TRANSPORTATION LEARNING NETWORK NEW APPROACH TO TRAFFIC OPERATION CENTER OPERATOR TRAINING

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TABLE OF CONTENTS

1.	INTRODUCTION	1
2.	BASIC TRAINING	3
	2.1 Background	
	2.2 Basic Training Program	3
	2.3 Additional Basic Training	10
3.	ADVANCED TRAINING	15
	3.1 Background	15
	3.2 Advanced Training Module	16
	3.3 Advanced Training Material	17
	3.4 Additional Advanced Training	20
	3.5 Advanced Operators' Performance Measuring	23
4.	TRANSPORTATION LEARNING NETWORK	27
	4.1 How to Access TLN	27
	4.2 Taking Classes on TLN	
	4.3 Advantages for TLN Users	35
5.	RESEARCH EVALUATION	37
6.	CONCLUSIONS	39
7.	REFERENCES	41

LIST OF FIGURES

Figure 2.1	Roads by Classification	6
Figure 2.2	Local Map	7
Figure 2.3	Image from CCTV to Determine Camera Orientation	8
Figure 2.4	Introduction of TOC Functions for New Operators	
Figure 2.5	Transportation Introduction	
Figure 2.6	Traffic Theory and Levels of Service	
Figure 3.1	Levels of Operator Performance	16
Figure 3.2	Curriculum for Advanced Training	17
Figure 3.3	Customer Service – First Impressions	
Figure 3.4	Cross-Section	
Figure 3.5	Good Operator Progression through Advanced Training	
Figure 3.6	Valley Emergency Communicating Center – Part of TSM	
Figure 3.7	One of the Lecture Slides from the Introduction to MUTCD	
Figure 3.8	Introducing Operators to UDOT CMS Message Format	
Figure 3.9	Basic Level Checklist	
Figure 3.10	Evaluation of the Geometric Design Course	
Figure 4.1	Login Access to Transportation Learning Network Course Material	
Figure 4.2	The Example of Training Material Content on TLN	
Figure 4.3	TLN Lecture Slides – Standard View	
Figure 4.4	TLN Lecture sSides – No Sidebar Menu	
Figure 4.5	TLN Lecture Slides – Only Slides View	
Figure 4.6	Sidebar Options in TLN Lectures	
Figure 4.7	Standard View of the Navigation Bar for One of the TLN Presentations	
Figure 4.8	TLN Lecture Slide – Additional Buttons for Playing the Lecture Slides	
Figure 4.9	Attachment Options in TLN Presentations	
Figure 4.10	An Example of the Quiz Results from TLN Lecture	
Figure 4.11	Glossary of a TLN Lecture	

LIST OF TABLES

Table 2.1	Operator Mission-Essential Task	4
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EXECUTIVE SUMMARY

This report is a summary of work performed by the Utah Traffic Lab (UTL) to develop training programs for Utah Department of Transportation (UDOT) Traffic Operations Center (TOC) operators. The report includes training materials that are already in service and those additionally developed, at both basic and advanced levels. The entire training material is now a part of Transportation Learning Network — a new learning tool for the TOC operators presented in the final part of this report.

The basic training is designed to train operators in the basic knowledge, skills, and ability to work as traffic operators. It was performed at the UTL and the TOC in a concise two-week training course. A military approach is applied to develop individual training tasks for the operators. The UTL uses the unique approach of focusing training on the regional transportation network and branching off into other relevant topics when appropriate. The UTL found that understanding the local and regional transportation network was the single most important factor in efficient incident management.

The advanced training program is designed to develop the knowledge, skills, and ability of traffic operators to identify and solve advanced traffic management and operation problems encountered at the TOC. It supports incident management instruction at the highest level and utilizes the advantages of traffic operators who work 24/7 and continually monitor the traffic network through closed circuit television.

Transportation Learning Network (TLN) is a new learning tool that goes beyond the existing training programs by adding some new topics to both basic and advanced training levels. The report explains how to use TLN and presents the benefits of online accessible training material.

This report also provides methods of training program testing and evaluation and offers a critical overview of all training methods developed by the UTL to date.

1. INTRODUCTION

In the past decade, the focus of traffic operations centers (TOCs) has expanded from the implementation of new traffic control and monitoring technologies to consideration of human factors' roles in the traffic management process. The importance of eliminating human error and maximizing efficiency has increased as the problem of congestion costs becomes more serious. Even in normal traffic conditions, TOC operators' skills and knowledge can increase the level of safety and efficiency. During special events and unplanned incidents in traffic, well trained and prepared operators will improve the TOC's response time, making delays on the network less severe. New TOCs are training oriented and aware of the importance of operators' role in traffic management.

This report combines new research into TOC operators' training requirements with existing practices to create a comprehensive learning procedure. Basic training is developed for new operators, while advanced techniques apply to good, more experienced operators. Already existing basic training material now deals with some additional problems, such as theory of traffic flow and queuing. Advanced training material now includes procedures for managing traffic incidents and special events, Manual on Uniform Traffic Control Devices (MUTCD) basics, changeable message signs (CMS) design and operation, and other more complex topics.

The most important contribution of this report is the integration of both existing and new material into a new learning tool called Transportation Learning Network (TLN). The main difference of TLN from previous training approach is a complete online access to training course material. The new online course is easier to use, offers the possibility of testing the trainees, and makes a good background for further training of advanced operators. The greatest advantage is the possibility to acquire theoretical knowledge and prepare for further training levels in classroom-independent environments. The UTL has had its own site for these purposes, but TLN operates in a much more sophisticated and user-friendly manner.

2. BASIC TRAINING

This section explains what is currently being done to train new employees and what additional changes have been made to improve basic training. This section also contains approaching methods used in the training module.

2.1 Background

The basic training already in service and created by UTL was established in order to bring improvements to two areas: defining critical operators' tasks and the method of training. The first area of improvement determines a finite list of operator tasks, relevant to the UDOT TOC that can realistically be taught in a two-week operator course. The second area of improvement is related to the best method of acquiring the necessary operators' skills in a confined period of time.

UDOT TOC operators' training was relying on so-called "on the job" training (OJT). Unfortunately, this method results in inconsistent competence of newly hired operators. It also degrades the TOC's ability to manage the transportation network as seasoned operators must be removed from the control room to train the new hires. The essential problem, with UDOT TOC operator training is that it is neither structured nor evaluated. A structured training program is needed to ensure all topics are covered. Items taught during OJT are often seen once and then forgotten, and there is no checklist of items for new hires to be trained. The second problem with OJT is that it has not been quantified by evaluation prior to beginning work. There was a gradual level of increased responsibility as the new operator is allowed to operate independently, but there is no evaluation of abilities at the conclusion of training. Such evaluations are critical to provide a "check on learning" that ensures all topics have been trained to an expected standard.

