concept of a case study was also redeveloped, to include three intersections in Moscow that would be the subject of lab work during the week, and tie the week's activities into a cohesive whole. The instructors worked closely with one another, in order to reduce the amount of overlap in material. The names Camp, Campers and Counselors were left in place for another year.

TSSC 2001 Evaluation

In the second year of TSSC, students were again asked to respond to a set of questions at the end of each day's class. A month after camp had concluded, students were asked to submit a second evaluation. Instructors were asked to evaluate the week's activities immediately after camp concluded. NIATT staff compiled student and instructor evaluations, distributed the document to instructors for analysis, and the compilation is included in Appendix D of this report.

After analyzing the TSSCII evaluations, it was clear that the major issue of the previous year's camp had been resolved. Students all agreed that the balance of lecture and hands-on work was appropriate and greatly enhanced the learning experience.

> *"The hands-on experiences were what I liked most about the week's activities. The variety of instructors was also very nice."*
>
> *"The best parts of the week were the hands-on work and introductory lectures to the more advanced technologies of video detection and hardware-in-the-loop simulation. Exposure to this technology was worth the trip alone."*

Few students this year commented on the overlap of material between days, so it appears that the new case study concept, combined with adequate communication among the instructors, has helped to resolve that issue.

Many students, however, did comment on the choice of names – Camp, Campers, Counselors. The decision was made to change the name of future camps, beginning next year.

SECTION FOUR – COSTS TO CONDUCT TRAFFIC SIGNAL SUMMER CAMP

The following table illustrates the costs of conducting TSSC in its first and second years. Not surprisingly, the first year of camp was considerably more expensive due to initial development costs. Salaries for the first camp were significantly higher, because they included time for developing the case studies and other supporting course materials. In addition, the first year included major one-time costs for the initial upgrades of hardware and software in NIATT's two traffic laboratories. An additional factor that brought the second-year costs down somewhat was the $250 fee which students were charged, to help defray expenses. Costs for NIATT Director and Management Assistant time were not tracked in either year, and are not included in this report.

Traffic Signal Summer Camp Expenses		
	TSSC 2000	**TSSC II (2001)**
Category	**Amount**	**Amount**
Salaries/Fringe	$9228	$4364
Instructors	4033	5376
Student Costs	2838	2093
Printing Handbook	1491	1949
Advertising	1422	1240
Miscellaneous	646	805
One-Time Costs (Computers, software, projector, supplies)	12,514	---------
TOTAL COSTS	**$32,172**	**$15,827**

SECTION FIVE – FINDINGS AND CONCLUSIONS

Traffic Signal Summer Camp has been a tremendous success, on many levels:

- It provides students with the hands-on experience in advanced traffic signal control technologies that is missing from today's transportation engineering curriculum.
- Students responded enthusiastically to its real-world, hands-on approach to the study of traffic signal technology, as well as the interaction with practicing professionals.
- It integrates technology that NIATT has developed during other UTC projects, such as the Controller Interface Device.
- In the process of developing TSSC, NIATT created a set of traffic signal technology course materials that is now available to others in the educational community. Educators and students can access the TSSC materials through NIATT's web site at (http://www.its.uidaho.edu/niatt_tssc/index.htm).
  This follows the lead of NIATT's Online Transportation Engineering Lab Manual, which provides background material and lab exercises to supplement universities' introductory course in transportation engineering. The lab manual is also available on NIATT's web site, at (http://www.its.uidaho.edu/niatt_labmanual).
- The summer camp concept will be expanded beyond traffic signal workshops for university students, to train professionals from the Idaho Transportation Department. ITD has approached NIATT with a request to conduct a modified version of Traffic Signal Summer Camp for their district employees. Though the basic curriculum for the ITD version will remain the same, specifications such as signal timing parameters will be customized to reflect ITD's standards. The first ITD-TSSC is tentatively scheduled for first-quarter 2002.
- In cooperation with Purdue University, we have had preliminary discussions with FHWA about developing a traffic signal workshop that can be delivered to practicing traffic engineers throughout the U.S. The workshop will be based on our Traffic Signal Summer Camp model.

SECTION SIX – FUTURE PLANS FOR TSSC

Plans are underway for Traffic Signal Summer Camp III, scheduled for August 2002. The basic structure of the camp has proven to be very successful, so it will be repeated next year, with two minor modifications:

- In keeping with the name "Traffic Signal Summer Camp," NIATT staff initially began referring to the instructors as "Counselors," and the students as "Campers," but the overwhelming majority of TSSC students told us that they felt the names sounded unprofessional. Consequently, the decision was made to change the name to "Traffic Signal Summer Workshop", and to refer to participants as "Instructors" and "Students".
- The results of a current NIATT project will be included in the Traffic Signal Summer Camp curriculum beginning next year. The project is entitled, "Development of Traffic Signal Training Materials Integrating Hardware-in-the-Loop Simulation." A portion of the training materials will address using NIATT's Controller Interface Device (CIDII) for hardware-in-the-loop simulation, and will be incorporated into TSSC's Day Five curriculum.

APPENDIX A

APPLICATION FOR ADMISSION TO TRAFFIC SIGNAL SUMMER CAMP

Traffic Signal Summer Camp Application

Please complete the information on this form, print it, and mail withther applications materialsto:

NIATT Traffic Signal Summer Camp II
University of Idaho
P.O. Box 440901
Moscow, ID 83844-0901

Deadline: April 3, 2001

Please provide the following contact information:

First Name	
Last Name	
Middle Initial	
College/University currently attending	
Street Address	
Address (cont.)	
City	
State/Province	
Zip/Postal Code	
Country	
Home Phone	
E-mail	
Birth Date	
Social Security Number	

Please indicate your academic level in fall 2000:

☐ Junior

Application, Traffic Signal Summer Camp

- ☐ Senior
- ☐ Graduate school (degree sought _____; years completed _____)

Engineering grade point average	
Name of academic advisor who can provide information on your academic performance	
Telephone number of academic advisor	
email address for academic advisor (if available)	

I understand that the registration fee of $250 (due within two weeks of notification that I have been selected as a participant) will cover all costs of the camp, including housing, meals, and material. However, I am responsible for providing my own transportation.

_____
Signature of applicant

Please send the following with your application

1. a letter describing your interest in transportation engineering and why you think Traffic Signal Summer Camp will enhance your professional and educational career
2. a list of courses in transportation engineering that you have completed
3. information about any professional experiences that you have had working in the field of transportation

NIATT Home

National Institute for Advanced Transportation Technology
University of Idaho
Moscow, ID 83844-0901
208/885-0576
http://niatt.uidaho.edu | niatt@uidaho.edu

APPENDIX B
ACCEPTANCE LETTER TO
TRAFFIC SIGNAL SUMMER CAMP

May 15, 2001

«first» «last»
«street»
«city» «state» «zip»

RE: Traffic Signal Summer Camp 2001

Dear «first»:

Congratulations! You have been selected to participate in the National Institute for Advanced Transportation *Traffic Signal Summer Camp* this August 12 through 17 on the campus of the University of Idaho in Moscow. Your "camp counselors"—professionals from various transportation fields—are busy preparing for camp to ensure that this summer experience will be both challenging and rewarding. I look forward to meeting you.

Because interest in the camp has been very high, we need to have confirmation that you are still interested and will be able to come. Please complete and mail the enclosed acceptance form along with a deposit of $50 (payable to UI Bursar) as soon as possible, but no later than June 15 A number of other forms are enclosed that we also need completed and returned by July 28.

We will provide you with more detailed information once we have your acceptance, but you may want to start arranging your travel. You should plan on arriving by early afternoon on Sunday, August 12—we'll have some sort of picnic/barbeque that day. Your departure should not be before Saturday morning, August 18. (Since this does not involve a Saturday night and may impact airfare, we will be glad to provide housing for Saturday, August 11, or Saturday, August 18.) The Moscow-Pullman airport is only minutes away from campus. The other airport choice is Spokane, Washington (about 85 miles north) and you can arrange shuttle bus transportation from there to Moscow (and back).

Please call or email if you have questions. Judy B. LaLonde will be in touch with you as the summer progresses. I look forward to meeting you!

Sincerely,

Michael Kyte

Michael Kyte
Director

enc.: Acceptance and Registration Form (return by 6/15/01)
Health Statement (return by 7/28/01)
Photo/Recording Authorization (return by 7/28/01)
Informed Consent Agreement to Participate (return by 7/28/01)
Notice of Insurance
Continuing Education Credit Registration (you can delay this decision until after 8/13/01)

MK/jb

APPENDIX C

COMPILATION OF CAMPER AND COUNSELOR EVALUATIONS

TSSC 2000
AUGUST 2000

TRAFFIC SIGNAL SUMMER CAMP
AUGUST 2000

Compilation of Camper and Counselor Evaluations

PART ONE - CAMPER EVALUATIONS DURING CAMP

DAY ONE – INTRODUCTION TO TRAFFIC SIGNAL SYSTEMS
What did you hope to find out today that you didn't?
Not knowing much of anything about traffic signal systems, all the material was fairly new to me.
I thought the introduction was pretty involved. A brief discussion on how the traffic signal actually received the data would have been good. Group: Felt the discussion was very good, almost all areas were discussed.
Everything was gone over well, there isn't really anything that I expected to learn which I didn't. I did expect to go out in the field, but in hindsight it's probably good that we didn't, being that today was in essence an overview of everything. Group: Stuff that wasn't gone over in school.
I hoped to learn more about uses of pre-timed signals, but I understand that they are less common and I do appreciate what I learned about actuated signals.
If this is all we need to know for the intro, then it covered it well.
I knew today would be an introduction for the rest of the week. It was actually more detailed than I expected. I thought it was good and didn't leave out anything that I'd hoped for.
Today was a review to get everyone on the same page. A lot of the information was review. I hoped to have hands-on experience with the control boxes.
It was a good broad overview/review. Maybe a little more about the actual traffic controllers we will be using, to see how things like recall and force-offs work.
I hoped to find out about state-of-the-art (3D) traffic simulation software. More hands-on, less equations. Introduction more detailed than expected.
I wanted to learn some topics that weren't covered or I missed in school, i.e., I hoped for more hands-on learning.

What did you learn today that helped you to better understand basic traffic signal systems?
Good explanation of loops.
How the traffic signals work. The different phases involved, extensions, loops were all interesting. I had an idea of how traffic signals worked, and it was good to know I was at least on the right track.
The discussion on phasing and the different phase settings like "Max gap, recall" was very informative. Group: Topic on phasing, gaping out, max green, discussion on the polygon and figuring out the cycle length and the topic about the dilemma zone was beneficial.
I learned some of the theory that goes into properly setting up a signal controller. Group: Good refresher, very quick packed and well organized.

I understand the dilemma zone and all red phase better.
Covered stuff I already knew but needed to review. I had never worked with software simulations but they seemed to use same principles as those taught in class. The logic that controllers actually use was new to me; I was familiar with the different phases but not how controllers treated them. The methods to evaluate intersections was also something I hadn't seen before, though I've heard of LOS and fuel consumption costs.
The phasing and determining the all-red, y, green, w and FDW times.
The theory behind all the software we use.
Nothing really, it was pretty much review. Calculations part was the best for me since I hadn't done manual calculations for two years or so. Everyone else probably benefited from the cabinet/controller descriptions. I would daresay everyone in here could probably pass the IMSA Level I Traffic Signal Tech test.
The polygon discussion was very thorough. Demonstrative program – TacSim.
I learned a lot about queue length and the phasing, queue accumulation polygon and what different effects it has on delay. Good theory behind programs. Controller cabinet descriptions.
I learned the basic fundamentals (refresher) of traffic signal intersection timing, i.e. saturation flow rate, walk/FDW, etc.

