

Technical Training Status for the Departments of Transportation in Montana, North Dakota, South Dakota, and Wyoming

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INTRODUCTION

The transportation industry is going through an extensive change in the way it conducts business and the way it needs to address the management of its workforce. Today's workforce is faced with having to adapt to a more rapidly changing environment than ever before.

According to a number of studies, knowledge doubles every four to seven years. Society will continue to experience the exponential part of the total knowledge curve well into the future. This trend also applies to DOT workforces and their ability to keep pace with knowledge demands of their work activities. Previously, employees could rely on physical exertion to progress. Now, in a knowledge-based economy, individuals create value by applying knowledge and information.

Budgets and programs for DOTs have been increasing, yet employee numbers have been level or decreasing. More work is being contracted out and programs are becoming more complex because of an increasing number of new rules and regulations. In this environment DOT employees must have skills in contract, project, and program administration and management. Technology advances in transportation are also generating more of a demand for on-going employee training and employee versatility. The public's "demand to know" is also requiring technical employees in an organization to become more adept at communication skills, thereby necessitating a better balance of technical and support skills. Workers with new diverse skills will be a requirement for effective program delivery.

Future workforce demographics also are portraying a challenging situation. According to the Federal Highway Administration, national statistics illustrate a potential for 50 percent of the transportation workforce to be eligible for retirement by 2010. They also indicate more than one-third of the senior managers at state DOTs are eligible to retire immediately, with another 10 percent eligible in just three years. The statistics for the four DOTs involved with this study illustrate similar trends.

Another challenge facing DOTs, is their ability to adjust to the changing work environment demands of the new generation of workers. Each generation of workers, whether it be the "Veterans" born in the decades of the nineteen twenties, thirties, and early forties; the "Boomers" of the forties and fifties; the "Gen-Xers" of the sixties and seventies; or the "Millennials" of the eighties and nineties; each has a different philosophy and approach to work habits and technology.

DOT leadership, managers, and human resources staff need to recognize and adjust to all these elements of institutional change that are occurring around us at an ever increasing pace if they are going to maintain an effective and efficient workforce into the future. There seems to be a couple of solutions to this problem. One is to create a more optimally sized workforce within the DOT by hiring more, higher-level trained employees. This would require the approval of both the executive and legislative branches of state government. Additionally, it would likely require an upward salary adjustment of some significance to be competitive in the marketplace. The other alternative is an increase in productivity of the limited workforce available to the DOT. It seems the latter solution is more pragmatic of the two.

Increasing productivity can be achieved through a number of ways. Two stand out: (1) improved motivation of the workforce; and, (2) improved and increased skill sets and information base through training and education. They should both be considered; however, training and education are the more easily implemented and can be immediately applied. This report is intended to address the aspects of training and education.

BACKGROUND

Discussions between management from four DOTs - Montana, North Dakota, South Dakota, and Wyoming - led to the realization that they were all facing the same issues and that something needed to be done to improve their position to deal with the changing work force environment around them. The four DOTs agreed the demand for training was increasing, the competition for a dwindling workforce was becoming greater, the workforce itself was changing, the needs for training were changing, and the costs for existing training were increasing. Consequently they agreed to cooperatively pursue an initiative to determine if a program could be developed to provide quality technical training in a more efficient and cost effective manner.

The Upper Great Plains Transportation Institute at North Dakota State University was asked to conduct a site review at each DOT. The purpose of the site reviews was to:

- Obtain information to identify training challenges facing the DOTs,
- Identify common training needs,
- Identify training resources available that could be used (as is or modifiable) to meet common needs,
- Assess issues associated with training delivery, and
- Obtain good practice examples used by the respective DOTs that could be shared.

This document serves as the Phase 1 report outlining the findings from the site visits. It was requested by the Executive Advisory Group for the Transportation Learning Network (TLN). This group is composed of senior management staff from each of the DOTs participating in TLN, the Director of the Mountain Plains Consortium, and the Director of Upper Great Plains Transportation Institute. The report also was to include Phase 2 recommendations for proceeding with a program to jointly provide new training development and delivery for DOT employees that would be high quality, affordable, efficient, and effective.