2.2 Basic Training Program

The existing basic training is developed with a military approach and an emphasis on understanding the transportation network.

Military Approach Applied to Training

A military approach is used because the development of operators' tasks is poorly defined in the available transportation literature. The US Army is a highly-structured and well-trained organization where training of new employees has been refined to a very high level. This is why the UTL applied a similar approach to operator training at UDOT TOC. Using the existing UDOT TOC mission statement, the principles from the cornerstone of the Army's training program FM 7-0 *Training the Force* were applied to TOC operators' training. This concept is well-suited to TOC operator training because state DOT's usually have a defined mission statement but lack the structure or training program to support it. The mission of the UDOT TOC is five-fold. It has been virtually unchanged since the inception of the TOC in 1995 with the Department of Public Safety (DPS). It is as follows:

- 1. We support UDOT and DPS activities to improve highway safety.
- 2. We operate the highway system to provide reliable and efficient travel time.
- 3. We provide accurate, timely, and useful real-time traffic information.
- 4. We work together with other government agencies to serve the public.
- 5. We provide excellent customer service.

This mission statement is complete and directive in nature, but what is missing is the derivation of training tasks from the mission statement. Implementing each of the statements above is only possible if individuals are proficient at tasks that enable the statement. Beginning with the mission statement, this study develops key operator tasks for each tenant of the statement. They are listed in Table 2.1 with the statement they support. This mission essential task list is more detailed than a generalized job description, but it is not overwhelmingly long. There are 22 tasks of various difficulties. While each task must be taught using different techniques, simplifying the job into these tasks enables building the two-week course from a list that is quantifiable but not unmanageable.

Table 2.1 Operator Mission-Essential Task

1. We support UDOT and DPS activities to improve highway safety

Communicate effectively with the UDOT complex (headquarters) and DPS operators and dispatchers

Understand the DPS' computer automated dispatch (CAD) system; utilize it to pull real-time incident data

Understand internal processes (work orders, maintenance requests) between the TOC and other UDOT divisions

Understand and have access to current highway safety statistics, trends, and publications

2. We operate the highway system to provide reliable and efficient travel time

Understand the regional and local freeway system, surface streets, and geography

Understand the interstate highway system (numbering, signing, and impact on the local network)

Recognize local transportation trends and traffic patterns to enable more informed decision-making

3. We provide accurate, timely, and useful real-time traffic information

Operate the Commuterlink website

Operate closed-circuit television (CCTV) cameras throughout the network to enable incident detection

Operate variable message signs (VMS) throughout the network to communicate real-time with travelers

Operate the incident management system (IMS) to manage incidents and populate the Commuterlink website

Operate the 511 Traveler Information System Hotline

Operate Highway Advisory Radio (HAR)

Monitor scanners and commonly-used radio frequencies to enable incident detection at earliest possible state

Operate the remote weather information system (RWIS)

Operate the traveler advisory telephone system (TATS)

Send text updates (J-Page) on incidents to appropriate UDOT personnel

4. We work together with other government agencies to serve the public

Understand emergency procedures, such as disaster evacuations or AMBER alert, and respond appropriately

5. We provide excellent customer service

Maintain appropriate dress, appearance, and behavior at all times

Operate phone system with proper courtesies and competencies

Handle walk-in customers and group tours appropriately

Communicate with media members appropriately

Transportation Network – Oriented Training

The objective of this project is to develop a logical training program that teaches all concepts in the most efficient manner possible. It is determined from observation and initial pilot training courses that the most critical component of an operator's knowledge is an understanding of the local transportation network. The entire training course is built around this concept.

The term "transportation network" defines the freeway and surface street network, as well as the travel trends, regional socio-economic factors, and geographic or topographic factors that can influence travel patterns. Understanding this transportation network is vital to becoming a functional operator. Operators must be able to manage cameras and variable message signs (VMSs) and understand the transportation network. The following part of this section represents the topics covered in current basic TOC operators' training:

- Roadway design and characteristics
- Regional geography
- Travel trends
- Software, policies, and procedures

As a result of operators not understating the larger network, the basic training module starts by teaching operators the transportation network from a larger overview and working to a smaller, localized understanding. This "larger to smaller" approach is applied to each major area taught: roadway design and characteristics, regional geography, and travel trends.

Roadway Design and Characteristics

To start with the big picture of the road network, the initial classification taught is the Interstate Highway System. We teach how the local portion of the interstate system is part of a much larger system that has national implications for both freight movement and passenger travel. After understanding of the nation's highway system is achieved, operators are trained on the next "smaller" classifications, beginning with non-interstate freeways and continuing to important U.S. and state highways, followed by principle arterials in the urbanized areas, and finishing with local roads. Operators are taught to recognize key parts of the highway infrastructure, particularly dangerous intersections, and basic principles of traffic flow and signal timing. Again, operators do not need to be traffic engineers, but they should be able to communicate with professionals in engineering language. Figure 2.1 is from the basic training module in the road and traffic basics course. The figure is a summary of the road classification terms taught to the new employee.

Roads by Classification Road Type **Speed Limit** Lanes 55+ Freeway 4+ (separated) Arterial 3-5 45-50 Collector 2-3 35-40 2 Local Road 25-30 Rules of thumb; not specifications Values often vary according to region, population Categories frequently overlap Practically, at TOC: - Freeways "Surface streets"

Figure 2.1 Roads by Classification

A unique technique to help operator trainees learn the transportation network was developed. Operators start with sketching a map of the local system of roads on their first day of training. Drawing the map of the local roads is repeated until operators become comfortable with the local network. Creating these map sketches helps operators create their own "mind map" and rely on it when they hear an incident location called out by a dispatcher. They should be able to place the incident on the map in their heads and immediately recognize what may be happening around the incident and what else it may affect. This proves to be the most effective technique of the entire course. Once the operator has the map of the region visualized, it is easy to overlay cameras, signs, and other ATMS field devices onto the "mind map." Figure 2.2 is an example of a completed local map compared to an actual Google image of the same area.



Figure 2.2 Local Map

Regional Geography – Key to Incident Management

The most important operator skill, and the most difficult for the vast majority of operators, is locating and verifying incidents. This requires two skills that are often very difficult for operators to master – selecting the correct camera and locating the incident on that camera. Both of these skills rely on a traffic operator's detailed understanding of the geography of the area.

With a good "mind map," the ease of selecting the correct camera is largely dependent on the software application that controls the cameras. Cameras that are named and listed logically will be helpful to the operator. Mileposts are the most common method of labeling cameras TOC's have focused on freeways.

Once the operator has selected the appropriate camera, understanding the area's geography and transportation network becomes even more important. The operator will usually have to maneuver the selected camera, and often numerous cameras must be selected. This requires that the operator determine where the camera they are viewing is located, where the incident is located in relation to the camera, and the direction in which the camera is looking. Adding to the difficulty is that many initial reports are unrefined and do not give an accurate incident location.