What topics didn't you understand as well as you would have liked?
Recall, Delay Estimation.
The capacity analysis, cycle length, phase length and delay estimation topics were a little difficult for me to follow.
I have some knowledge of the materials discussed, however I think topics like MOE should be dealt with in greater depth. Group: Didn't really understand topic on delay. Incremental delay should have been expanded a bit more, and should have explained significance of calculations.
I didn't understand the QAF, Delay Estimation or the Estimating of Other Measures quite as well as I would've liked. Group: Finding the yellow time. Some topics were very lightly touched on.
I didn't understand Measures of Effectiveness as well as I would've liked. I didn't understand the motivation for evaluating U/C rates or saturation levels or their benefit in evaluating a signal's effectiveness.
I think the controller logic and phases should have been explained in more depth. Recall in particular was giving me a lot of trouble. Perhaps more visual step-by-step necessary for controller logic and phases. Coordinated signals not covered at all; at least some introductory material needed. I am still a little confused on the difference between phase control modules and the rings and overall controllers.
I understood it all as well as I would have liked, but I hope to analyze more complicated situations further in the week.
I would have liked to spend more time in delay estimation in Session 4.
Nothing really. I think the ring structure probably should be covered a little more in-depth, as far as the NEMA standard and how you would create a structure with lagging

lefts or an exclusive ped phase. Maybe this will be covered later on. Oh yeah, one big thing. I found his use of the phrase "control module", or whatever that thing was, totally bizarre. I'm assuming that is something he just created to make us see things more clearly, but it confused the heck out of me for a while till I realized it was just theoretical.
Types of control delay, incremental, etc.
I would like to understand everything better. All of the material was gone through very quickly. I was able to glean the concepts well, but I would need more time to study this material if I were to be tested on it. Controller cabinets. Overlaps, parent phases.

What suggestions would you make to improve the presentation of this material in the future?
Coordinated signals, more intro. More hands on. Exercise in every section.
The PowerPoint presentation and handouts were a good help. I seemed to miss a couple of the assumptions in some of the exercises - actually just the phase time apportionment exercise. Understanding the computer programs was a bit challenging. I'm sure it was just lack of time to play with them. More hands-on applications.
The presentation was pretty good and the only suggestion I have is to make it more interactive. Group: More participative.
The breaks are good. I think a film or video might serve very well.
Instructors eat lunch with campers to discuss questions. I know they are expensive, but I would like to work with latest versions of software, i.e. same versions used in the workplace. Work on coordinated signals.
The configuration of the computer, projector screen and writing space was just a little cumbersome. You had to rearrange these things to move from one to another. Perhaps try an under-desk keyboard holder and somehow lower the monitors.
Have more of the assignments at the end, so we can grasp the concepts better. Bring a sweater – it's freezing in here!
Drop the phase box illustration. Give us some type of hands-on in the afternoon to break the monotony of someone talking.
Involve campers more. Responses were only asked of us once. More activities would be helpful.
Better correlate handouts to slide projection (session 3) and use more headings/subheadings to aid navigation of the extensive material. The breaks are very helpful and allow time for material to sink in. We don't need the room to be kept so cold. CORSIM more useful presentation than TacSim. More straightforward presentation/less textbooky. Make computer monitors less obtrusive of instructor/projector screen.
The material covered today was extremely fast paced for the students with limited knowledge and experience in traffic intersection timing and design. Month's worth of material was covered in ONE day. In my school it took two months to cover that much material. Detailed and full examples of sessions 2 and 3 would be helpful in getting a better understanding. Video/visual example would be a plus.

DAY TWO – FIXED TIME SIGNAL TIMING AND DESIGN
Were your expectations met with today's material and topics?
Yes, field visit made it real. The activities were appreciated.
We all enjoyed going out in the field and seeing all of the equipment. Also enjoyed seeing the project/problem and coming back to create the design. Enjoyed the presentation of other teams.
Would like to have had time to cover wiring, etc.
Great – Stayed awake! ☺
Yes, most of the day was very interesting. We were able to do some sightseeing and do a little design work. That was what we were working for.
Yes, the subject of my expections was reasonably covered. Actual field visit and discussion including actual work/layout of a traffic signal was challenging.
Yes, my expectations were met with today's topics and discussions. The tough part about design is the fact that different states/jurisdictions like to design in different ways and I was really curious how were going to deal with it today. I thought that was very interesting.
My expections were met and exceeded! I particularly enjoyed the hands-on practice.
In spite of last night's "adventures", I found today's lecture much more interesting. It seemed to strike into the heart of why I am studying civil engineering, while yesterday served more as a review. The topics and field tour were done very well and my usual short attention span was no problem today. NOTE: I was very impressed with today's counselors, both in class and in the field. They really knew their stuff, weren't afraid to share it, and were all prepared and flowed nicely together.
Yes. I enjoyed seeing the actual equipment in the field and I enjoyed working with my team on our design. We all took advantage of the experiences of each team member to come up with a good design. Also, as the other teams presented their designs I saw elements of our different designs that could be combined to create an even better design. Would like to have learned more about the wiring.
My expectations were more than met. I learned so much today on things that I would love to do every day. There's just something about design that gets an engineer going!
Yes. Very thorough into signal design. Going outside was nifty neat-o.
Yes, very interesting. Some of the physical signal design was new and appreciated.
Yes, my expectations were met. I did not have many beyond a PowerPoint presentation in this lab and a walking field trip to get a close look at traffic signals and controller cabinets. The fewer expectations I have, the more open-minded and receptive I tend to be.
Everything was pretty much expected according to the syllabus except that I expected a little more hands-on learning and exercises on the signal timing equipment. Getting a chance to see inside the traffic cabinet was very informative. The same for getting to see the 5-light traffic light head.

Was the balance of lecture, field tour, and lab reasonable?
Yes, the balance facilitated greater understanding. Possibly some lecture material could have been covered in the field.
Excellent balance.
Good – maybe more time in the field.
Ya! The lecture was good for a review and for learning new material. It was great to get out and se the control box and be able to put our minds to work with design.
Yes, the combination of the three helped bring it all together. The actual field visit along with the discussion in the field helped explain video detection more elaborately.
The balance was good. I really liked the fact that we got to go out in the field. It is a lot easier to learn things when you can actually see them being done or already completed.
The balance between lecture/field/lab was very good. I would have enjoyed it more if some of the lecture time were exchanged for more field time.
Very good balance, although more time and explanation in the field would be helpful. It seemed a little hurried out in the field and maybe if we had spent a little more time there, more interesting questions would have been asked.
I think it was a very good balance in today's session.
The balance was – well balanced. I really enjoyed the fact that we discussed the "design steps" lecture before we went out in the field. This gave us a chance to reinforce the material that was just learned.
It was wonderful. Mornings you are ready for lecture, then by afternoon I was ready to do hands-on. This afternoon didn't drag on like yesterday afternoon . Tour was neat.
Very balanced. I was focused all day and the time went by fast.
The balance of lecture, field tour, lab and hands-on design was terrific. I enjoyed especially getting out in the field to see the problem and then returning to come up with a design solution. I'm happy we had lunch waiting for us on return.
Yes, the lecture, field tour and lab were well balanced and allowed better combinations of learning as well as variety.

Was the design assignment an effective and interesting experience for you?
Yes, it forced us to concentrate on some real-world difficulties. The challenge was appreciated.
Absolutely. Real project not textbook. Learned from team members and other teams.
Basic problem ok. Would like a more in-depth assignment, maybe building on each day and turning in a complete project at the end.
Very interesting. We learned a lot about different advantages and disadvantages to each part of the designs. Working together was great.
Yes, it helped bring out and challenge the engineer in me, and also brought back previous traffic signal length experiences.
The design experiment was good. I pretty much do that exact same thing at work every day during the summers and it was interesting to get a different perspective on it.
The design assignment was very effective as practical experience. I am a very "example-

oriented" learner. it was an appropriate and helpful example and it included many real-world difficulties.
I was a little disappointed with the informal nature of the exercise. I was expecting to have a lot more data (costs, traffic counts, etc.) and to produce a more formal report. It was a nice end to the lectures and field experience, but I can't help but think we could have done more.
Note for future camps: The project could be improved if we were to work on another aspect of it each day, culminating in a larger formal report and plans.
Absolutely. This is a real project and not some fiction made up in a text book.
The design assignment was great. I enjoyed putting all my new knowledge into use. It really brings all the aspects together.
Yes, especially breaking up and then seeing everyone else's design in the end. Makes time go fast when you are actively engaged in a project.
The design assignment was interesting and forced us to think about the aspects of the design. Many things I had not considered in the past.
Yes, the design assignment was interesting and effective. I'm glad my group members ha dprevious experience with traffic signal design. I let them chat about each possibility while I drafted the design with one ear on the conversation.
Yes, interesting to see other's design and perspective, as well as opinion of instructors.

What are your expectations for the rest of the week?
So far so good. We anticipate trips to the NIATT labs and working with detection and modeling. We are also anticipating the newspaper coverage.
Expect to learn some things that we have not experienced before. Expect to do more things like today as well as using computer for traffic analysis and simulation.
Pizza! More of today - hands on.
Pizza! I am hoping for some more hands-on learning. It seems to keep my interest better.
Good expectations. So far we've learned a lot.
An equal balance of lab time and lecture time. I kind of expect at some point to deal with state-of-the-art computer programs.
My expectations include heading down to the NIATT lab rooms at some point to check out the equipment.
Expect hands-on project assignments like today as well as using the computer for traffic analysis and simulation.
I'm looking forward to the rest of the week.
More hands-on stuff. I want to play with the Peek controller and the video detection equipment – now! Also interested to hear about coordination since that's what I did this summer.
I am anticipating and eagerly awaiting the days on detection and modeling. I also want to see this newspaper article. Pretty exciting stuff…
I expect to get more sleep at night and be able to eat breakfast first. I expect to take more field trips and use the computer for some traffic signal simulation.
For the rest of the week, I expect more hands-on and technical material.

DAY THREE – ACTUATED TRAFFIC SIGNAL SYSTEMS
What did you hope to find out today that you didn't?
Run simulation, play more with Synchro. See what we did (maybe by using the controller/mock intersection).
Video Detection stuff, Transit, CORSIM.
I didn't think we went over too much actuated material. More hands on would have been nice.
I was hoping that some explanation would be made for other simulation software like Transyst or CORSIM, which we didn't get to.
I wanted to play with the controller a little more than we did, and possibly run some simulations with it (on computer or otherwise). I also would have liked to see how the VCR's worked and how the program was used and applied to counting cars and the simulation mode.
I didn't get to see the video detection stuff working, but I assume we will see that tomorrow or Friday.
More about the traffic controllers. There is the light simulator in the electronics lab next door that would have been helpful in demonstrating the signal timings we worked out. I don't feel that I had mine adequately reviewed to feel confident in my own timing skills.
Maybe more work with the controller itself. We didn't get to do the traffic simulation part of Synchro.
SimTraffic. I would have liked to run my network through to see it in action.
How our Synchro coordination plans run on SimTraffic.
Work with other programs.
I hoped to wire/program the controller and see the intersection simulation light box in action. I also hoped todo some traffic simulation from the model we developed in Synchro.
Everything was exactly as expected.

What did you particularly like about the material that was covered today?
More hands on – touched the hardware, used the software. I liked running Synchro on a network we had seen/worked with. We really liked Dr. Khatib's sense of humor and dynamic teaching style (w/audience participation). He kept us interested and in a good mood.
Three intersections being simulated; controllers – functions; computers
It was interesting to find out how the computer programs help in setting up the signals.
I liked the presentation showing how the timing plans were implemented in the field using the controllers.
I still really liked the hands-on stuff. I liked the diversity of it. I also liked running the computer program even though we couldn't get around its small glitches.
I particularly liked seeing our previous intersections in Synchro.
The hands-on nature of the controllers and Synchro software. Dr. Khatib is a nice, very laid-back guy who took all difficulties in stride.

I like working with Synchro. I didn't have much experience with this software before today.
It built on what we did on day two.
Working on modeling real intersections on Synchro trying to get in some coordination. Hands-on with the controller.
Working with the controllers. I had never done that before.
I particularly liked getting acquainted with the controller and its menu interface, though after a while it became tedious. I liked making Link-Node diagrams with Synchro a lot, since it fit well with my previous class experience (except that now it was on computer).
Today was much more technical and had real-world implications, such as the use and implementation of the TCT controller. Coordination was very interesting as well as using Synchro (computers) for traffic signal design. Dr. Khatib's great sense of humor was very helpful in maintaining high energy in the day, and stimulated my interest.