Funding for the site visits and preparation of the findings was done through the pooled funds efforts of the participating DOTs. Cost of this initiative was \$22,500.

SITE VISITS

Although it was anticipated the site visits would be completed by the middle of April, scheduling conflicts prohibited this from occurring. Actual site visits to the four DOTs occurred as follows:

Pierre, South Dakota – February 16-17, 2006
Cheyenne, Wyoming - March 13-14, 2006
Bismarck, North Dakota – April 24, 2006
Helena, Montana – June 5-7, 2006

A listing of attendees for each site visit is included in Appendix A. Attendance ranged from nine to 21 people.

Site Visit Findings: Commonalities

Part of the purpose of this effort was to identify the commonalities that all the participating states share. By focusing our efforts towards areas that all states share in common we can reduce costs and increase impact of those efforts. The following is a list of some of the issues that each state had in common.

- No DOT has a highly formalized method for determining or prioritizing technical training. Montana is the farthest along in developing a more structured process.
- Actual budget costs for training in each DOT are difficult to determine. Dollars budgeted to the human resource area is the closest that can be obtained from most. Often training dollars also are allocated to other areas of the organizations, however. The identity for certain costs such as travel and expenses for the training seem to get lost. Wyoming appeared to be closest to knowing a cost (\$4.5 million per year), although not all costs seemed to be noted either. There did not appear to be a consistent definition of what constitutes training.
- Soft-side training sponsored by the human resources people generally was better planned and scheduled than technical training.
- Technical training usually was prioritized as “need of the moment.”
- There is a communication/interpretation gap between the engineering and human resources sides of the organizations (they don’t always talk the same language).
- Training mandated by legislation (such as bituminous certification, bridge inspection, etc.) is better developed and scheduled than other technical training.
- What is needed for training for field people versus central office staff can be different for a particular subject (e.g. – surveying).
- General agreement that DOTs needed training on new delivery techniques before trying to implement them. Good training, not delivered properly, can be bad training.
- All the states require similar continuous training for registered professional engineers and land surveyors.
- Considerable training occurs for DOT employees; but is it the best and most appropriate for the needs? It does not appear that any process exists for screening training for appropriateness or cost effectiveness.
- All entities have difficulty hiring and retaining technicians and engineers.
- All entities rely heavily on FHWA, AASHTO, and NHI for training.
- All entities take advantage of applicable training developed or offered by other in-state agencies and vendors.

Site Visit Findings: Unique Activities

- SDDOT requires LTAP training to be developed for DOT-level employees and courses are tailored down for local training. LTAP training in the other DOTs is developed primarily for the local levels.
- SDDOT's training is handled by a central training group outside of the DOT (Bureau of Personnel).
- WYDOT has WYDOT University which concentrates on DOT skills training and emphasizes leadership and management. A copy of its training program is included in Appendix B.
- WYDOT has training management software to track training by employee and to advertise training (ESS, PO Box 29661-2032, Phoenix, Arizona 85038-9661).
- WYDOT uses maintenance employees on construction. NDDOT is starting.
- NDDOT has developed cash incentive program for employees obtaining certifications or licensing in their respective fields.
- MDT, NDDOT, and WYDOT have established equipment operator's academies (week-long course).
- NDDOT has contracted for training by videoconference for professional development hours for PEs. Also available to partnering states.
- NDDOT has established an internal training team to discuss and coordinate department training. Representatives are included from both the engineering and support services areas. This group is headed by a "technical" training coordinator.
- NDDOT has established a formal employee mentoring program. Participation in the program has more than doubled since its inception.
- NDDOT is dealing with department training through the agency's strategic planning process. One of the department's goals is to enhance employee effectiveness and well being with an objective of developing and implementing a department training management program tailored to enhance employee development and meet department educational needs.
- NDDOT utilizes ND National Guard leadership training sessions.
- MDT cannot use maintenance employees on construction because they are unionized.
- MDT is making a concerted effort to formalize its training identification and prioritization process.
- MDT has established a management development program for employees wishing to advance into management positions. A copy of the program is included in Appendix C.