The knowledge, skills, and ability of operators all determine how effective they are at identifying incident locations through CCTV. Knowing which direction the traffic is headed, as well as the geographic and network conditions, helps experienced operators anticipate some of these problems, which will enable them to select the correct camera quickly. Although this is a skill that often takes operators months to master, teaching some universal methods for recognizing location and direction are very helpful in

developing this skill quickly in new operators. Three methods of orienting that operators are thought to use are listed below:

- Using topographical features
- Using shadows and the position of the sun
- Observing the road traffic (intensity, truck speed)

Figure 2.3 is an image taken from a CCTV at 2:46 PM. It displays the three methods that can be used in determining orientation of the camera. The first method of locating the Wasatch Mountains can be used in this image. The Wasatch Mountains can easily be located in the background of the image, and the operator can conclude that the yellow truck is headed southbound because the Wasatch Mountains will be east of I-15. Method 2 uses the position of the sun. In this image, the sun is in the west. The yellow truck has no shadow on its left side, and it can be concluded that the sun is located there and the truck is in the southbound lane on I-15. The final method of looking at the commuter trends and density is not easily determined from this image. But it does appear that the traffic is denser in the same lanes as the yellow truck. It can be concluded that because it is the afternoon at 5300 S on I-15, that the denser direction is southbound and the truck is heading in that direction.



Figure 2.3 Image from CCTV to Determine Camera Orientation

Travel Trends

Traffic operators must be taught a basic understanding of local travel trends. This can be helpful for identifying location and image, but it is equally important to understand the impact of an incident on the network. Operators should understand why a similar crash in the same location will have different impacts at 7:00 AM than it will at 5:30 PM. They also have to understand where important facilities and businesses are located, as well as special events hosting sites. In Salt Lake City, the airport, the headquarters of the Church of Jesus Christ of Latter Day Saints, the Utah State Capitol Building, and the University of Utah are all population and economic centers in the city. As a result of Utah being very rich in natural resources, there are three oil refineries, numerous rock quarries, and the Bingham Canyon Mine, the largest open-pit mine in the world. There are also many regional distribution centers in the western portion of the valley that lead to Salt Lake City being called the "crossroads of the west." Traffic operators must know the locations and general operations of these facilities to determine what type of traffic is projected onto the network. Although they do not need to capture the detail that an urban planner would, the operators should understand how the socio-economic characteristics of the region affect the local traffic.

Software Programs, Policies, and Procedures

After an in-depth understanding of the network is achieved, the trainee still must learn various day-to-day operations and programs used by operators. The UDOT TOC uses the TransSuite software package to operate all ATMS devices and conduct incident management. These programs, as well as UDOT internal policies and procedures, comprise the remainder of the operator course. The unique technique of teaching operators the road network as the first subject helps them to learn the location and capabilities of ATMS field devices.

The TransSuite package consists of four applications commonly used by operators: the ATMS map, incident management system (IMS), traveler information system (TIS), and the video control system (VCS). When learning these programs, the operators use them as they would in the course of managing an incident. The standard operator procedure for incident management is:

- Verify incident on camera
- Post VMS sign if applicable
- Create incident in IMS (populates Commuterlink website and 511)
- Monitor until incident is cleared

The programs are taught in the order they are accessed, beginning with incident detection, followed by VCS, TIS, and IMS. This order follows the same order of the standard operator procedure to help with the training process. Initial training sessions reveal that none of the software programs are difficult to master for the newly-hired operator. All are Windows-based and operate with familiar toolbars and functions.

New operators are trained to understand the initial incident report called out over the radio. While all incidents called out over the radio will eventually be posted to a computer automated dispatch, it is very important for the operator to capture all relevant information from the first radio call-out. The faster the response to the incident, the faster the network will return to normal flow. Since the UDOT TOC is directly linked to the highway patrol dispatch center, all traffic over the radio is in "police speak," using the state 10-codes and other acronyms. The relevant state 10-codes and commonly-used acronyms are taught in the classroom, allowing the operators to identify incident locations more quickly upon beginning work.

VMS messaging techniques is a dynamic subject covered in the training module. VMS practices and standard procedures are changing as more research is done. At the TOC, TIS is the software that posts messages to signs. More classroom time is spent on messaging theory and application than on the TIS program itself. The training module teaches that when using a VMS message the operator must keep the message as clear, concise, and direct as possible. Another technique asks the operator to try and rework the message so that it conveys a clear message as if the operators themselves are on the roadway reading the VMS message.

2.3 Additional Basic Training

The existing basic training for the new TOC operators already represents a new approach to operators' training. Compared to the previous way TOC operators were trained, new basic training provides many advantages. It is in-classroom-environment training, with established teaching methods, structured approaches and organized training materials that cover critical problems that TOC operators must deal with. The way that basic training was prepared leaves enough space to expand the training material to other topics that are helpful for new TOC operators. The existing basic training is focused on introducing new trainees with local roadway network. Knowledge about transportation network is the first condition operators must meet to monitor and respond to every day and incident situations in traffic.

Additional basic training introduces trainees to some basic traffic phenomena, giving new operators a better understanding of traffic problems they are facing. New training will include introductions to transportation, traffic, and TOC. These additional training materials are described in the following section.

TOC Operator Introduction

Every operator's training should start with an introduction. The introduction is not built to be time consuming and its nature is introductory. This part of the training should serve as a checklist or a manual that points out the main TOC functions and traffic operators' roles. Once new operators acquire basic knowledge about functions they should perform, learning each of those functions in detail is much easier. The purpose of these training materials is to inform and give operators a bigger picture of the importance of TOC for the local transportation system.



Figure 2.4 Introduction of TOC Functions for New Operators

Transportation Introduction

The Transportation Introduction section of the operators' training covers basic transportation terminology and helps operators understand the importance of the job they are doing. It introduces them to general definitions and activities related to all modes of transport. Some statistical facts related to how transportation affects the economy and environment on both micro and macro-levels are included. Challenges in terms of safety, congestion, delay, environment, energy consumption, and new technologies are also presented.



Figure 2.5 Transportation Introduction

The topics covered are not directly applicable to TOC operators' responses in different traffic conditions. Rather, the introduction to transportation basics brings all into one — the network, the vehicles, and the drivers — and creates a background that helps operators understand the relationships between these elements. In this way, operators become better prepared to face potential problems on the network, different drivers' behaviors, and adequate response measures.

Traffic Basics

Traffic basics is the most complex part of the additional training for new operators. It introduces them to theory of traffic flow and queuing, explaining terms such as speed, flow, density, queuing, and level of service. In this way, operators can recognize the conditions that might lead to an incident and will pay more attention to certain parts of the network. If the congestion level is too high and alternate routes are available in terms of capacity, operators might consider rerouting traffic to prevent delays.