What suggestions would you make to improve the presentations, materials and exercises?
This lab is bad for lectures - tight facilities and uncomfortable chairs. The presentation covered material for the problem, and an example problem would have been nice, to combine the two. Play with the controller after the problem, so it will sink in and we can correlate the data. Slow down a little with Synchro instruction and utilize the other two instructors.
Same file – new material. Volume, density, controllers. Barely see. Better explanation.
Don’t talk in such a monotone voice. Go through more examples of systems.
My main suggestion will be that Synchro be explained a bit more than was done. Also a lot more time should be spent dealing with advanced topics than revisiting previous discussions, and the software used for actual time implementation should be shown.
The presentations were good and well organized. I think if we had sheets of the exact same numbers on it, the program would have run a lot more smoothly. I would have let us program the controller.
Have all the data from the intersections saved as a file on everyone's computer (so there is less discrepancy or variability of results). I don't know if that is a good suggestion or not, the practice we gained entering data was also good.
The lab is a poor place for lectures, with bad visibility and uncomfortable chairs. The dark lighting didn't help in staying awake either. Next time have Eric and Mike circulate around more during the Synchro part, to help with the exercises. They seemed to have more than adequate knowledge of the software.
It would have been better if we had all come up with the same answers after the optimization, but that may not be possible with the software.
The exercise on the traffic control was fine. The exercise on Synchro was a little confusing. If all the steps had been written down in our notes, things would have gone smoother.
Drop the repetition of the first part of the day. Didn't need to be reminded that the four types of controllers were pre-timed, semi-actuated, actuated and coordinated (really semi-actuated) again. Remember it all too well from Monday. Run controllers (maybe only one

group's) in cabinet with conflict monitor and test board.
Make the input data (slide show) more readable. Use a whole page for each computer screen dump. Step us through the data entry together firs t, so that we don't have to spend so much frustrating time debugging Synchro lat er.
An example problem to the materials covered today would have been helpful.

Were the exercises appropriate for the time allocated to them?
No, we ran out of time on both.
Not really. No time to go over Synchro.
Yes. The exercises could be completed in the required time.
They were ok, except that too much time was spent on the timing implementation.
Yes, the exercises were good.
Yes.
Better time allotted for exercises today. Would have liked to spend more time with the controllers.
Yes, except we did get to simulate.
The last exercise did not have enough time. Everything else was fine.
Yes, it was interesting to see the variation in timings for the AM intersection. If we could have run those timings on SimTraffic or CORSIM it would have been a good way to show how silly some of them were.
Synchro is so data-intensive it is hard to cover much. Otherwise it was ok.
Maybe we could have seen more visible results with the controller, or else its time could be shorter. We spent too much time figuring out what went wrong with Synchro. The professor had a good sense of humor, which helped a lot.
Exercises were appropriate for the time allocated, with the exception of the data errors in our handout, which took time to fix.

DAY FOUR – LOOP DETECTORS AND VIDEO DETECTION
What did you like about today's activities?
Video detection. Making loops. How fast the time went. Everything in general.
I enjoyed the computer simulations, video detection, physics for idiots and loop detectors. They all made it a requirement to think and allowed for a hands-on experience in understanding.
I enjoyed loop detector building and data collection using video.
I liked the fact that we got a lot of hands-on stuff. I liked playing with all of the computer programs and I also liked designing and building the loops.
The hands-on combination of lab with lecture (both video and loop detection).
Bring Dale back again. He has a personality well suited to teaching and worked well in the exercises too.
I enjoyed building the loops the best. I also enjoyed the video detection a lot.
Lots of hands on!! I loved learning about video detection. And the loop detection activity was excellent. I learned a lot about the theories behind the loops.
The activities were very engaging. The lack of lecture was finally appreciated.

I really liked today's activities. I enjoyed the hands-on video detection – using software and the Autoscope. The most fun was learning about magnetism and building our induction loops and the bike detectors. I am really tired after learning so much new material. It has been fun and interesting.
I liked the hands-on exercises we did such as the video detection with the Autoscope and the construction of the loop detectors at the end of the day. I also enjoyed making the electromagnets.

What suggestions would you make to improve the video detection presentation, materials and exercises?
Give us an example of typical detector locations before we try to analyze the intersections for problems with Autoscope.
We had problems with the Autoscopes. They wouldn't work properly. It would be nice if all the equipment worked properly.
More time for experimentation with placement of detectors.
More guidance would have prevented the mismatch in Traffic Tracker and Autoscope counting time periods. Exercises with 5-6 video segments good for judging placement.
More time!! If we could learn more from hands-on than from the lecture we would have more time. Maybe more like training at a job.
The video detection was engaging. To see it detect was good.
T he video detection felt faster-paced than I would have liked. I felt rushed during our activities, especially when we used Excel during the last section. I would like to have learned what the lights on the Autoscope meant and the ports and such.

What suggestions would you make to improve the loop construction activities?
Bonus Question: How did lecture influence design of loops?
Maybe have preformed cardboard boxes or plywood to build loops around (although there were a lot of interesting designs that would have made the pavement fail in about two weeks!) Loop amps didn't work for the most part, I think only about two of them were reliable. It made you wonder if you were doing it correctly or not.
Have a mat to place over loops to allow the bike to be ridden over the loops. This would allow for a more realistic situation.
The lecture covered the placement, configuration and magnetic field of the loops. This was helpful in the design. It allowed us to figure out a design that would detect the bike. Knowing that the magnetic fields run perpendicular to the wire, we were able to determine a design that was efficient at detecting the bike. In short, it allowed for a good knowledge of loop design.
Bonus Question: I learned that detectors operate using magnetic waves generated by a current flowing through them and that the tighter the coils and the closer they are the larger the magnetic waves produced.
Get some newer detectors.
Bonus Question: I learned that detectors create strong points in the fields and that helped

us come up with a design. The project was actually a lot of fun.
More time for loop design.
Bonus Question: 1-The number and angle of corners influenced detector sensitivity proportionately. 2-The number and cross-sectional configuration of coils influenced detector sensitivity proportionately. 3-The plan view dimensions of the loop affect the height of the detection field. 4-The direction of the coils must be uniform or they will cancel out. 5-The gauge of wire used in the coil affects the detector sensitivity.
While it is important, shorten the intro to physics at the beginning.
I guess the physics review would be important to realizing how detectors work, but I think it was too in-depth and started out too simple. While it's been a while since most of us have had physics, I think we all know electrical flow, current, resistance, etc. pretty well. A quick intro to magnetic fields formed by electrical flow would have been all that was necessary to design our loops. More explanation was needed for how the detectors worked and were tuned.
How the magnetic field was created by the loop wire. 2-How the wiring was connected at the terminus to create the continuous loop. 3-All turns have to be in the same direction or they cancel out. 4-It helped me to see how I can come up with a more accurate measurement of wire length for loops for estimated quantities.
Less lecture. I learned so much from just the exercise.
Bonus Question: The first part of the lecture was a lot of background. Mos t of the material was review for most of us. I was reminded of the theories and concepts behind loop detectors. When we did the first experiment I learned a lot more on how to increase the strength of the field in our loop. I also learned that having many loops is not necessarily a good idea. Sometimes your field can be too strong and tuning your box becomes impossible. I believe I learned a lot more from the experiment/assignment than from the lecture, but it was nice to have the background. A brief summary would have been sufficient, though.
Bonus Question: I guess we just took Dale's design and used it. I was under the impression that was what we were supposed to do. I made sure the corners were good to try and establish better sensitivity near the corners. And that was it. Basic loop. Picked up the bike. Woohoo! What's in the street really works.
Not much to be improved. The counselors were great.
The first 1/2 of the detector design was fun. He was a great instructor, but everything was review and could have been spent other ways. I guess I still don't know what inductance is and I don't think we measure it in our small coils. That seemed to be the factor that makes or breaks loops. Ours, it seems, was far too powerful.
About detector design I learned that more loops yield a stronger magnetic field. The principles of induction were helpful but the atomic-electric theory was very basic review – probably not needed but fun to role model as an electron.
Most loop amp boxes were defective and, when swapped, finally worked. A contest with prizes between groups for best loop would have raised some competition and energy.
I learned that the more turns applied to the loop, the more sensitive the detector was to objects. Each loop had four intertwined pieces of wire that contributed to increasing the number of "turns". I learned to wire the loops such that each of the four wires looped around, so that the actual physical "turns" would be multiplied by four.

DAY FIVE – HARDWARE-IN-THE-LOOP SIMULATION (INCLUDES GENERAL CAMP COMMENTS)
Please comment on your experience in learning hardware-in-the-loop simulation.
There were a couple of challenges in getting to know the controllers. Entering some of the data without pressing the enter key was one. We just forgot to do it before changing screens. Locating the settings was challenging when we were modifying the intersection. It was great to be able to work hands-on. It allowed for good experience in putting everything together throughout the week.
I thought the activities of today were really enlightening as to how actual simulation model data actually is programmed into the controllers, and how they work.
I really thought getting to work with this program as well as with the controller was very interesting. We got to do some things that 99% of current traffic engineers haven't had the opportunity to do. The program is definitely very informative and I look forward to hopefully getting to utilize it in the future. I really enjoyed the hands-on and group work throughout the week. They gave me a more concrete understanding of the processes and programs.
This was an excellent experience. I am very happy to be able to see everything working for real in real time! Excellent use of our Synchro results obtained in a previous lab.
The programming lab exercise in the afternoon was done well, a good balance of lecture and experience. There was actually almost enough time to adequately finish off this exercise. Some of the morning lecture was less than helpful. There was too much on the history of simulations and on using KenSim, both of which will have little bearing on my future education or career. The info on probability and random number generation was helpful in a limited sense. I know how the program operates, but this info would be more helpful for a computer science major. More on CORSIM necessary. I found it frustrating that we wanted to make a simple change in our coordinated network, change a phase from protected to protected-permitted, and couldn't. We learned each piece of software separately and didn't know how to combine all functions to make this change.
I thought using all of these programs and devices was very good experience. I feel much more confident in my ability to use them. I really enjoyed using the intersections that we had used previously to do the coordination.
Today's simulation assignment put together all the prior things we have learned. Inputting all the data and parameters into the controller helped us understand and become familiar with the controller. I feel comfortable using one and changing settings. The simulation in TraFW helped us visualize all the work we had done. Linking all the intersections together helped me understand coordination.
The afternoon was awesome. The KenSim was a little unnecessary. We should have stuck with CORSIM the whole time so that we would have a better feel for what we did in the field.
This morning was less than what I expected. The KenSIM factors could have been gotten from a CORSIM output and then put in Excel to evaluate. All the extra time could have been used with CORSIM. Overall, more time with CID would have been appreciated. It

is such a "black box" kind of magic. I have so many questions.
Prior to this summer camp, I had no experience in hardware-in-the-loop simulation. Having learned what I know now, I felt Darcy Bullock's method in covering the directions were very effective and gave me some invaluable experience in handling the hardware and software in traffic simulation. The green book was also very useful and a helpful tool in getting the simulation running. Even though it was not apparent at the time, Ken's lecture on CORSIM was valuable for the rest of the day.