- MDT has established a highways and engineering conference annually for its Engineering Division staffs and Planning and Administration Division representatives. Simultaneous sessions occur daily. A copy of the 2006 program is included in Appendix D.

Site Visit Findings: Identified Challenges

- Providing equal opportunities for training and development to all employees.
 - State areas are not all covered with appropriate equipment to disperse training.
 - Communicating training availability properly to all employees.
- Providing appropriate training.
 - Capability to review content for appropriateness of training.
 - Improving communications of actual needs.
- Timing of training not to conflict with heavy work periods.
- Keeping up with new technology.
- Updating training information and programs.
- Maintaining appropriate communication and coordination within a department on training.
- Dealing with diverse professional areas with specific or specialized training needs.
- Determining the proper balance between “soft” training and technical training.
- Budget limitations and justifying training budgets.
- Travel limitations.
- How to be assured training is applied (effectiveness of training).
- Can training be used as a recruiting and retention tool?
- How to align training requirements with job titles.

TRAINING DEVELOPMENT COSTS

Costs to develop specialized training can vary from being relatively inexpensive to extremely costly. There are pros and cons to each type.

The least costly and most readily available is generally vendor training. This type of training material has usually been developed at vendor expense and the vendors are very willing to promote their product or service with free or relatively inexpensive presentations. It is important for an agency or training recipients to be able to distinguish product or vendor bias when receiving this type training. New products and ideas are generally introduced to customers in this manner. This process should not be discouraged, but rather encouraged to some reasonable level, to keep employees up to speed on changes. Examples of some of the more popular, non-company specific sources are organizations that support a product but not necessarily a company, such as an asphalt association or a concrete association. Their training is typically technically generic yet very informative and useful.

A form of training that has been around for a long time is a mentoring program. Informal mentor programs (a.k.a on-the-job training) have been the mainstay of DOT employee development for years. However, most DOTs are losing their mentor base through a disproportionate loss of middle managers and their considerable institutional knowledge. Informal mentoring should always be supported and encouraged. Formal mentoring programs are becoming more prevalent in some agencies. Ideally, formal mentoring programs should match mentees with mentors in positions they can aspire to or have activities related to their career development. Time commitments for a successful mentor/mentee program can be considerable because of the one-on-one relationship; therefore involvement should not be taken lightly. Informal mentoring is also less costly than formal mentoring, however a side benefit of formal mentoring is the public relations aspect from a recruiting and retention perspective.

The next level of training from a development cost and availability perspective is that produced by LTAP/TTAP groups. Traditionally this has been geared more to local governments and is not as technically in-depth as other DOT-received training. This does not mean this type training could not be tapped with the idea that modifications can be made to the training to better incorporate the technical needs of the DOTs. There may be additional costs involved with doing this. However, the costs may not be extensive if the changes are incorporated early in course development, the modifications needed are slight, or the costs possibly shared with multiple agencies.

Agency-developed training (in-house) is another level of development. This type of training is usually more agency specific. There is a cost involved that varies by the training subject. The cost and success of this type training is dependent on the expertise required to coordinate content and delivery. Consideration needs to be given whether this is a one-shot training course or something that will be ongoing therefore requiring updating.

The use of university faculty to develop new training and delivery is another option to consider. This is a university's role - to educate. The difference however, is the development of courses are generally geared to students receiving a degree. This concept has been changing recently with the technology developed for online, at-your-convenience, at-your-location, delivery of training. The potential exists for the training to not always fit the specific need. Another possibility, however, is for universities in a region to pool their expertise and contract for development of specialized training. This option already exists for the four DOTs involved with this training initiative through the Transportation Learning Network (TLN). Universities involved with the Mountain Plains Consortium (CSU, NDSU, SDSU, UU, and UW) presently are involved with this arrangement. Another university, Montana State, could also very easily be included. It should be noted that several of these universities are also the LTAP contractors. Closer management and coordination of training development and delivery under this scenario needs to occur. Costs are dependent on course subject and expertise readily available from staff resources. An obvious benefit to utilizing this arrangement is the mechanism is pretty much in place, and an economy of scale exists with four DOTs sharing costs.