Figure 2.6 Traffic Theory and Levels of Service

Also introduced in the traffic basics section of the training material is traffic signal timing jargon. In case of a serious traffic incident, even if new operators are not primarily responsible for a response, their basic knowledge about traffic signals might be of great help to advanced level operators.

These new topics are added to the existing TOC operators' training to help operators understand the complexity and the importance of their role and the entire TOC role for local transportation. The new training material enables new operators to recognize the areas of potential problems in traffic and make them better prepared for their responses. Both existing and additional training contain quizzes so that operators can be tested as soon as they are finished with their learning. The existing material is updated to match the new topics, and everything is presented on the Transportation Learning Network (TLN) – a new training tool that will be explained in details in the final section of this report.

3. ADVANCED TRAINING

Various levels of training at a TOC help to retain and increase the knowledge and ability of employees. Training research and programs have recently focused on two areas. The first area is finding and training of new employees (11). The second area is training for large emergency management scenarios, such as city evacuation or terrorist response (12, 13, 14, 15). The emergency response training is built by federal agencies and done as a need-based training program.

After creating the basic training program for UDOT TOC operators, the UTL has built an advanced training program as the second area of operators' training. This section describes the purpose of advanced training and key points to include in training when implemented. Some additional topics for advanced training material are also presented.

3.1 Background

The levels of aptitude are as follows:

- Entry level operators are new employees with no prior work experience in TOCs. Training for entry level operators includes the new employee or basic training which can take up to two weeks.
- A full performance level operator should be able to carry out his or her responsibilities with a minimum of supervision, guidance, and direction (9). Training to reach full performance is accomplished through recurrent training commonly given to operators in the form of monthly meetings or instruction from other operators over a period of one to two years. This level includes skills of network monitoring.

A good operator is an operator who can perform all the capabilities and duties of a full performance level operator. The capabilities of a full performance level operator may include managing multiple incidents at once; using all ATMS software effectively; understand all interchanges; reporting emergencies on 511/website; communicating with invested partners; working with no supervision; implementing special event signal timing plans; filling a work order; issuing a J-page; using TATS, etc.

Advanced training is presented as a specific training program with the purpose to develop and use the opportunities available to traffic operators. This is accomplished by training operators to identify and solve advanced transportation management and operation problems. Important components of the advanced training procedure are as follows:

- Define a "good operator" and prepare for the advanced training.
- Introduce a specific curriculum that develops the necessary knowledge, skill, and ability to identify and solve advanced transportation management and operation problems.
- Suggest a method for measuring the performance of the operator on the knowledge, skill, and ability gained from the curriculum.

This report also proposes that a specific advanced training program can increase the capabilities of good operators to identify and solve advanced transportation management and operation problems. It defines the separate components of the advanced training program, including the definition of good operators, the specific curriculum, and ways to measure operator performance of the curriculum and learned capabilities.

3.2 Advanced Training Module

The advanced training module that the UTL has created defines the entire training procedure, from choosing the operator who qualifies for the advanced training to completing the entire training.

To determine what a good operator is, the description of a traffic operator and the different levels of aptitude must be defined. A traffic operator is described in Guidelines for TMC Transportation Management Operations Technician Staff Development (9).

"A Transportation Management Operations Technician is a person who is capable of working a typical shift in a Transportation Management Center (TMC). A typical shift may include operation under congested, non-congested, incident and non-incident conditions. The operator's work will usually consist of direct, "hands-on" accomplishment of tasks necessary to deliver one or more accepted TMC functions. An operator must also be able to show competent knowledge, skill, and ability."

Not all full performance level operators are considered good operators or are good candidates to receive the advanced training program. There are other traits shown by the operator that help to determine good candidates. Some key traits that have been identified include what the operator does in his/her spare time, the operator's attention to detail, and a general interest shown in traffic and the TOC by the operator.

Good operators help TOCs run smoothly in their duties to manage and control traffic in a transportation network. A good operator may start to receive more responsibilities because he/she shows the knowledge, skill, and ability to accomplish all duties and tasks given in prior training. Figure 3.1 shows the process an operator follows to reach the advanced aptitude level. An operator who seeks to reach the advanced level must be fully capable in all the duties and tasks at each previous level. Other preparation in receiving advanced training is that an operator must show an ability to work with others and take interest in situations that are beyond the entry and full performance level tasks and duties. Some situations may include an operator notifying supervisors of areas of congestion at non-peak hour times or an operator suggesting better camera locations to supervisors.



Figure 3.1 Levels of Operator Performance

Understanding the traveler information procedures is also an important part in preparing to receive the advanced training program. A one-hour recurrent training course can effectively teach the traveler information procedures of 511, TATS, emergency alert, Highway Advisory Radio, and IMS as related to traveler information.

3.3 Advanced Training Material

A specific curriculum that helps good operators develop the necessary knowledge, skills, and ability is an essential part of the advanced training program. The curriculum is designed to teach them to identify and solve advanced problems that other TOC employees, specifically engineers, handle. The curriculum is divided into three different courses to accomplish this goal. Figure 3.2 shows the divisions with the subjects addressed in each course.



Figure 3.2 Curriculum for Advanced Training

A structured curriculum will help TOCs meet the overall goal to develop valuable employees, monitor the transportation network, and identify and solve transportation problems. The curriculum presented will help good operators obtain the specific capabilities to perform many of the responsibilities that are given to them. The capabilities that an advanced level operator should be able to complete are:

- Handle difficult phone calls
- Respond to HAZMAT
- Fix broken traffic signal timing
- Identify all road elements and calculate superelevation
- Lead/Train other employees
- Understand traffic flow theory
- PeMS Report delay times
- Manage work zones
- Manage ramp meters

Advanced Operator Techniques

The first course in the advanced training curriculum is called advanced operator techniques. An operator who has received basic training and reached the status of a good operator should be able to understand the transportation network and use the advanced transportation management system software effectively and efficiently. This course adds upon the full performance level by providing advanced customer service skills, knowledge to respond to atypical traffic crises, and the skills to manage traffic signals. The advanced operator techniques course develops the capabilities of good operators to identify and solve the advanced transportation problems in operations.

The interaction between the operators and the public and media, often referred to as customer service, is the first subject covered in the advanced operator technique course. This interaction improves upon the full performance level and helps develop capacities for the daily task. TOCs are information centers; they monitor the conditions of the transportation network and have access to all DOT agencies. To make use of the information, the TOC provides a direct phone line to the operators that they are required to answer during their shift. This means that part of the traffic operator's job is to answer phones and use customer service techniques to successfully provide the information to both the public and the media. The customer service aspect of the traffic operator's duties can create challenges and must be handled appropriately. Handling the challenges of customer service and phone etiquette are addressed in the course. Figure 3.3 describes how an operator can create a good first impression on the phone and how they will be evaluated. Operators are taught to be polite, informative, and professional. The qualities that are needed for good customer service skills include listens well, gives verbal feedback, uses the caller's name, and works to provide immediate feedback. These qualities are emphasized in the training.