Consider the entire week of activities; how will these experiences help you in your career and education?
The camp will help with my education through working with groups. That was a great benefit. It will help with my career as well. Not knowing much about traffic control systems, I have definitely come out of this week more educated. This camp will give me the edge in class. I am very pleased with the knowledge passed on. This camp will enhance my education and career in the future. Being able to apply the material learned to both the work atmosphere and classes.
The activities we went through during the week were very enlightening and brought together a lot of the concepts behind what I do at work. It helped me understand some of the basics behind the traffic signal operation, using simulation software and actual field work. Personally, the week's activities were very informative and educational, and were quite a load. I think that if the topics discussed were narrowed a little bit – emphasized on a smaller scale – it would have been very good. A little bit less time could have been spent on theory and spent on a little more hands-on and simulation activities. However, I think the week's activities will be really helpful for my career. I also think that if more camps like this are done, the hours should start about 8:30. 8:00 is a little early.
My experiences this week have been great. This will be something for me to always be able to reference in the future. I especially liked that everyone was 'laid back", but at the same time getting a lot of work done. The breaks throughout the day really help to make the day go by. This camp will help me in my future profession in that it has really shown me many of the processes in the "whole" design of a single intersection or a whole series of them.
This experience has been a perfect transition for me going into graduate school in traffic engineering. It has been everything I anticipated and more. I particularly appreciate the networking opportunity that personal interaction with experts and professionals with real-world experience affords us, as well as the practical perspective those professionals bring to our educational process. This experience has started me out on the right food for graduate school, both in my classes and in my research. It has increased my desire to be a traffic engineer and do traffic engineering.
There is no doubt that this week has taught me much I would not normally have known. Most of the experiences will directly impact my future career and probably education too.
Notes on future camps: I think one uniform project for the entire week would have tied things together better. Sometimes it felt like a series of barely connected lessons. Instead, I think it would be better as a series of steps culminating in the completed signalized intersection. One idea for the future: a visit to the Traffic Ops Center in Boise. The

logistics might be challenging, but many of the campers may eventually be working in large cities with such centers operating large coordinated networks. Finally Symposium or Conference instead of Summer Camp. And get the word out better to civil engineering departments nationwide. I didn't hear a word about it at Penn State.
I have much more knowledge about all of the components of signal design of isolated as well as coordinated intersections. I'm going to try to use some of the software I used this week (probably Synchro) in the presentation of my senior design project.
The lessons I've learned this week are a great help for me. Having only been exposed to transportation for a short time, I've learned many programs but not many concepts and theories. Being here helped me fully understand what I'm doing at work. Professor Courage's statement on going to "ground school" before learning to fly hit it on the nose. Although it might be somewhat tedious, after learning it, one can be so much more efficient in their work. This was a great experience.
Immensely. This is better than education because the instructors have to cut through all their bull (not that it is all bull, just a lot of stuff they teach isn't worth remembering). Career, this is what people work with and do everyday. If you can relate to your Traffic Techs and see where they are coming from, you are a lot better off. Darcy was awesome, you can tell he loves what he does and he projects that as he teaches/answers your questions. He makes me want to go to Purdue for grad school. It was cool that you got a lot of different instructors from a lot of different backgrounds so that we could see different perspectives.
Day 1 could have been totally eliminated. All info was or could have been covered on the other days.
All info could be eliminated on volume/density controllers and a lot more time spent on force-offs and permissive periods, which were NEVER explained.
More time can be spent actually using Synchro/CORSIM and other things.
This course has been a review and only a slight overview of that. So much time was spent rehashing what we know that there was no time to spend teaching what we don't know.
Much of what I was exposed to was hands-on. Being a very visual learner, this allowed me to conquer the concepts of traffic simulation in a strong manner, mainly because I now know how each piece of equipment works (hardware and software), not just the theory or concepts behind it. I was able to use the equipment and apply it to what I have learned from the week at NIATT.

MISCELLANEOUS COMMENTS FROM CAMPERS
Please tell future campers to bring their own phones, towels and washcloths.
Barbecue – Excellent
Signs and directions at check in – Terrible. There were complete directions to check in, unless the people were gone, i.e. at noon or after 4:00. Then the directions just stated that check in was available at the tower. How do we know where the tower is?
Dorms – Hot, only 1/2 have air. No activities. Pool table, no balls. Lounge in basement not open. No phones, though there are phone lines if you'd told people to bring phones. Suggest radios to future campers. Suggest additional towels also.
Name – Traffic Signal Summer Camp is terrible. You really need to find something much less childish. If we are the top traffic engineering students, treat us that way and give us a name we can be proud of.

PART TWO – CAMPER EVALUATIONS ONE YEAR LATER

DAY ONE – INTRODUCTION TO TRAFFIC SIGNAL SYSTEMS
Upon reflection, what three key things did you learn from this day's session? Please list in order of priority.
It was a good introduction into the basics of transportation and traffic terms. Further understanding into what levels of operations. We were introduced to how basic signal timing works using a pretty simple software which was quite challenging, especially when applying it in the lab exercise.
Pretimed signal timing has come in handy for work with HNTB in St. Louis through Synchro and CORSIM traffic simulation packages.
Controller/Cabinet elements. GOOD overall discussion of phasing/rings
1What parts are inside traffic signal controller cabinets. I learned what signal performance measures are. I learned about a software package, but I forget what it did.
Theory of signal phasing. Software implementation. Performance measures

What three key things do you wish you could have learned more about? Please list in order of priority.
Most of the information was pretty much from books. I would have liked to know how it applies directly in the field.
How to create and program phase rings, not what they are. Common signal timing/analysis software. Other controller types (besides NEMA), the similarities and differences between all (has definitely come up before at work).
More about all the parts inside traffic signal controller cabinets. I would have liked to learn more about phasing terminology and the appropriate use of phasing techniques (overlap, split-phase, when to protect left-turns, why to lead or lag left turns). I wish more time was spent explaining what each signal performance measure is used for (when should timing be based on delay, when should it be based on v/c, what should be done if an intersection v/c or a critical movement v/c is greater than 1 or a LOS is worse than C or D).
More software applications. More software applications. More software applications

If you could teach this day's session, what would you change?
I would spend a little bit more time explaining traffic control equipment and their functions.
I wish we could have had more time for the lab exercises. The lectures were often longer than my attention span and the hands-on labs could have helped.
Let the students run analysis software (common software that they will encounter in the profession – Synchro, CORSIM, etc.)
Leave out all of the theory and background. The one thing I was most hoping to get out of the week was a basic knowledge/experience with CORSIM, and the most we did was

see its results and load some of the same into it with little understanding of the software itself.
I would try to break the lecture into shorter sections and try to include more exercises for the campers to apply the lecture principles and see the results between every section.
I can't remember much, but I do remember it being a little long and drawn out.

DAY TWO – FIXED TIME SIGNAL TIMING AND DESIGN
Upon reflection, what three key things did you learn from this day's session? Please list in order of priority.
Being creative with your own design while following accepted standards. Going to the field and collecting information.
I really liked the construction walk. I had never taken a close look at a traffic signal controller before and learned about its computer systems.
Signal layout. Teamwork
I Learned how to position signal heads to be seen appropriately. I learned that a minimum of two signal heads are required for the main through movement in case a bulb burns out. I learned some of the things to consider when placing signal controller cabinets (the ability to see the signal heads without having to leave the cabinet, right-of-way requirements, ease of vandalism or vehicle contact).
"You mean to tell me that there actually is a design aspect in traffic?" The different things to look for when designing an intersection. The different options one has in design.

What three key things do you wish you could have learned more about? Please list in order of priority.
More information on how to apply the MUTCD standards toward signal design.
I wish we could have studied geometric intersection design before performing the lab, but otherwise everything was good.
Timing. Signal equipment (not just an overview). 3-Illumination
More about how traffic signals are wired and where junction boxes are placed. More about lighting requirements at intersections. More about the signing requirements at intersections.
More on design.

If you could teach this day's session, what would you change?
Spend a little more time designing and critiquing designs by the students.
Once again, I feel that the morning session did not live up to what I thought was the goal of the camp – intensive, hands-on, practical experience – NOT theory and lectures. We were presented general information on the topics – again, the kind of information we've been given in college already. The sessions were more review than learning.
I would have tried to give more time to the actual design and presentations.

DAY THREE – ACTUATED TRAFFIC SIGNAL SYSTEMS
Upon reflection, what three key things did you learn from this day's session? Please list in order of priority.
Signal control. Detection. Volume density
What a dilemma zone is and how it can be avoided. What max-out and gap-out mean. How to draw a time-space diagram.
Controller settings. Using Synchro. Coordinating.

What three key things do you wish you could have learned more about?
How to develop more complex intersections in Synchro. More information on how to model volume density settings in Synchro. More information on understanding Time Space Diagrams.
I wish we could have gotten more experience laying out our own Synchro designs, to gain familiarity with this useful software package.
Timing coordinated signals. Better understanding of gap times/volume density. Better understanding of bandwidths
I would have liked to learn how to use a PC to change signal timing in a controller. I wish I could have learned more about the effects of shorter and longer gap-out times and about semi-actuation. I wish I could have learned exactly how actuated signals can comply with the coordination requirements of a corridor.
Synchro. The section on coordination was a little abstract. The space diagram.

If you could teach this day's session, what would you change?
I think it was pretty informative. Can't come up with anything to change.
Kudos for the fact that this session reached beyond what I learned in college! Unfortunately, another drone presentation was still not involving everyone. The Timing Worksheet activity would have been an excellent learning tool, had we been given nearly enough time to complete it and learn from it. Possibly start with the worksheet and teach the material as you go. Or, once again, give students the written info, launch them into the worksheet and float and answer questions. They can go back and read the info as well (or better) than the presenters – and it involves their thinking process much more!
I have a terrible memory. If this wasn't already included in Day 5, I would have tried to have the campers split into teams and design time-space diagrams for a short corridor, and then use TRAFVU to compare the results (and compare them to what Synchro would suggest for offsets).
Include more on Synchro, coordination and the space diagram. Go over the timing plans more carefully and in more detail.

DAY FOUR – LOOP DETECTORS AND VIDEO DETECTION
Upon reflection, what three key things did you learn from this day's session? Please list in order of priority.
I learned how video detection works and how the data is transferred back to the main office, where the data is controlled or adjusted. Learning the basic concept behind loop detection was pretty interesting.
I liked seeing what conditions would affect video detection. Building loops was fun. I'm glad that ours (eventually) worked for bicycles.
GREAT introduction to video detection (something I had never worked with). Same for Autoscope and Traffic Tracker. Working with these programs (especially the former) was an excellent opportunity. How loops work and how they're constructed.
I learned a little bit about how electrical fields around loop detectors behave. I learned about some of the operational capabilities of video detection software. I learned a few advantages of using video detection.
Dale's lab was excellent. Everything I learned there was key and fun. Autoscope was also very key.

What three key things do you wish you could have learned more about? Please list in order of priority.
More details about how video detectors work. Other kinds of detectors in use in traffic engineering.
Honestly, I did not learn very much about electricity and magnetism – only that such fields could change in the presence of automobiles.
When/where the software we learned is being used and whether there is similar software and what it is called.
I wish I could have learned more detail about how to improve the detection capabilities of a loop design. I wish I could have learned more about how the performance of loop detection and video detection compare to other methods (3M micro loops, sound, light, microwave, etc.). I would have liked to learn a bit about how the other methods work too (but I realize this would probably take a lot of time and requires expertise that is not locally available).
A little more on Autoscope, maybe try a whole day to video detection. It is very important to the master's student who is trying to research different intersections.

If you could teach this day's session, what would you change?
The discussion before the bicycle loop detection was pretty long, but the experiment was quite interesting, so more time was spent on experimenting rather than theory.
This day was by far the best. The lectures were shot and to the point and included new and worthwhile information (no theory!) The activities were great, especially using Autoscope and Traffic Tracker. There was plenty of time for the exercises and I really felt like I learned much from my time this day. The loop theory and building were, yet again, excellent activities and we had enough time to not only perform them, but learn

from them.
I would have tried to include something about the other methods, but again I don't know how feasible that is.

DAY FIVE – HARDWARE-IN-THE-LOOP SIMULATION
Upon reflection, what three key things did you learn from this day's session? Please list in order of priority.
I learned that you could coordinate between a simulation software and the controller in the field. It was an eye-opener as to how the controller works based on what is going on in the field. I learned how to read data the controller generates and how to translate that into a simulation package.
Introduction to controllers. Introduction to hardware-in-the-loop simulation
I learned how difficult it is to program traffic signal controllers manually. I learned a lot about CORSIM. I learned about he Controller Interface Device (CID).
Simulations. CORSIM. Fine tuning the network

What three key things do you wish you could have learned more about?
I would have liked to understand how Synchro analyzes intersections in more detail. We learned about how to translate timing plans to a controller program. I wish we had spent a little bit more time learning how to coordinate between Synchro and the actual controller. I think we should have also spent a little bit more time on understanding the results Synchro generates.
CORSIM. More about how to program/read controllers
I wish I could have learned more about different traditional techniques used to improve signal controller coordination offsets and how they are effective. I wish there were an example of the CID controlling a traffic signal in a way that CORSIM cannot and showing the difference in traffic flow. I wish I could have created a small CORSIM file myself using ITRAF and watched it operate.
CORSIM

If you could teach this day's session, what would you change?
Personally, if I taught the class, I would eliminate the section on CORSIM, since it is a pretty complex software and is best left for when you have time for a detailed look into how it works.
While all parts of the program were important to the study of traffic signals, it would have been a wonderful mini-break to have one of the afternoons off to get out of the city of Moscow. I had never been to Idaho before, and would have enjoyed a greater chance to explore the surrounding area.
1-Again, too much theory! Queue models, simulation, random outcomes, please aim for practical experience. If the students want to learn how and why they can ask or read handouts. I remember Ken Courage telling us that we had to sit through the theory to

understand what we were doing later. I disagree! It's much easier to understand theory when you are familiar with the final system/product/output. Otherwise, you have nothing to relate the explanation to (i.e. if you explain to me why the sky is blue it would be very difficult to follow if I had never seen blue or sky). 2-Once again, I feel it was a waste of time to learn/use non-standard software (i.e. KenSim). I feel it would be a much bigger benefit to utilize industry-standard software. 3-Last but not least, the activities would have been much more educational had we been given more time to complete them, and had we not simply been entering provided information (i.e. possibly run 1 node, instead of all 3). Although I think the hardware-in-the-loop activity and introduction was a great bit to come away with, it would have meant much more had we been given a better background with the components we were using. In other words, if we had been able to spend more time with controllers and timing to have a better understanding of all the elements we were then able to pull together. (For example, I was aware that hardware-in-the-loop was somewhat of a breakthrough, but I couldn't really explain why).
I would have tried to include an exercise in which the campers programmed a traffic signal controller remotely using a PC, and also made a small CORSIM file using ITRAF.
The timing plans from Day 3 were not fully explained, and I would have put more emphasis on it.