Considerable effort is occurring through pooling of resources for course development among states and national organizations such as NHI, APWA, ARTBA, AASHTO, WASHTO, FHWA, and others. They recognize the need to adjust to the changed environment for training development and delivery. The Transportation Curriculum Coordination Council (TCCC), another multi-state pooled fund project, has taken on this challenge on a national scale. They are developing core curricula in five program areas: construction, materials, maintenance, safety, and employee development. Material developed through TCCC efforts is available to DOTs. Modifications may be required to accommodate individual state needs along with provisions for a state to provide their own instructors. There may be a definite benefit for the four state DOTs to consider developing a shared process to coordinate monitoring of activities provided by this group and if appropriate, coordinating course selection, modification, and delivery of training.

By far the most costly method of training development and delivery is a DOT-specific technical training package from an outside source. Development costs themselves can be quite costly and if instructor-led delivery is required, the per-student payout can become considerable. NHI course development was reaching the \$200,000 to \$300,000 range plus delivery costs. Recognizing the high-cost reality, NHI is presently investigating alternative methods of training delivery. Web-based training or web conferencing are two methods being investigated.

TRAINING DEVELOPED IN-HOUSE

Each DOT had already done some in-house development of training. All DOTs appeared to have training packages for traditional training subjects such as EEO, etc.. No state had an exhaustive list of all the training materials they had developed at all levels for all topics. The following list is surely not a complete one.

SDDOT Developed

- Certification of technicians – framemaker; pdf format – manuals – Referenced to SDDOT Specifications
 - Earthwork – pipe installation and erosion control
 - Concrete paving and concrete plants
 - Soils testing
 - Aggregate testing
 - Building structures – inspection and testing
- CADD training – disc; on-line course
- Flagger instructor training – on-line course
- Safety training – 60 separate topics; manuals and videos
- Maintenance management course – 1 week for supervisors
 - On SDDOT policies, procedures, etc.
- Maintenance equipment training – self study in Word
 - Generic on brands
 - Familiarize operators on basic information to operate and maintain various type equipment

WYDOT Developed

- Leadership and Management – by tiers/levels
 - Prepared and delivered through their DOT University
- QC/QA certification – tailored to WYDOT
- WYDOT policy-mandated training – tailored to WYDOT and delivered through their WYDOT University

- Work place discrimination
- Work place violence
- Ethics
- Performance appraisals
- Telephone skills and voice mail
- E-mail training
- Safety
 - Defensive driving
 - Blood-born pathogens
- Maintenance Equipment Training Academy
 - META is a week long maintenance equipment training

NDDOT Developed

- Plan reading course
 - Self study or classroom format
 - Being updated
 - Based on NDDOT design format
- Basic math course
 - Self study or instructor lead format
 - Being updated
- Maintenance Equipment Operator Academy
 - Some phases on DVD
 - Week long course
- Snow and ice control
 - CD-ROM
- Local government
 - Emergency relief training with manual
- Materials and research – all classroom-delivery training courses
 - Soils – covers soils tests in field
 - Classroom and hands-on with exam – 1 day
 - Certification
 - Introduction to asphalt – covers asphalt materials and aggregates
 - Pre-requisite for certification – 1 day with exam
 - Asphalt inspection – covers paver and roller types, operations, specification requirements, and agency and industry roles and responsibilities