Figure 3.3 Customer Service – First Impressions

Operators are also taught to respond to atypical or emergency situations and what their responsibilities are and what actions they should take in these cases. An atypical situation is defined as any severe weather hazard or HAZMAT incident. These incidents are usually given with little to no warning and require the operator to seek supervisor help to resolve them.

The final subject covered in the advanced operator technique course is how to use the traffic signals at an operator level. Developing and managing traffic signal timing plans is not the responsibility of the traffic operator. However, understanding how to use the traffic signal software and how to implement created planes can be an asset for the operators. Operators may be taught how to implement a signal plan, how to deal with signal software in non-working hours, and how to understand the basics of signal timing plans and identify the problem areas.

Geometric Design

Geometric design is the understanding of the road itself, the cross-section, road elements, and curvature. Understanding the road will help operators understand if problem areas are user related or a condition of the geometry of the road. Operators study the road looking for traffic incidents. After the geometric design training, the operators will begin to look for geometric design problems as they look at the road. The geometric design course is focused on the identification of advanced transportation problems. The primary goal of introducing this course is to increase operators' awareness of traffic safety issues. Figure 3.4 is a slide taken from the geometric design course. This figure is describing the elements that are taught in the cross-section subject.





Theory of Traffic Flow and Queuing

Theory of traffic flow and queuing is an update of the course "Traffic Basics" from the basic operators' training. It is essentially the same material adjusted for advanced level operators and brought into the advanced training for the purposes of traffic incident management. FHWA defines traffic incident management as a systematic, planned, and coordinated use of human, institutional, mechanical, and technical resources to reduce the duration and impact of traffic incidents and improve the safety of motorists, crash victims, and traffic incident responders. Having an understanding of capacity, flow, and

demand, the basic elements of traffic flow, helps operators see how efficiency in traffic incident management can benefit the travel time of the users.

Just as the basic level course, traffic flow covers definitions of speed, flow and density, but goes even further explaining mathematical relationships between these values. Advanced operators are also taught levels of service, but the course is expanded with basic definitions from the shockwave and queuing theory. This should help operators to better understand and deal with the problems of bottlenecks on the transportation network. A special part of the course is dedicated to queuing theory application in modeling traffic flow interrupted by incidents.

Performance Measurement System (PeMS), software that collects data on the freeway system in Utah, is also introduced in this part of the training. The speed and flow data that this software collects can be used to determine the trends that occur due to recurrent and non-recurrent congestion. This software can also be used to determine the delay time that an incident can cause. The training for this subject consists of learning how to use the software and how to calculate delay times.

The final subject covered in the traffic flow course is an introduction to vehicle monitoring technologies. This subject helps operators understand how and from what sources TOCs get their traffic flow data. This subject introduces six different vehicle detection methods and explains what information they provide.

The advanced training curriculum delivers the necessary information to develop the knowledge, skill, and ability to prepare good operators to work at the advanced level. Figure 3.6 illustrates the process to attain the advanced level. The curriculum should be given in a two-week period, but it does not automatically qualify operators as advanced. A measure of how well the operator can apply the information needs to be determined six months to a year after the training. This will allow enough time for operators to master the information taught in the advanced training curriculum.



Figure 3.5 Good Operator Progression through Advanced Training

3.4 Additional Advanced Training

Advanced operators' training offers more opportunities for the expansion of training material. The newly presented topics and problems are concerned with transportation system management, traffic engineering studies, Manual on Uniform Traffic Control Devices (MUTCD) and Changeable Message Signs. Advanced operators are getting the opportunity to learn more about efficient use of the available road capacity, traffic data collection, traffic control in different traffic conditions, and advanced traveler information systems.

Transportation System Management

The objectives of this module are to introduce the benefits achieved through transportation management. Transportation Systems Management's (TSM) purpose is to create more efficient use of existing facilities through improved management and operation of vehicles and the roadway. Focus is put on changing the facilities and how people use them through the implementation of TSM strategies and new information technologies.

Advanced operators should learn how to create and efficiently use road space in congested environments. They learn how to deal with increased traffic volumes and how to manage transportation supply and demand. Helping to provide and improve transit service is also one of the assets advanced operators should possess.

This course brings together geometric design of the roadways and traffic operations. It enables operators to combine the knowledge they have about capacity and level of service with the knowledge and skills in the area of TOC equipment and technologies deployment.



Figure 3.6 Valley Emergency Communicating Center – Part of TSM

Additional way of improving efficiency, including dedicated bus lanes, carpool lanes, and reversible lanes, are also introduced here. Besides managing the roadway capacity, operators get the freedom to coordinate different modes of transport to minimize traveler delays. The course prepares operators to manage parking problems, increase the size of pedestrian zones, and not only make traffic more efficient, but also safer for the users.

Traffic Engineering Studies

This course introduces the basic principles of traffic engineering studies for DOT personnel lacking civil engineering backgrounds. It includes speed, volume, travel time, delay and parking studies.

Speed studies will help operators understand how speed data is collected and how speed is distributed in the traffic stream. In this way, operators are enabled to make speed related decisions.

Volume studies introduce some very important terms such as average daily traffic, peak hour volume, vehicle miles traveled. Travel time and delay studies enable operators to understand how to calculate average traveler delay based on the available volume data.

Finally, some basics about parking studies are presented in this course with the purpose to inform operators about the terminology used in the area of parking management. Like every other course in the training, quizzes test operators' knowledge on this topic.

MUTCD Basics

Although MUTCD basics is a newly added topic, it is very important for advanced level operators. The objective is to introduce operators to MUTCD contents and its applications in practice. MUTCD defines national standards for all traffic control devices: signs, signals, markings and other devices. TOC operators work with these devices every day, whether they monitor or need to change the existing traffic control. It is critical for them to know how to apply standards from MUTCD.



Figure 3.7 One of the Lecture Slides from the Introduction to MUTCD

The course first explains the form in which MUTCD is written: standard, guidance, option, and support. Then each of nine chapters from MUTCD is presented so that operators become comfortable with the manual and it is easier for them to use it when needed. Finally, applications of MUTCD are presented with practical examples.

Changeable Message Signs

The first traveler information tool that TOC operators use to reach the drivers in traffic is Changeable Message Signs (CMS). The most critical part of operating CMS is posting adequate CMS messages. The area of CMS messaging is still new for the researchers, and methods of CMS application are constantly updated as new information becomes available. MUTCD has its own section dedicated to CMS, and every state DOT has its own rules of CMS messaging based on MUTCD standards.