PART THREE - COUNSELOR EVALUATIONS IMMEDIATELY FOLLOWING CAMP

DAY ONE – INTRODUCTION TO TRAFFIC SIGNAL SYSTEMS
Ken Courage
I feel that the whole week went really well. I'm not sure that I can offer you a whole lot in the way of an evaluation, but here are some comments, for what they're worth. Day 1: It's hard to escape the lecture format for the introductory material on signal timing, but even with the exercises it tired a few people out. If I did it again, I might want to move the first couple of lectures on signal timing to the beginning, and then do the control equipment session as a videotape instead of a live presentation, just to avoid a long series of lectures, I would probably work one more lab example into the afternoon.
Day 5 AM: I think that went about as well as it could have. I can't think of anything that I'd want to change.
Detector Lab: This was the only session presented by others that I had the opportunity to observe closely. I didn't see the lecture part, but I had the impression that the lab participants did not have a strong understanding of the basic loop detector theory. The basic theory is actually very simple, and can be simplified even more with a PowerPoint presentation. It is very important to understanding the loop design and operation.
When I teach this material I use a simple breadboard version of the oscillator circuit (copied from the Sarasota documentation), which requires about three dollars worth of parts from Radio Shack and takes about half an hour to build. Using a standard frequency counter instrument, which probably could be borrowed from EE, you can observe the actual effect of various objects on different parts of the loop from the change in frequency. The inductance change due to the object in the loop can be computed from the frequency shift by a simple formula.
You could take it one step further, perhaps in a senior project involving a team of EE and CE students, by building a hardware/software device that would communicate the loop frequency to a laptop computer for a more detailed and automated analysis, possibly with graphics. I would be happy to discuss either the simple or complex instrumentation with you in more detail. I appreciate the opportunity to be a part of this worthwhile event.

DAY TWO – FIXED TIME SIGNAL TIMING AND DESIGN

Joe Marek

What went well for Day 2:
I think that we had a good balance of lecture, field work and design time. This filled the students with knowledge, gave them a break in the field while still learning and then allowed them to apply what they learned through a hands on design project of a real intersection in the real world.

What didn't go well and suggestions for next year:
I would like to have more visual aids for the traffic signal design lecture, I had a few items but did not have time to get other examples of traffic signal items. I think that the visual aids work well to link, what can be an abstract topic, to reality which helps it set better with the students. John mentioned that it would be good to combine some lecture in the field also. When we are out in the field we either need mircrophone so that we can be heard or a more quiet place away from traffic.

Here are some of the questions that were asked.

* What the dimensions of a controller?
* Can we design a Z type signal without a center support since there is no median for this intersection?
* On the SE corner of 95/Lauder, can we require the property owner to relocate the retaining wall to outside the ROW since its shown to be in the State ROW?
* How do you draw a loop for video detection on the plan?
* Can we design 2-arm mast arm poles or can we only use one arm per pole in Idaho?
* Is there a problem if we place the controller on the NW corner and remove the landscaping?
* Can we use a 5-section signal head and show a SB right-turn overlap?
* How many through heads are necessary?
* Can x-walks be diagonal to the intersection or do they need to be perfectly perpendicular to the curb?
* Can we use video cameras to detect at both stop bar and advanced?
* How does and emergency vehicle preemption device work?
* Do the signal heads need to be raised because of the vertical curve northbound?
* Why can't we put all wires - detection, electrical and power in one conduit?
* Can we use a mix of both video and loops to minimize cost?
* What does the back loop at 60 do when there is also a loop at 4' and 12' from the stop bar?

John Ringert

Personal Observations:
I thought the day went well, but the lecture material overlapped a bit in the morning. I also agree with Joe that the students liked looking at the equipment and more visual aids would have helped.

Personal Observations:
I thought the day went well, but the lecture material overlapped a bit in the morning. I

also agree with Joe that the students liked looking at the equipment and more visual aids would have helped.
For the field visit we definitely need a microphone. In addition, we should have some safety equipment such as vests for the students and some signage to notify motorists of the work being done at the intersection.
Finally, I was very impressed with the quality of the students and some of their questions. I hope the summer camp can continue next year.
Comment from one of the Students: One of the students from Penn State (I think) e-mailed me (but I can't find the e-mail) and thought that our day went well. He also indicated that it would have been nice to take that particular intersection and use it as an example through the entire week so they could experience the entire operations and design process for a particular location.

DAY THREE – ACTUATED TRAFFIC SIGNAL SYSTEMS
Mike Boydstun
1- Change presentation so that it doesn't include so much detail on Volume Density.
2- Add example exercises for doing calculations during presentation.
3- Create exercise intersection – US95 and Lauder/Styner to calculate maximum greens, yellows, reds and ped clrs. Need: volumes, distances, lane configuration, phases, etc.
4- Go through controller after exercise and input data from calculations. Observe controller operation.
5- Make sure all controllers have the same version of firmware. Also try to get all of the same models – LM 8000 with comm. module.
6- Demonstrate LM system software. Input data from exercise and download to controller. Possibly do this as opposed to keyboard input.
7- Get data transfer cables for each workstation for controller data transfer.
Eric Rasband
I tend to agree with what the students had to say about how things went on Day Three. As we were creating our presentation we were unsure of what material had been covered and what had not been. After going through this one time, I would change the class structure to cover more advanced material focusing on creating timing plans and giving more time to hands-on experience
The afternoon session went well, but would require more time to cover the Synchro material. Those students in the back were complaining that the material was being covered too fast and they weren't able to keep up.
I have really enjoyed this experience. I also applaud the university for coming up with such a good program.

DAY FOUR – LOOP DETECTORS AND VIDEO DETECTION
Dale Moore
First of all thank you for the opportunity to be a camp counselor. I enjoyed working with

the campers, staff, and family at NIATT. In my evaluation I will try to keep it in the perspective of my own experience. The first-hand comments that I received from students were all very positive. They talked about the other modules and the one I was involved in. Several told me they enjoyed the hands-on in both the magnetism and loop building lab.

Changes that I would make in my module would be:

1. Lecture subject material
2. Time used
3. Upgrade of lab (loop) equipment

Considering that this is the first year I think that it went very well. The campers were screened well and were a well-rounded group. The counselors were admired and respected by their peers and the campers. They were well-prepared and presented the material in a professional manner.

I believe that the campers felt that they were given an excellent learning experience that they would not be able to get anywhere else. Congrats to the staff at NIATT for a job well done.

DAY FIVE – HARDWARE-IN-THE-LOOP SIMULATION

Darcy Bullock

Darcy Bullock's participation in the summer camp was the development of a hardware-in-the-loop traffic simulation problem for the final half-day session on Friday afternoon. The exercise was based upon the following three intersection corridors:

- Node 12: State Highway 95/State Highway 8(Blaine)
- Node 15: 15-State Highway 95/Sweet Avenue
- Node 16: 16-State Highway 95/Styner/Lauder

Six teams (of 2 students) configured the controller for Node 16, and then two teams (of 3 students) configured the controller for Node 15 and two teams (of 3 students) configured Node 12. These intersections were all tested in isolation with hardware-in-the-loop simulation. Students had an opportunity to conduct common debugging such as checking the coordination parameters, verifying cycle length, making sure phases were properly called, and checking to make sure split times were adequate. Then, the two teams each integrated three controllers into one intersection. Their mission was to "tune" the splits and offsets to obtain near optimal operation.

In general, this exercise was a success and appeared to generate significant enthusiasm on the parts of the participants. Students seemed to particularly like the fact that they used their Synchro timings developed in Khatib's exercise as a starting point. However, the following might be considered for improving this operation:

- Additional integration with other exercises. For example, the following design elements might be done earlier in the week and used in the hardware in the loop simulation:
    - Designing size and location of detectors

    - Designing gap extension of detectors (incorporating length of loop in gap extension time)
    - Designing all red intervals
    - Designing amber intervals
    - Designing ped and ped clear intervals

- Selecting three intersections that have closer spacing so that platoon dispersion is less of an issue and the impact of good/bad offsets has a more profound visual impact
- Have the hands on part of the work done in the morning. Then over lunch, have three to five replications run over lunch and then use the afternoon session to analyze the .OUT results so that a "winning team" can be objectively identified.
- In the afternoon session compare numerical data obtained from HCM analysis and compare it with the simulation.
- Incorporation of the LMD 8000 computer software for traffic management center graphics. This could be done earlier in the week and simply used in the hardware in the loop exercise.
- Configuration of the room so that two projectors could be displayed side by side showing LMD8000 traffic management software screens and TRAFVU animation.

APPENDIX D

COMPILATION OF CAMPER AND COUNSELOR EVALUATIONS

TSSC II
AUGUST 2001

TRAFFIC SIGNAL SUMMER CAMP II
AUGUST 2001

Compilation of Camper and Counselor Evaluations

PART ONE - CAMPER EVALUATIONS DURING CAMP

DAY ONE – INTRODUCTION TO TRAFFIC SIGNAL SYSTEM DESIGN
What did you hope to find out today that you didn't?
I wish we'd had time for a second ½ day of signal design. Wiring would have been great.
I hoped to know how the LOS depends on traffic signal designing. How LOS varies depending on traffic signal and planning.
LOS operational analysis would have been better before design.
LOS analysis/cost of signalizing the intersection.
I think I learned everything I expected and more. I understand that there is a lot left to learn and a lot of things aren't set in stone.
Things like signal phasing, but we realize that will be covered later.
I was hoping for more in-depth signal design ideas, maybe more about legal and liability issues.
I had hoped to learn about phasing signal timing today, in order to better determine phase distribution, but I assume we will learn more about it later.
The only thing that I wondered about was how they install the detection loops in the pavement.
Signal timing diagram, which will be tomorrow.
I hoped that we were going to design signal timings today for Styner and Lauder.

What did you learn today that helped you to better understand basic traffic signal systems?
A general procedure of going through a signal design, and the specific issues to consider like placement of poles, mast arms, cabinet around existing utilities and landscape.
Phase numbering, how things work, how to take practical info into consideration.
Site visit was good, informative.
Today's presentation helped me more in designing traffic signals. It is real experience.
Traffic signal equipment.
I learned about the costs that go into making them work and keeping them working. I learned about the controller and how much is inside.
We learned about signal equipment, organization, and right-of-way issues. We also learned that there are not necessarily right and wrong answers. There is a lot to learn.
I learned a lot about the organization of a signal system, such as locating equipment.
Learned a lot about some technical terms surrounding traffic signals – mast arms, cabinets, etc. Plus, presenters did a great job of incorporating examples into their lecture, which made understanding material easier.
I learned which are the most basic problems in the realization of a traffic signal system. Going into the field was worthwhile, to see the interferences with profiles, urban services such as electricity or cable TV. And, to learn the American philosophy of traffic signals,

which is quite different from Europe's. It has been shocking for me.
I learned how to set up signal phases a little better and how to understand all the different obstacles encountered when placing traffic signals.
The overview of signal design, integrating the road geometry, constraints, equipment, controller, signal, and design ideas.
The traffic signal systems, not only the signal timings, play an important role. Also the safety, like visibility of signal posts, things like placement, availability of space for signal post and controller box.
I liked the fact that visual examples were used – going to the intersection helped and seeing the control box was nice.

What topics didn't you understand as well as you would have liked?
So far I don't understand which phasing and timing plans work the best for different traffic volumes.
I feel like I got a really good intro, but nothing in-depth. It's the nature of the beast – we only had 7.5 hours.
Good basic info, but hard to learn everything in one day.
I wish that traffic signal phasing had been explained in detail.
If anything, wiring information was unclear.
I felt like all topics were clear.
Some of the wiring electronics dealing with the cabinets and boxes.
The use of detectors.
I feel that I understand the topics covered to a good level, except for how to accommodate for skewed intersections.
The mechanics and technical aspects of the controller and the connection with different types of detectors (regulations, laws, policies).
A quick intro with terminology, e.g. define conduit**,** easement, etc.