- Classroom with exam – 1 day
 - Aggregate testing – covers all tests and procedures for aggregate certifications
 - Classroom and labs with exam – 1 day
 - Asphalt mix testing – covers QC/QA testing
 - Classroom and demonstrations with exam – 2 days
 - Asphalt controller – covers Superpave and Marshall mix design requirements
 - Geared to NDDOT QC/QA specifications
 - Classroom with exam – 3 days
 - Re-certification refresher classes (1/2 day each) in asphalt pavement inspection, asphalt controller, aggregates, and asphalt mix tester
- Construction
 - Construction Automated Records System (CARS)
 - Instructor led training and manuals
 - NDDOT procedures specific
- Bridge inspection training
 - Instructor led training
- Technician training - instructor led training, week long course
 - Construction inspection
 - Plan reading
 - Basic materials testing
 - Safety awareness
 - Basic math
 - Basic surveying
 - Work zone traffic control
- New supervisor training
 - Peer to supervisor
 - Content geared to NDDOT forms, processes, and policies

MDT Developed

- Maintenance Training Academy
 - Equipment operator training
- Management training
- Basic math self study workbook and math training sessions delivered by local college of technology
- A closed caption video on “Understanding Highway Right-of-way and Construction Plans

- Laboratory soils testing course being developed by MSU
- Annual Highways and Engineering Conference
 - Agenda changes every year
 - 3 days – 1 day general, 2 days of simultaneous technical modules

ALTERNATIVES TO CLASSROOM TRAINING

Classroom training is a time-tested method of training and information delivery. It is also one of the most expensive in terms of time, salary, travel, and opportunity cost. New alternatives are being developed. The following is a quick run-down of some of these new technologies and what they can mean to the DOTs.

Distributed Learning¹

Distributed learning is any educational or training experience that uses a variety of means, including technology, to enable learning. It can provide for intentional and incidental learning outcomes and may be separated by time, distance, or both. Distributed learning includes, but is not limited to, distance learning and online learning. Often, regardless of the location of the learning environment, distributed learning eliminates time as a barrier to learning (Oblinerg, Barone, & Hawkins 2001). In *distance learning* the learner is typically separated in space and time from the instructor and peers. In *online learning* the learner is limited to Internet-based learning technologies. Another commonly mentioned subset of distributed learning is *e-learning*, which Clark and Mayer (2003) refer to as “a combination of content and instructional methods delivered by media elements such as words and graphics on a computer” (p. 311). With the changes in the Internet and in computing technology, the lines between these areas are rapidly becoming blurred, and may cease to exist in the near future.

Distributed learning may occur among people scattered across the globe or among coworkers at a single facility. What characterizes distributed learning is the use of a very flexible functional architecture that takes a variety of manifestations. These could include any combination of on-campus lectures, computer-based training modules, online seminars, reference websites, books, DVDs, threaded discussions, videoconferences, weblogs, simulations, performance support systems, and numerous other elements by which learning is accomplished. Another attribute of distributed learning is that it may be *synchronous* (takes place in real time), *asynchronous* (does *not* take place in real time), or a mixture of both.

Distributed Learning in ... Corporate Settings²

Corporate online learning environments often include an intranet (a network similar to the public Internet but secure from outside access) for employees of a corporation. A great deal of training is taking place over corporate intranets. Corporate training budgets are investing billions of dollars in Web-based training alone, and investments are expected to increase for the foreseeable future (Abernathy, 2001). The rationale is that it costs the company money not only to transport and house employees for out-of-town training but also to replace that employee during the training. Moreover, employees are able to get training when and where they need it instead of waiting for the next scheduled training session. Employees can log on to a company intranet and take the classes they need when they need them. Such

¹ Trends and Issues in Instructional Design and Technology, 2nd Edition. Robert A. Reiser and John V. Dempsey (2006), p. 290.

² Ibid. p. 290-291.

training is managed by learning management systems (LMSs), which track who has taken what course, at what time, and which individual objectives have or have not been met. LMSs thus allow institutions to track what their employees know or can do. This saves money and simplifies compliance issues.