The operators are first introduced to the importance of the role that CMS have in traveler information systems. CMS are the fastest way for TOC operators to directly inform travelers about traffic conditions. Then different types of CMSs in terms of application, size, and location are defined.

UDOT TOC Message Format				
DESCRIPTION / ACTION LOCATION				
CRASH ON RAMP TO EB I-80				

Figure 3.8 Introducing Operators to UDOT CMS Message Format

The essential part of the course is dedicated to CMS message design. Operators learn what types of messages are unacceptable for the drivers. The purpose is to enable operators to understand how drivers are receiving CMS information. Operators are taught to create clear and concise messages that drivers can read and understand in the amount of time they have while in traffic. If the message is poorly designed, it might create confusion among drivers and worsen traffic conditions instead of helping to deal with possible delays and incidents. Standards for message length, characters' size and visibility distance are provided as minimum criteria that need to be respected based on MUTCD and other available literature from this area. Before testing the operators' knowledge at the end of the course, some examples of CMS messages with design considerations are provided for the training.

3.5 Advanced Operators' Performance Measuring

The final component of the training is to suggest a method for measuring the performance of the operator about the knowledge, skill, and ability gained from the curriculum. Performance measuring is the process of identifying current knowledge, skill, and ability and determining how well the trainees learned the

training and how effective they are at applying the training. Performance is measured on how well operators can perform their capabilities, including identifying and solving advanced transportation management and operation problems. Three additional publications are used to help in the formulation of this specific performance measurement system, two from FHWA (16, 17) and one from the Transportation Research Board (18).

The performance measures are a balance of quality and quantity. The quality of the performance measures should be comprehensive enough to assess the knowledge, skill, and ability — both of what is already known and what is taught. The quantity of the performance measures is assessed to assure that the evaluation does not become too cumbersome. The result from the performance measuring also needs to provide a way to help revise and improve training service, quality, and productivity.

The quality of the performance measures can be evaluated against the Kirkpatrick Four Level Model of training evaluation (10). This ensures that the assessment and evaluation processes will accomplish their purposes of helping the operator understand the training and retain the information.

- 1. Student reaction "What they thought and felt about the training."
- 2. Learning "The resulting increase in knowledge or capability."
- **3.** Behavior "The extent of behavior and capability improvement and implementation and/or application."
- 4. Results "The effect on the environment resulting from the trainee's performance."

With the new method of measuring performance developed for the advanced training, both assessment and evaluation methods are used. The performance measuring for the advanced training gives an assessment of current employee levels through a checklist method. Next, an evaluation of the advanced training is given to the trainee, consisting of short answer and problem solving questions. Finally, the frequency and duration of the performance measuring is presented.

Assessment through Checklist

The assessment of current operator knowledge, skill, and ability levels is developed in the research and given by the operator's supervisor. The checklist is modeled after the generic activity groups presented in the staff development FHWA publication (9). Three checklists are available for the basic, full performance, and advanced levels. The checklists follow the quality and quantity guidelines, and limits the number of performance measures to no more than ten specific areas of assessment. The checklists are valuable in finding the strengths and weaknesses of each operator and allow the supervisor to focus on the development of the operators. The checklists follow the capabilities so that the supervisor and operator know exactly what the expected performance should be.

The basic level checklist measures the knowledge, skills, and ability of an operator after the basic training and two full weeks of on-the0job experience. The areas are measured by marking if the operator achieves certain capabilities as shown in Figure 3.9. The three levels of capability are not capable, needs work, and fully capable. The areas of assessment for the basic level are hearing incident/using radios, create correct VMS signs, create an incident on IMS, select/orient cameras, Salt Lake geography, overall geography, communication with other operators, reading CAD system, willingness to learn, and productive during down-time.

Basic Level Operator Capabilities			
	Not Capable	Needs Work	Fully Capable
Hearing Incident/Using Radios			
Create correct VMS signs			
Create an incident on IMS			
Select/Orient cameras			
Salt Lake Geography			

Figure 3.9 Basic Level Checklist

The full performance level checklist is given to an operator six months to a year after the basic level performance is achieved. The full performance level is the level at which an operator can work an entire shift and do the day-to-day tasks without supervision. The areas of assessment for the full performance level are:

- manage multiple incidents at once
- use all ATMS software effectively
- understand all interchanges
- reporting emergencies on 511/website
- communicate with invested partners
- work with no supervision
- implement special event signal timing plans
- fill a work order
- issue a J-page
- use TATS

The advanced level checklist is given to the employee after the advanced training and after a month of using the knowledge and skills that were learned. The areas of assessment for the advanced level are:

- handle difficult phone calls
- HAZMAT response
- fix broken traffic signal timing
- identify all road elements
- calculate superelevation
- leadership/train other employees
- understanding of traffic flow theory
- PeMS report delay times
- work zone management
- ramp meter management

Evaluation after Training

Evaluation or testing of the employee after training is critical to determine what was learned and how capable the employee is of applying the training, specifically in identifying and solving engineering problems. The following steps are used in creating the evaluation for advanced training. The information is from the FHWA Handbook for Developing a TMC Operations Manual (17).

- 1. Identify the critical activity.
- 2. Identify the goals and objectives of the activity.
- 3. Develop a set of candidate performance measures.
- 4. Identify performance targets.
- 5. Compare actual performance to targeted goals.
- 6. Determine corrective actions or progress needed to achieve goals.

The critical activities or tasks are identified for each course in the curriculum. These tasks are then compared to the goals of the training. The questions are then created to both help employees apply the tasks that are learned and fulfill the goals set in the training. The number of questions for each course follows the quantity and quality guidelines. The questions evaluate the employee's understanding in ten questions.

Two techniques are used in the evaluation: short answer and problem solving questions. The two techniques are used because of the two methods in how information is retained. The short answer evaluates the operator about what he/she remembers from the training. These questions are often easier and can appear multiple times. This method of learning uses short term memory recall and repetition. Problem solving questions require more thought and the actual application of the principals taught in the training. The problem solving technique uses the critical thinking method of learning. Figure 3.10 is an example of the short answer and problem solving questions.



Figure 3.10 Evaluation of the Geometric Design Course

4. TRANSPORTATION LEARNING NETWORK

The Transportation Learning Network (TLN) is a distance learning partnership among organizations in the western United States. TLN links together the transportation departments (DOTs) in North Dakota, South Dakota, and Wyoming and the Mountain-Plains Consortium universities of Colorado State University, North Dakota State University, South Dakota State University, University of Utah, and University of Wyoming.

TLN's mission is to support quality transportation through a network of people and technology that serves TLN members by enhancing communication, education, professional development, technology transfer, and research.