What suggestions would you make to improve the presentation of this material in the future?
Would have liked to model the intersection before/during design, to see if phasing would work with expected volumes. Also, it was a little hard to hear during the site visit.
Go through step-by-step a "perfect" or "good" design. How would professionals design the intersection?
More background info such as pricing, standards, etc. We would read, study info beforehand and/or buy manuals.
Focus on signal planning, ped signals.
Everything was presented well and there were plenty of hands-on things. It was nice to hear the local perspectives on design, which differ nationwide.
It was difficult to hear in the field. Some of that stuff could have been discussed before going out. We could also have had more interactive discussions in the field.
In the field, I think there could have been more interaction between students and teacher,

such as challenging students about the issues at the site.
No rain for field trips and have PowerPoint working.
In the field trip part, it was sometimes hard to hear discussions with traffic and other noises.
Show pictures/drawings of different mast arms, signal heads, and detectors.
It's good the way we went through the steps. Add some of the problems that students had to think about while answering or finding the solution to the problems.
Good presentation overall. More emphasis on how the wiring works underneath the road might have helped, but I felt that the topics covered were well done, considering the time constraints.
I liked the fact that visual examples were used – going to the intersection helped and seeing the control box was nice.
A quick intro with terminology, e.g. define conduit, easement, etc. would have been nice.
Critiques of projects were very helpful in learning.
Visual examples, like walking out to control box and seeing different devices, was helpful.
Connected many concepts.
Steps taken to solve problem good (went over it in class, went out to field, etc.)
Couldn't hear out in the field.
Little understanding of wiring.
Packet with mast arm plans, or actual plans, would help.
Good job covering a lot of material considering the time constraints.

DAY TWO – FIXED TIME AND ACTUATED SIGNAL TIMING AND DESIGN
What did you hope to find out today that you didn't?
Basics of both fixed and actuated signals was good. The changing of signal timings and observing the intersection operation was good. It helped a lot to see the results of the changes made.
Introducing HCS and using HCS in signaling.
Using HCS for signal analysis.
Which fixed time signal timing plans and lane geometries work the best for different traffic volumes. Which geometries and plans work best for actuated, actuated/coordinated.
I learned more than I had expected to, and I don't feel that I missed anything.
Details about detector makeup, otherwise great.
I feel that today exceeded my expectations.
Optimum phasing patterns.
I was hoping to learn about optimum phasing patterns for certain conditions.
Method for actually modeling a signal. I learned lots of equations and benefits and drawbacks to doing certain techniques, but I would also like a recommended method to proceed. A summary, if you will. There was no summary of the day's activities.

What did you learn today that helped you to better understand basic traffic signal systems?
I think some of the things like what are the basic parameters that vary the signal operation should be considered more.
Day two was very informative and educational. I learned a lot more about simulation and modeling, and also about optimization of signal timing.
I learned about inputs for signal timing design and simulation.
Inputs and considerations for design issues.
Working with CORSIM to adjust timing plans to try to improve delays, but I was initially unclear on which adjustments would improve and which would make the operation worse.
Basic info about fixed-time and actuated controllers. A good feel for using CORSIM.
CORSIM, which is the first traffic modeling system I've used in depth. Lots about how actuated and fixed timing signals work, and some of how they differ from one another. Good job of explaining terminology using good descriptive visuals by both presenters.
I understood the actuated control concepts better than I have. Doing calculations for saturation flow, etc. was helpful.
Better understanding of actuated systems. NEMA system phase designations.
I learned how actuated systems operate and about the complexities of using them in coordination. I learned how the NEMA system designates phases, which was unclear before.
Better understanding of the actuated signals.
I finally understand how actuated signal timing designs work and what their limits are, which is quite difficult to understand with only theory. Experiences and exercises are always positive.
Basic terms and concepts having to do with actuation in particular. Fixed-time was mostly review for me, but this was also useful. Also, how to use CORSIM.

What topics didn't you understand as well as you would have liked?
I wish I could have learned more about dual ring controllers. I am happy that I learned more about activated signals.
Record types in TSIS def. file.
Software input. When things didn't work like they were supposed to, I got stuck, I got frustrated.
Why CORSIM didn't really work for actuated models, maxed out with both volumes.
I felt clear.
Build an intersection in CORSIM from ground zero.
How to start from ground zero in CORSIM and built an intersection.
I think I've understood everything today.
Grad students helped a lot when errors came up.
Morning and afternoon presentations were sequential in logic.
CID part was something I had never seen before.

More step-by-step is needed on what the inputs mean, particularly for the actuated signals phase timings and phase delays.
Somebody could make a lot of money by cleaning up CORSIM and making it more user-friendly.

What suggestions would you make to improve the presentation of this material in the future?
Other software for design signal timing, as a check for manual calculation.
Maybe a little more instruction on the software, basic commands, ways to edit, etc.
Guidelines to improve signal timing and intersection geometry.
Less lecture in the afternoon, dragged a little.
The preparation for CORSIM actuated controls should have been better. It doesn't seem right to get into an exercise and have it not turn out, with results beyond the program's capability.
Phasing optimization.
Bring examples of phasing optimization.
Working on assignments in groups of two.
Focus on signal timing design project – phases, optimization, and more examples.
Less time playing around with CORSIM with no direction. The lab time really needs to be tightened up. There has to be some purpose – something concrete to leave the class with. Conception stuff is good, but without a method to apply it, what good will it be to us?

DAY THREE AM: VIDEO TRAFFIC DETECTION PM: ACTUATED TRAFFIC SIGNAL SYSTEM
What did you hope to find out today that you didn't?
More time with video detection.
More detail about video detection. It was fun and more work with that program would be fun.
I found out as much as I possibly could. I am happy.
More about actuated signal timing (have examples).
Probably some field-lab to see how video detectors work.
I can't think of anything. I learned a lot of stuff and there really wasn't any time left to learn any more.
Today's presentation was very interesting, educational and informative. We got a good background on detectors and sensors.
Computer actuated/coordinated timing design of a network.

What did you learn today that helped you to better understand basic traffic signal systems?
Programming controllers. This is important knowledge. Video detection exposure is also very helpful.
How video detection works in general, some DOS programming, and more detail on actuated fixed signals in progression/offset.
I got a much better understanding of the abilities available in the control for me to use.
I have learned about pretimed coordination before, so the actual coordination was a little bit easier. I think I understood it.
Controllers.
I've finally seen how effective video detectors are, as I always thought that the complexity of the images made it a non-effective method.
I learned a lot about video detection, and it made me much more interested in it.
Step-by-step walkthrough of video detector setup and actuated signal timing was very informative.
The parameter/variable signal timing (actuated/coordinated).

What topics didn't you understand as well as you would have liked?
Controller programming.
Details in the programming in DOS – really complex.
Coordinated signal control.
I didn't understand as I would have liked the last part of the afternoon session, surely due to the huge quantity of information we've been given.
Coordinated timing of light.
I wish I could remember it all.
I wish I could get more information about traffic signal timing. The second part of the day went very fast and hurried. One class is not sufficient to learn all this stuff. I wish that I could get more background on activated coordinated signals.
Coordination.

What suggestions would you make to improve the presentation of this material in the future?
There was a lot of overlap between yesterday's and today's actuated signal lectures.
Run less lecture late in the day, also a little repetitive with intro terminology.
I think it was presented very well. Yesterday's afternoon session about actuated was very similar to today and may have been better combined.
To combine actuated signals from Day 2 with today's pm session, to allow more time for the exercise of coordinated/force off/ permissive timing (to avoid lecture duplication).
Video detection was very good. Afternoon part was confusing at times. I feel it will be difficult to remember all the steps if I should attempt to do it again.
More background, actual examples.
Got better understanding of the controller function

Good step-by-step procedures.
Good demonstration, hands-on and work.
Material was new and outstanding. Autoscope worked.
The concept of using Autoscope, and how one can use tapes to study or count the traffic.
It was very hard to do, but entering the data into the controller and knowing the various parameters in it. And, also the instruction regarding coordinated signals.
Overlap between Day 2 and 3
More time needed on programming of the controller.
More activated coordination examples.
Coordination parameters.
Maybe just have us do a few computations. A pre-set example with most of the grid filled in would be less time-consuming and repetitive.
Should tell more about limitations of Autoscope.
We should have been told about the uses of Autoscope and its limitations.

DAY FOUR – AM: ACTUATED SIGNAL COORDINATION PM: LOOP DETECTORS
What did you hope to find out today that you didn't?
Actuated/coordinated optimization for an MOE.
More advanced electromagnetics…not really! Everything was very good introduction to electromagnetics.
I would have liked to learn more about Synchro's capabilities.
Nothing in particular.
I learned everything about coordination and Synchro that I expected. Altogether, I can't think of anything.
I would have liked to test how our group of intersections work using a CORSIM simulation. I don't know if we were going to do it tomorrow.
To finish up the Synchro lab on coordinated signals on an arterial. More detail on how to optimize the coordination other than the space-time diagram showing bandwidths would be interesting.

What did you learn today that helped you to better understand basic traffic signal systems?
Detectors background/theory and traffic applications. The importance of detectors in traffic signals.
Synchro and hands-on loop detection. Both presenters went at a good pace with lots of good examples. Building loops was fun.
Working with loops to measure effectiveness was a great experience. I learned a lot about signal coordination/green bands.
Finding out how loops work and are installed and wired. Coordinated timing exercises on the engineering paper helped me understand bandwidth.
Coordinated actuated systems and loops, Synchro.

A little bit of coordination and Synchro and an incredible amount about loop detectors.
Mainly, I really understood how a loop detector works, as for me it was a thing that I knew its purpose, but didn't now how it worked (like a TV). Other specifics on coordination, Synchro, and loop detectors were very informative.

What topics didn't you understand as well as you would have liked?
Inductance.
I understood all topics well.
I think I could understand better the qualities of good and bad detectors.
Some of the different options in Synchro for coordinating timing of intersections.
I understood all of it today.
I got a bit lost when we were optimizing our group of intersections.

What suggestions would you make to improve the presentation of this material in the future?
None, excellent job today, very good!
Today was a good day, as it was adaptive and very much geared to the students. Great day!
Maybe the examples for Synchro could have worked. Instructor should have run through it and made sure it worked before trying it in class.
Excellent am/pm presentations.
The demos were excellent today. We learned a lot of useful information.

The input about the use of Synchro to coordinate signals was good.
Practicing on the field detectors was very good. The whole concept helped one to know how these detectors operate in the field.
Provided engineering paper and did a good example.
Hands-on.
Related complicated concepts in a simple way. I understood concepts that I used to only know the equations of.
Learned Synchro. It is becoming more popular and I feel I know it inside and out.
Didn't get to work on actuated coordinated signals.
Need to take more breaks in the afternoon.
Perhaps SH8 and US95 intersection can't be modeled in this program. We didn't do it correctly in class.

DAY FIVE – HARDWARE-IN-THE-LOOP SIMULATION
What did you hope to find out today that you didn't?
Nothing that I can think of.
Today I've found everything I've expected. We've mixed all the things we've learned during the week.
Everything was very informative.
I found out a lot more today than I expected.
We could have worked more with Synchro to coordinate/optimize the network.
Covered a lot of stuff.
Pictures and guides in handbook detailed and easy to follow. Very well done.
Jeopardy was cool.
Answered questions about topics not explicitly covered in lab.
Well prepared (both Darcy and Andrew).
Tied a lot of topics for the week together.
Coordination in lineup tied everything together.
Examples were good.
Pictures in books helped.
More than expected.
Some things didn't work. Should probably re-think the wiring in the lab.
Went fast, but it was worth it to cover the topics.
More on coordinated systems

What did you learn today that helped you to better understand basic traffic signal systems?
Running simulations with an actual controller, monitoring the controller's phase changes, keying data into controller to run simulation.
Very good step-by-step examples. I felt I learned better by doing these well-set-up examples. Good presentation. Today tied a lot of different steps together, to show an overall picture.
I've understood how a real set of intersections work, and how we use our technology to coordinate the intersections.
Great job showing how to tie intersections together in coordination. Good intro to the ARIES program, working with a different (Econolite) controller was also helpful.
How to check their behavior with the CID and CORSIM and the suitcase detector instead of putting the traffic in a gridlock.
How to test a virtual network without messing up traffic.
Coordinated system. Coordination between CID, PC, Controller.
It was grat to use the CIDs to coordinate the entire network and see it in use. I learned about the factors that affect coordination.
Day 5 was very educational. I learned about the CID developed by NIATT and also ARIES software.
Connections among PC/CID/controller/simulation software.

What topics didn't you understand as well as you would've liked?
I felt that I understood the topics that were covered very well.
Probably it has been hard to understand how the 3 CIDs , computers, and controllers worked together in the same simulation.
Everything was presented clearly today.
I feel pretty clear on everything.
I wish I could learn about CID in detail. How to input data. I think one day is not sufficient enough to get knowledge about CID and controller.
Aries computer software/signal parameters calculation.

What suggestions would you make to improve the presentation of this material in the future?
Repeat next summer!
Make sure interlinking system works well, took some time to fix, may be unavoidable. No Purdue questions in Jeopardy!
The presentations have improved all week. I can't think of anything wrong with this one.
Excellent presentation.
None – great job!
Lab notebook was very well set up.
Due to time some topics were passed overhead. Presentation is very good, it gave great experience.

PART TWO – CAMPER EVALUATIONS ONE MONTH LATER

How do you feel about the combination of lectures and hands-on experiences throughout the week?
Combining lectures and hands-on practice were an essential part of TSSC. If we were dependant on lectures, it would have been a very long week.
I thought that all of the hands-on experiences were very good, and helped retain the lectures.
I think it was a good integration of practical experience and theoretical knowledge. The presenters were from both the academic field and practicing consultants.
I thought it was pretty good, at times a couple of more short breaks could have been provided during lectures. I still paid attention and was excited about the stuff on Friday, and I wasn't sure that was going to happen.
I feel that there was just about the right balance between lectures and hands-on experiences.

What did you like the most about the week's activities?
The best parts of the week were the hands-on work and introductory lectures to the more advanced technologies of video detection and in the loop simulation. Exposure to this technology was worth the trip alone.
The hands-on experiences were what I liked most about the week's activities. The variety of instructors was also very nice.
I liked the hands-on activities. These activities allowed me to get an idea of what a transportation/traffic engineer will be doing.
We were given a decent amount of free time, and we had a chance to hang out with one another and relax. Stargazing with Dr. Kyte was a lot of fun, and I would recommend it again for next year. I also liked the picnics, but I wouldn't try to schedule something for every night. The order of the presentations was chronological and everything tied together really well at the end.
I enjoyed the video detection system demonstration by Dr. Kyte the most.

What did you like the least about the week's activities?
I was unimpressed with the topics that we covered on a shallow level. This includes Synchro and traffic signal design. We touched on these so lightly that I didn't learn very much about them.
I don't remember.
I think there was a little too much of the traffic theories and concepts in the sessions. This was not a class but a seminar – a technical session.
I thought every session was valuable, and I would not discard any of them. Again, I would just make sure that example problems are better prepared in advance, to reduce the busywork.

I didn't necessarily like the loop detector portion in which we designed our own loop detectors. The instructor should have made his own loop to show us a working example.

List the three most important skills that you learned during the camp.
1-CORSIM - I had never had any experience with this and found the time spent with it useful. [this is the most important thing I will say]. The use of CORSIM was helpful because it built up into further lessons and the working knowledge gained was essential to understanding the hardware-in-the-loop simulation. 2-Video Detection - I learned a lot about how this works, when it won't work and its practical limits. I see more and more agencies going to video detection and this is knowledge that I need. While we didn't have time to go too far in depth, it was a lesson greatly appreciated! 3-The hardware-in-the-loop simulation - While I don't know that I learned the how, I learned the what and the why. Understanding that this type of simulation can exist (and why is was created) completes the circle of education from concept to practice. It has planted the seed in my head that when I am traffic engineer somewhere, I will be trying to implement advanced technology
I think the exposure to the variety of aspects of the traffic systems design field was important, I don't know that I would call the exposure a skill that I learned though.
I think there were lots of transportation topics cramped into a week session. I did not learn any new skills. I know a little more about the topics, transportation software, and transportation in general. But for the situation, I think it helps to have a learning attitude, listen, and have fun.
How to use Autoscope. How a loop detector should be wired. How to use Synchro.
Video detection – CORSIM and TRANSYT knowledge – Linking traffic signals together in a corridor.

If you could design next year's Traffic Signal Summer Camp, what three things would you change?
Eliminate a topic that is covered only in a 4-hour session and then not touched again, such as Synchro. Make the hardware-in-the-loop simulation more hands on - I felt like a spectator. I would move the simulation to the middle of the week - I was too tired. Cover that first and then go back and make traffic signal design more specific. Since that is more physically hands-on it would help keep the energy up later in the week.
I would maybe add in pieces of common practice in the profession wherever applicable, like in the intersection design lecture and project, give a brief structured overview of how the professionals giving the lecture would go through the design process for that particular intersection.
Have one day specifically cover the traffic signal theories and concepts. This will save time because each presenter does not have to repeat the background. Simplify the examples. Coordinate the examples. Maybe just have one project and each presenter addresses a portion of the project. This coordination will put everything together and give us a complete picture.

Start each session with a definitions and short discussion on the terminology - most of us weren't familiar with some of the jargon right away
The food in the cafeteria was the same nearly every day of the week, for every meal. And it wasn't all that good. I know there is probably not much you can do about that.
Some of the sessions had us doing long example problems that had us doing basically the same computation for many steps (i.e. min green for 8 movements). It might be a better use of time if the examples are partially solved for us.
Make sure the instructors go through their software examples to make sure they work – Spend less time learning about the physics behind loop theory.

How do you feel that TSSC will help you in your education and in your career?
This is what I want to do. Any exposure to this material and technology will help me in my career.
I feel that the more exposure that I get to professional practice in the traffic engineering field will greatly help me pursue a career in this field.
It has given me a broader view on the transportation field. The sessions by the practicing consultants help me to experience the traffic profession.
In a lot of ways. First of all, I am a few steps ahead of everyone on a lot of technology. Second, I realize the value of continuing education. Thirdly, I made a ton of great contacts, and that will help if I want to do research or go for a Ph.D. and study under one of the presenters, or even just to have more flexibility in jobs.
I feel that it will help a little. My school doesn't have any of the software I learned, so I will likely just retain a general knowledge of what I learned.

Would you recommend this program to a friend or colleague? Why?
Yes. I think that there is no other place to learn this subject matter.
I would recommend this program to any of my classmates who want more exposure to traffic engineering, or even young colleagues in the profession who are wanting to have a better understanding of traffic engineering.
Yes, it is a good introduction/overview of traffic signal design. This program introduces one to concept, software, equipment, lots of information, etc.
Yes - I feel a learned a ton of stuff in just one week, and it has allowed me to take on more advanced and interesting research. Also, I met some really nice people who were fellow campers.
Yes. Many employers in the Midwest are seeking traffic engineers with knowledge in the software that I learned at TSSC.

Additional Comments?
A lot of people probably will respond against the name "camp." And I must agree. The reason being this, when I tell my friends I went to traffic signal summer camp, they laugh. I don't think it has a professional ring to it that will impress prospective employers the same as another name (like conference).

I thought the course was overall very valuable.
Less lecture, more technical activities.
Very well run, and you guys did an outstanding job taking care of us.
Do not make any major changes to the content of the sessions - all of them were helpful and they will only get better as they are fine-tuned by the presenters.
Giving money for everyone to use at the Commons for lunch was outstanding - that should be continued.
The recommendations of bringing extra clothes to the lab were probably not accurate - not once was I cold in a lab. Also, we probably don't need to bring any extra towels (you should just see if housing can provide 2 towels per camper). It wasted some room in my suitcase to bring all that extra stuff.
Encourage the campers to book any flight well in advance (like at least a month), so you don't get stuck for 4 extra days with nothing to do like I did.

PART THREE - COUNSELOR EVALUATIONS IMMEDIATELY FOLLOWING CAMP

DAY ONE – INTRODUCTION TO TRAFFIC SIGNAL SYSTEM DESIGN
Joe Marek
1. What is your assessment of the materials that you prepared: were they adequate or do you think that you need to modify or improve them for next year? I believe that the materials were good. As always, adjustments can be made to the materials to make them more informative and interesting. Both years, there has been interest in the wiring and more detail of the traffic signal and its construction. You may want to consider trying to add some of that information into the course, but I'm not sure how you could accommodate that given the already busy weekly schedule. I want to bring more traffic signal equipment next year.
2. What is your assessment of the level of student involvement and activity? Did you provide sufficient problems and tasks in which the students could be actively involved or would you do more of this next year? The student involvement seemed better than last year. The balance of field versus lab was much better this year. It felt as though the students were very actively engaged in the project.
3. Were the facilities (lab space, computers, software, other hardware) adequate for what you needed to accomplish or would you recommend changes for us to consider for next year? The lab was ok. We had the little hiccup getting started with the PowerPoint presentation which we'll want to check beforehand next year. The temp in the room was hit and miss. If I start bringing much more signal equipment with me, we will need a table to lay that equipment out for students of look at it.
4. Was there good continuity in the five-day program and adequate coordination between the days? Please comment. The coordination between day 0 and day 1 was great! Probably other folk will have better insight with respect to how the days flowed.
5. Were the data sets (for the three intersections) used sufficiently during your session? Should we consider changing the data sets in any way? Yes. No.
6. Were the logistics sufficient for a smooth operation of the camp? Any suggestions on what worked well and what should be considered for change for next year? We need to check our PowerPoint presentations the night before to make sure we're ready to go. We also need to always order good weather - about 75 degrees and sunny - not 90 degrees and thunderstorms.
7. In reviewing the topics that were covered during the week, should we consider changing, adding, or subtracting from the topics? There is interest from the students to add more info about traffic signal wiring. I'm not sure if that would result in too much detail or not.
8. Do you have any other suggestions for improving the quality of the camp for next year?

I was very pleased with how things went this year. There was an excellent group of students and, of course, all of great support of NIATT. You might consider having the copies of the slides in the book to be in color, an additional expense, but potentially worth it.
John Ringert
1. What is your assessment of the materials that you prepared: were they adequate or do you think that you need to modify or improve them for next year? I thought our class went smoother than last year due to the following changes: 1. We shortened the presentation and gave more project time. 2. We limited the groups to two people. 3. We introduced the project better before the field visit. I do think there are areas for improvement: 1. We need to have the presentation equipment ready and tested prior to showing up Monday Morning. 2. We should have vans available for the site visit in case the weather looks bad (we were lucky it didn't rain harder). 3. We should keep trying to find ways of making the class more useful for the students. We are trying to pack in a lot for one day and even with the reduced presentation, there is a lot to learn.
2. What is your assessment of the level of student involvement and activity: did you provide sufficient problems and tasks in which the students could be actively involved or would you do more of this next year? I thought the activity level was good and think the class/project balance was good.
3. Were the facilities (lab space, computers, software, other hardware) adequate for what you needed to accomplish or would you recommend changes for us to consider for next year? The facilities were good, but we need to have the projector and presentation tested the day before. Our problems with the projector Monday morning were likely because we were the first class of the week.
4. Was there good continuity in the five day program and adequate coordination between the days? Please comment. I wish I would have been around for the other days. Maybe my wife Nancy will let me stay all week next year.
5. Were the data sets (for the three intersections) used sufficiently during your session? Should we consider changing the data sets in any way? We would like to get a new survey of the intersection with the Right-of-Way and utilities. The survey from ITD was limited and the file had some corrupted pieces. Maybe one of the survey classes next year could do it as a project?
6. Were the logistics sufficient for a smooth operation of the camp? Any suggestions on what worked well and what should be considered for change for next year? I thought it was well done, everyone was very helpful
7. In reviewing the topics that were covered during the week, should we consider changing, adding, or subtracting from the topics? I wasn't around.