As mentioned in the beginning of this paper, what the existing TOC operators' training was missing an advanced and organized tool that can deliver both basic and advanced training material in a user-friendly manner. TLN makes this goal realistic using sophisticated presentation software Articulate to combine learning and testing material into a final distance learning product. The greatest advantage of this type of learning approach is accessibility of the training material. TLN does not require classroom presence for the theoretical part of the training. This makes the preparation for practical training exercises much more convenient for the operators. TOC operators can read or hear their lectures at home, test their knowledge using the quizzes at the end of each course, and proceed to the in-classroom training at the UTL.

4.1 How to Access TLN

TLN provides an e-learning possibility for new TOC operator training. This means that trainees have constant online access to training material. When the users want to access the course material, all they need are credentials to log in. The access is allowed through the following link: https://ugpti.rapidintake.com/.

After they receive the credentials, users can test the course material. This kind of course access gives more freedom to schedule the operators' training and makes the theoretical part of the training more time and space independent. Distance learning allows trainees to adjust this part of the training to their own schedule. It also allows the teachers to update the training material and grade the trainees. When it comes to grading, this kind of learning provides a very clear grading system, same for all trainees, with the instant possibility to see the results of their work. All trainees do not have to take the class at the same time, but it is possible for the teachers to establish some time limits. The basic concept is to make a great part of the training more convenient for both trainees and teachers.

At the same time, distance learning allows the option of separating the trainees who are taking online courses from those that have classroom training. Only trainees that complete online training are allowed to continue to the classroom and test their knowledge on practical problems. In this way the capacity of the classrooms is used more efficiently and only for the purposes of practical training related to traffic monitoring, incident management, traveler information systems, and other traffic operation activities. Figure 4.1 represents a screenshot of an access attempt to TLN training material.

ugpti.rapidintake.com		
Heernamer		
osemanie:		
Password:		
Login		
Forgotten password? <u>Click here</u> .		
Terms of Service		
Privacy Policy		

Figure 4.1 Log in access to Transportation Learning Network Course Material

4.2 Taking Classes on TLN

TLN training is based on animated presentations built in software called Articulate. The software uses PowerPoint as the main development environment and overlays interactions, audio, and flash media. Then, it exports it out into a handy, single file for distribution on the web. What sets this e-learning solution apart from many other of its competition is the ease of use. Articulate combines video and audio effects and allows the possibility of having a narrator who gives the lecture. This learning software also has the ability to handle questions. It has a range of built-in question-handling options with various question types. The software is produced by educational experts, and its purpose is to make e-learning environments comfortable for the users.

Once operators have accessed the TLN, the list of possible training lectures will open. Trainees can access lectures by clicking on the title or using the option "search" at the top of the screen. Each lecture file has the following information:

- ID number
- Lecture title
- Date when the lecture is posted
- Date when the lecture is due
- Lecture status

An ID number at the beginning of each lecture file does not concern the trainees. It is for organizational purposes and will be used by teachers only.

A lecture title provides information about the lecture topic, and trainees and teachers can access the training material by clicking on the lecture title.

The date when the lecture is posted is also for the purpose of organization and is used by teachers when updating the course material.

The date when the lecture is due is important for the trainees because it tells them when the lecture needs to be completed. To complete the lecture, trainees need to read and listen to the learning material and submit the quizzes at the end of the presentation.

The status of the lecture has two options:

- For trainees: Open / Closed
- For teachers: Open Complete

If the trainees see that the lecture status is "open," the lecture is open for them to access. If the status is "closed," then the trainees cannot access the lecture. When teachers log in they will either see status signing "open" or "complete." When the teacher sees status "open," that means the lecture can be updated and changed. When the teacher sees status "complete," the lecture is closed for updates and changes.

Figure 4.2 shows an example of training material content available for trainees' access on the TLN.

Ay Projects					
Collapse/Expand All	Search:	Name	▼ Search	<pre>< 1 of 1</pre>	> > go
Alerts	ID Name		Date Added	Date Due	Status
Default Group					
	18001 <u>National and Regional</u> <u>Geography</u>	O	2011-05-12	None	Open
	17992 Traffic Studies	O	2011-05-12	None	Open
	17915 Transportation Introduction	O	2011-05-10	None	Open
	17637 TMS (Transportation System Management)	00	2011-04-25	None	Open
	17636 MUTCD Basics	O	2011-04-25	None	Open
	Traffic Operations Center 17407 (TOC)Operator Introduction	00	2011-04-14	None	Open
	17406 Changeable Message Signs (CMS)	Ø Q	2011-04-14	None	Open
	14617 Traffic Basics updated 5- 09-11	Ø Q	2010-12-17	None	Open
	10022 High Visability	00	2010-06-08	None	Complete
	10008 Aggregate Sampling	O	2010-06-07	None	Complete

Figure 4.2 The Example of Training Material Content on TLN

After choosing one of the lectures opened for access, the trainee may start the learning process. The lecture will be opened, and trainees can use the button on the right side of the bottom of the screen to access the standard view, no sidebar view, or slide only view menu (see Figures 4.3-4.5).

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Figure 4.3 TLN Lecture Slides – Standard View

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Figure 4.4 TLN Lecture Slides – No Sidebar Menu



Figure 4.5 TLN Lecture Slides – Only Slides View

The side menu serves as navigation. It is one of the options that software Articulate offers, making these presentations so user-friendly. This navigation tool provides the option of skipping the slides that the learner does not want to see and going directly to the slides that they are interested in seeing. The new slides will load fast, which is also one of the advantages of this software.



Figure 4.6 Sidebar Options in TLN Lectures

As shown in Figure 4.6, the side menu offers several options:

- Outline
- Thumbnails
- Notes
- Search

The option "outline" provides the list of all main topics covered in the lecture. This also makes trainee's orientation in the training material much easier. Option "thumbnails" allows the trainee to see every slide in the lecture together with the name of the topic that slide belongs to. When the trainee clicks on the option "notes," he/she will be able to see the narrator's text, which might make following the lecture easier for those who see the material for the first time. Finally, option "search" in the side menu provides the opportunity to find the particular word/group of words in both slides and lecture notes.

For those trainees who are working in this environment for the first time, TLN provides the instructions on how to use the navigation bar at the bottom of the screen. Figure 4.7 shows how to manage the volume, how to play and stop the slides, how to change the playing slides, and the attachment option.



Figure 4.7 Standard View of the Navigation Bar for One of the TLN Presentations

Figure 4.8 shows the functions of the additional buttons on the lecture slides. The red button with the white arrow takes the trainee to the next slide when the playing of the current slide is completed. If the trainee wants to skip the current slide and continue to the following, "back and forward" option is available. In the final part of the lecture, when the trainee takes a quiz, there is a "submit" option that the trainee needs to click to proceed to the next quiz question (see Figure 4.8).



Figure 4.8 TLN Lecture Slide – Additional Buttons for Playing the Lecture Slides

The "attachments" button at the top of the lecture slides helps the trainee to view the attached content. Once the trainee clicks the "attachment" button, a table of contents with the scroll bar will show up. By choosing any available topic from the attached content, the trainee is taken to the appropriate website and can see the literature source for the chosen topic (see Figure 4.9).



Figure 4.9 Attachment Options in TLN Presentations

When the trainees reach the end of the lecture slides, the quiz is created to test their knowledge. Quizzes have different question types:

- True/false
- Multiple response
- Multiple choice
- Fill in the blank
- Word bank
- Matching drag and drop
- Matching drop-down
- Sequence drag and drop
- Numeric questions
- "Hotspot" questions

Each question has its score posted at the bottom of the lecture slide, and trainees can see if their answer is correct or incorrect right after they click the "submit" button. At the end of the quiz, trainees can see their total scores and the "passing score." The result will tell them if they have passed the test or not. If they want to see a recap of their results, the button "review quiz" offers that option.

		I AT	TACHMENTS EXIT	
Material Requirements	Quiz			
Material Requirements Quiz				
Yo	our Score:	100% (70 points)		
Pa	ssing Score:	80% (56 points)		
	Result: Congratulations, you passed.			
You can click the 'Re	view Quiz' button	for a play-by-play recap of your res	ults.	
	Review Quiz Re	etry Quiz Finish		
SLIDE 29 OF 34 PLAYING	00:00 /		Ø	

Figure 4.10 An Example of the Quiz Results from TLN Lecture

After the trainees complete the lecture and the quiz, there is an option of viewing a glossary of the entire lecture at the end of the presentation. The glossary is organized in alphabetical order and provides the definition for each important term used in the lecture.



Figure 4.11 Glossary of a TLN Lecture

After finishing the entire lecture, an "exit" button at the top of the slide on the right side next to the "attachments" ends the current lecture session.

4.3 Advantages for TLN Users

What follows is a summary of benefits to TOC operators who use TLN as a new training tool:

- Easy to access
- Easy to use
- Good slides navigation
- Quick video loading
- Access to literature resources
- Possibility of learning and testing
- Instant test results
- Possibility of reviewing the taken quiz
- Glossary of important terms
- Well organized and well-presented lectures

An additional advantage is, as mentioned, the possibility of distance learning and a more independent training approach.

5. RESEARCH EVALUATION

The TOC operators' trainings provided to date have shown that different individuals require different training treatments considering their background and experience levels. The low number of trainees make it possible to customize the training program to the individual, a luxury many larger metropolitan areas may not have.

While the operator course has been effective to date, some limitations still need to be addressed. One of the largest obstacles is the confidential nature of much of the information gathered, analyzed, and disseminated at the TOC. The UTL will most likely never have access to the CAD or radio traffic coming from the DPS dispatch center, which is unfortunate because listening to the constant radio transmissions and extracting relevant information is one of the most difficult, and important, skills of the operator. This would prevent achieving a complete off-site training at the UTL.

A final limitation is that the UTL cannot train and evaluate an individual's ability to cope with boredom. A common description of work in an operations center is "hours of tedium interspersed with moments of terror" (8). A recommendation is for the control room manager to consider the changing pace of the operator job when designing work schedules and break periods.

As the advanced training program was given to operators, several questions began to arise, such as "Does increased responsibility mean increased performance?" This question is an important one because if no noticeable increase in performance at a TOC is seen, why implement the advance training program? If operators correctly apply the training, then they can identify problems in the transportation network and solve the problems from the skills gained through the training. Many practical examples illustrate the knowledge gained in the advanced training courses where operators have managed to deal with the problems that are usually covered by engineering level tasks: fixing signal timing, identifying poor geometric design, etc.

The delivery of the advanced training program was another problem that was discovered in the previous research. The new method developed using TLN is created to improve the teaching and learning efficiency. When it comes to the practical part of the training, UTL is now equipped to train new operators in transportation network monitoring. Starting in 2011, the UTL has access to UDOT TOC traffic cameras, and this provides a realistic TOC environment in the UTL classroom. New operators will be able to learn how to find traffic incidents in real time and outside of UDOT TOC. In this way, employed TOC operators won't be bothered with the training and new operators will be prepared to respond to traffic incidents as soon as they start their job in the TOC.

The benefits these training programs provide to the public include that certain problems can be fixed any time of the day by advanced level operators, and congestion can be reduced by identification of poor design. The benefits to a TOC are that problems can be identified by observation of unusual congestion and TOCs will have more qualified employees in their workforce. Finally, advanced training can benefit operators by increasing the competency and responsibility at TOCs.

The advanced training program is a specific program that will help direct TOCs in the advancement of their traffic operators. The training program deviates from the traditional methods of placing more responsibilities gradually on good operators. Instead, it focuses on a structured training method that prepares operators to identify and solve advanced problems and to share the results with other TOC employees. The advanced training program is recommended to TOCs who have 24 hour, seven day a week, transportation monitoring operators.

The recommended delivery method for the advanced training program is an interactive training program from a web-based program or CD. The benefit of having a completely electronic training program is that the operator can receive training at any time. Having dedicated instructor-led training can cause the operator to miss critical time in the control room — time needed for traffic management. This training program can provide many benefits to help TOCs meet the demand for service to the public and provide a reliable and efficient transportation network.

6. CONCLUSIONS

The basic training module described in this paper is designed to teach the necessary knowledge, skills, and ability to new operators in a concise two-week program. Using the critical or mission-essential task list to guide the training of new operators achieves this. Using a military-styled pedagogy helps new operators identify which skills are most important and how to gain the knowledge and ability to perform them. Finally, a network centered training approach is found to be the best method to teach new employees the importance of incident management. By focusing on the geography of the area, the operators gain the understanding of their role in traffic management.

The advanced training program is designed to train traffic operators at TOCs to identify and solve advanced transportation management and operation problems. The program creates quality training by providing TOCs with tools to help identify which operators are ready to take on more responsibilities and how to prepare them for these responsibilities. The specific curriculum aids the training program by giving direct information and training courses that are not too general and can be applied immediately. The last element of the program suggests a way to measure the performance of operators under advanced training.

The basic and advanced training are both designed to be delivered through TLN. This new e-learning tool will enable operators to have trainings adjusted to their schedule. New UTL equipment will separate operators training from using the UDOT TOC space even more, providing real-time traffic monitoring practices. Finally, operators will be trained on realistic traffic incident scenarios to establish a higher level of traffic incident management in UDOT TOC. Prepared training methods and materials are structured, well organized, and presented in the manner that focuses on developing necessary knowledge, skills, and abilities for both new and advanced TOC operators.

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