DAY TWO – FIXED TIME AND ACTUATED SIGNAL TIMING AND DESIGN
Mike Dixon
1. What is your assessment of the materials that you prepared: were they adequate or do you think that you need to modify or improve them for next year? I am contemplating using a more user-friendly simulation package such as VISSIM, so less time will have to be spent on explaining software quirks and more on training.
2. What is your assessment of the level of student involvement and activity: did you provide sufficient problems and tasks in which the students could be actively involved or would you do more of this next year? I think that I did enough in the way of problems...but we will see what the students had to say.
3. Were the facilities (lab space, computers, software, other hardware) adequate for what you needed to accomplish or would you recommend changes for us to consider for next year? The facilities were fine.
4. Was there good continuity in the five day program and adequate coordination between the days? Please comment. There seemed to be good coordination, after consulting with the other Instructors. However, it would have been nice if we had used a standard traffic signal timing software package, such as HCS or SYNCHRO.
5. Were the data sets (for the three intersections) used sufficiently during your session? Should we consider changing the data sets in any way? I thought the data sets worked out well.
6. Were the logistics sufficient for a smooth operation of the camp? Any suggestions on what worked well and what should be considered for change for next year? The camp seemed to operate smoothly.
7. In reviewing the topics that were covered during the week, should we consider changing, adding, or subtracting from the topics? It would be nice to get into the topics of actuated coordination and address some cases where traffic problems are much more severe and challenging. This might be accomplished by condensing all of the material that we covered earlier and then spending the last day working on a situation that they have not seen yet but can bring to bear all of the material they have learned earlier in the week.
8. Do you have any other suggestions for improving the quality of the camp for next year? I would like to see more undergraduate students from the northwest (schools that do not have traffic engineering curriculum) and a different name like Summer Traffic Signal Training (not very creative).
Ahmed Abdel-Rahim
1. What is your assessment of the materials that you prepared: were they adequate or do you think that you need to modify or improve them for next year? The materials were fairly adequate. However, there is always room for improvements and modifications. I would like to add more reference materials and maybe put more emphasis on the functions of the actuated controllers under different settings. I think we also need to coordinate more between different sessions that covered the actuated controller operations.

2. What is your assessment of the level of student involvement and activity: did you provide sufficient problems and tasks in which the students could be actively involved or would you do more of this next year? The level of student involvement was also adequate, but again I see some areas that can be improved to allow more involvement. The lab materials and exercises need to be more defined and improved.
3. Were the facilities (lab space, computers, software, other hardware) adequate for what you needed to accomplish or would you recommend changes for us to consider for next year? Maybe we need room for more students. The computer lab is fine and well equipped (somehow noisy though). The CID lab could be modified to hopefully add one more station.
4. Was there good continuity in the five-day program and adequate coordination between the days? Please comment. This year seems to be much better coordinated than last year. But I would like to see more coordination between days two and three.
5. Were the data sets (for the three intersections) used sufficiently during your session? Should we consider changing the data sets in any way? I think the data set was fine. Maybe the actual volumes were too low , but I do not see any need to change the data set.
6. Were the logistics sufficient for a smooth operation of the camp? Any suggestions on what worked well and what should be considered for change for next year? I really don't know much about this subject
7. In reviewing the topics that were covered during the week, should we consider changing, adding, or subtracting from the topics? I think anything that is typically covered in basic transportation courses should not be covered in the camp. We should assume, as students who come here are interested in traffic, that they know the basics. We need to concentrate more on things that are not typically covered in classes (controller operations, CID, …etc)
8. Do you have any other suggestions for improving the quality of the camp for next year? Other than changing the "camp" name, no.

DAY THREE AM: VIDEO TRAFFIC DETECTION
PM: ACTUATED TRAFFIC SIGNAL SYSTEM

Mike Boydstun
1. What is your assessment of the materials that you prepared: were they adequate or do you think that you need to modify or improve them for next year? There is still TOO MUCH review at the beginning of my session. I will work out a way to figure out what I need to cover (maybe asking some questions at the beginning of the session will help this). I'm assuming that they don't know any of what I am covering, and both years, this seems to have been an incorrect assumption. I found some additional material that is needed to complete my Signal Timing session (a map w/ phasing, volumes, distances, etc). I am in the process of creating this. Also, I am working on the database(s) for the LMSystem software, so that the students can

input the "basic" data, and not have to worry about all of the details that it takes to get the controller running (there just isn't enough time for all of that). I have the current data for US95 & Sweet, and now I also have the current data for US95 & SH8. I got it installed on the Instructor's PC, but not the others.
2. What is your assessment of the level of student involvement and activity: did you provide sufficient problems and tasks in which the students could be actively involved or would you do more of this next year? I think there is plenty of activity for the students during the actuated signal timing session. It would be even better if I could have an entire day, and devote most of the morning to actuated signal control, and the afternoon to coordination program development, but I just don't see that fitting in the time frame.
3. Were the facilities (lab space, computers, software, other hardware) adequate for what you needed to accomplish or would you recommend changes for us to consider for next year? The only thing I can see would be to give the students more space for manuals and work materials in the Lab. That seems to be the biggest problem for the Lab. There is room enough for one student's manual, or if everything is pushed around, both manuals can be "crammed" into the workspace. I'm not sure how to do this, unless the other equipment is moved off of the top of the workstation, onto shelves or something.
4. Was there good continuity in the five-day program and adequate coordination between the days? Please comment. The coordination between days was better this year than last. However, I don't think it was quite there yet. I didn't get the data I needed to use the actual intersection programs for US95 & Sweet and US95 & SH8 until it was to late to implement for this session. I will be utilizing that in the next session. Also, I think it might be a good idea to move the detection items to Day 3 and move the Actuated/Coordination and Synchro to Day 4. This would introduce the detection devices and then incorporate that into how the actuated controller works.
5. Were the data sets (for the three intersections) used sufficiently during your session? Should we consider changing the data sets in any way? I didn't have/use any of the data sets for the Actuated control session. I would like to use the design for US95 & Steiner/Lauder to develop the actuated timing plan for this intersection. *6. Were the logistics sufficient for a smooth operation of the camp? Any suggestions on what worked well and what should be considered for change for next year?* The only thing I could suggest is maybe a few more organized evening activities where the students and counselors could get together and talk about things (like what you do, why you like what you do, where you live, how things are done differently where you are from, etc.). The pizza/picnic thing is good, but I think another night earlier in the week might be good to. I don't think you would want to do something every night. I know I need some time for myself and to allow my brain to regroup.
7. In reviewing the topics that were covered during the week, should we consider changing, adding, or subtracting from the topics? I think the topics are appropriate. I would like to have more time to provide what I think are necessary items within the actuated control session, but again, I just don't see where the

additional time could come from (see question number 2 above).
8. Do you have any other suggestions for improving the quality of the camp for next year? I just need to get all of my materials "finalized". I know that it will change a little from year to year, but I didn't have it all together to start with this year. Having the database files for the LMSystem will help quite a bit, and I will be able to utilize it much more during the next session.
Zaher Khatib
1. What is your assessment of the materials that you prepared: were they adequate or do you think that you need to modify or improve them for next year? I need to update my files for the new version of Synchro. Also, I would like to get the details of the network (US95 South, Moscow) in terms of geometric and traffic counts, as well as signal timing.
2. What is your assessment of the level of student involvement and activity: did you provide sufficient problems and tasks in which the students could be actively involved or would you do more of this next year? I think this year's level is good enough, and it matches with the whole week's stream. The students are very good, and I think I can give them more information, but I would need more than half a day.
3. Were the facilities (lab space, computers, software, other hardware) adequate for what you needed to accomplish or would you recommend changes for us to consider for next year? The facilities are very adequate
4. Was there good continuity in the five-day program and adequate coordination between the days? Please comment. For my part, yes. The only thing I would change is that I would get better information on the US95 for next year.
5. Were the data sets (for the three intersections) used sufficiently during your session? Should we consider changing the data sets in any way? The three intersections is an excellent sample problem, but I need the data a little bit earlier.
6. Were the logistics sufficient for a smooth operation of the camp? Any suggestions on what worked well and what should be considered for change for next year? I think it was very well organized. *7. In reviewing the topics that were covered during the week, should we consider changing, adding, or subtracting from the topics?* The topics about signalization need to be looked at in terms of the fact that we do not have overlapping.

DAY FOUR – AM: ACTUATED SIGNAL COORDINATION PM: LOOP DETECTORS
Dale Moore
1. What is your assessment of the materials that you prepared: were they adequate or do you think that you need to modify or improve them for next year? The material I used was condensed from last year. I think that it was an improvement, however I was having so much fun I almost forgot to include any breaks. I will continue to evaluate the materials and make changes as necessary.
2. What is your assessment of the level of student involvement and activity: did you provide sufficient problems and tasks in which the students could be actively involved or would you do more of this next year? Student involvement this year was very good. I tried to do the labs as we covered the topics. This gives the feeling of more hands on, as well as increases the learning curve.
3. Were the facilities (lab space, computers, software, other hardware) adequate for what you needed to accomplish or would you recommend changes for us to consider for next year? Lab space was good. It would be nice to have a regular lab, but we adapt well. The hallway works fine for the loops. Lab materials will need to be replenished next year.
4. Was there good continuity in the five-day program and adequate coordination between the days? Please comment. Yes, students seemed to like timeline.
5. Were the data sets (for the three intersections) used sufficiently during your session? Should we consider changing the data sets in any way NA
6. Were the logistics sufficient for a smooth operation of the camp? Any suggestions on what worked well and what should be considered for change for next year? Yes
7. In reviewing the topics that were covered during the week, should we consider changing, adding, or subtracting from the topics? No, it is getting so that the feeling is that there is plenty of info to digest. Any more might be too much. However, one should never become complacent and should always look to improve their materials and/or presentations.
8. Do you have any other suggestions for improving the quality of the camp for next year? Improvement will grow as the program grows. This year was an improvement over last year, and next year will be no different. I do believe that as time goes we will have to present more on the technical side of the signals. ITS and other programs are going to be an integral part of signal operations. In changing we will have to present a bigger picture of traffic signal design and timing, not just hard numbers. I do believe that the students were pleased by this year's TSSC. As always, I will be looking to improve my portions of the camp, but I believe that this year was a success

DAY FIVE – HARDWARE-IN-THE-LOOP SIMULATION
Darcy Bullock
1. What is your assessment of the materials that you prepared: were they adequate or do you think that you need to modify or improve them for next year? I was happy with the improvements we made this year. The only minor "down side" is that it required us to ship Econolite Equipment out.
2. What is your assessment of the level of student involvement and activity: did you provide sufficient problems and tasks in which the students could be actively involved or would you do more of this next year? Other then about 10-15 minutes of introductory lecture, I tried to make this session 100% lab based. We thought of Jeopardy at Lunch on Friday - I wished we'd had more time to prepare the questions.
3. Were the facilities (lab space, computers, software, other hardware) adequate for what you needed to accomplish or would you recommend changes for us to consider for next year? - All PC's should be configured identically, with the same operating system. - Some minor thought needs to be given to cable management and locating USB hubs.
4. Was there good continuity in the five-day program and adequate coordination between the days? Please comment. -Not sure I can comment as I did not observed other days. -I am not sure the students got through the SYNCHRO work earlier in the week because their networks were not properly configured - we had to give them starting timings for the controllers. This precluded them from competing against each other with signal timing designs.
5. Were the data sets (for the three intersections) used sufficiently during your session? Should we consider changing the data sets in any way? -This was still a problem. Mike Boydstun indicated the data set we used was not the correct phasing. -Upon further reflection, I am not sure it is essential we use a Moscow arterial if we complement it with good photos. The double right turn with overlaps and one way streets were unusual enough that they caused confusion. -We need a good set of engineering drawings wherever the network is.
6. Were the logistics sufficient for a smooth operation of the camp? Any suggestions on what worked well and what should be considered for change for next year? Logistics seemed very good.
7. In reviewing the topics that were covered during the week, should we consider changing, adding, or subtracting from the topics? - I would like to see them have an opportunity to cut, install, seal, and test a loop detector. - Maybe do Jeopardy a couple of different nights (with small prizes like base ball caps or t-shirts). This is a fun way to review important material
8. Do you have any other suggestions for improving the quality of the camp for next year? I do think the comment from last year's attendant of changing the name from "Summer Camp" is a good idea. Perhaps "Summer Workshop on Traffic Signal Design."

APPENDIX E
TRAFFIC SIGNAL SUMMER CAMP II
STUDENT HANDBOOK

In the hard-copy version of this report, the complete text of the TSSC Student Handbook follows.

In the electronic version of this report and the TSSC web site (http://www.its.uidaho.edu/niatt_tssc/index.htm), the majority (but not all) of the Handbook materials are included, as separate documents.