The Online Environment as a Learning Community³

Although often viewed as an isolating experience, the paradox in online learning is that learners sitting alone in front of a computer monitor may actually be satisfying their human need for community (di Petta 1999). ... Online or virtual communities may also be effective vehicles to improve learning overall. According to the American Society of Trainers and Developers (ASTD), 70% of what an employee needs to know to do their job is learned outside formal training, and virtual communities of practice (VCOPs) are a good way to acquire tacit knowledge (Kaplan 2002).

If constructivism has one true champion in circumstance, it is the shared construction of learning assignments – an inherently social activity. Many online course developers are coming to see the information they incorporate as less of a product (permanent in the sense of a textbook) and more of a process of a learning group in action among an increasing array of learning options and shared experiences. Research on the benefits of learners as designers, peer tutoring, and collaborative design may be one of the unanticipated strengths of developing online instruction and training (Dede 1995). Participation and creativity not available in conventional classes are becoming commonplace in well-designed online environments (Abrami & Bures 1996).

New Delivery Methods: Some Definitions⁴

Online or Web-Based Training (WBT)

Web-based training (WBT) is a type of training that is similar to computer-based training (CBT); however, it is delivered over the Internet using a web browser. Web-based training frequently includes interactive methods, such as bulletin boards, chat rooms, instant messaging, videoconferencing, and discussion threads. WBT is usually a self-paced learning medium, however some systems allow for online testing and evaluation at specific times.

DOT Applications

This technology could be used to allow employees to do self-paced training on computers that are connected to the internet. A broadband connection and a multimedia computer would be required to best utilize this medium.

Distance Learning

Distance education, or distance learning, is a field of education that focuses on the pedagogy/andragogy, technology, and instructional systems design that is effectively incorporated in delivering education to students who are not physically "on site" to receive their education. Instead, teachers and students may communicate asynchronously (at times of their own choosing) by exchanging printed or electronic media,

³ Trends and Issues in Instructional Design and Technology, 2nd Edition. Robert A. Reiser and John V. Dempsey (2006), p. 294.

⁴ From www.wikipedia.org on July 26, 2006.

or through technology that allows them to communicate in real time (synchronously). Distance education courses that require a physical on-site presence for any reason including the taking of examinations is considered to be a hybrid or blended course or program. E-Learning: a combination of content and instructional methods delivered by media elements such as words and graphics on a computer.

DOT Applications

Distance learning allows employees located at far-flung locations to participate in training. A variety of media can be used including paper-based, computer-based, web-based, videoconference, podcasting, and others that allow learners and instructors to be physically separated. Training may take place at a specific time with other learners or the instructor also participating, or it may take place at the learner's convenience.

Computer-Based Training (CBT)

Computer-based training (CBT), also called **computer-assisted instruction (CAI)** is a type of education in which the student learns by executing special training programs on a computer. CBT is especially effective for training people to use computer applications because the CBT program can be integrated with the applications so that students can practice using the application as they learn.

Historically, CBTs growth has been hampered by the enormous resources required: human resources to create a CBT program; and hardware resources needed to run it. However, the increase in PC computing power, and especially the growing prevalence of computers equipped with CD-ROMs, is making CBT a more viable option for corporations and individuals alike. Many PC applications now come with some modest form of CBT, often called a tutorial.

This technology could be used to allow employees to do self-paced training on computers connected to the Internet. A broadband connection and a multimedia computer would be required to best utilize this medium.

DOT Applications

Computer-based training requires multimedia computers, but not necessarily a connection to the Internet. Individuals can do this at their convenience and without an instructor. They can be costly to develop, but once developed can serve many individuals and recover the development cost. Updating as material becomes dated needs to be considered in choosing this medium.

Breeze

Adobe (formerly Macromedia) Breeze is software used with Microsoft PowerPoint to create powerful sales and marketing, information and general presentations, online training, web conferencing, learning modules and more. With the power of Macromedia Flash, music, sound, interaction capability and more is available. Breeze allows for online PowerPoint presentations that can be either synchronous (Breeze Meeting) or asynchronous (Breeze Presenter).

DOT Applications

Breeze is currently a growing phenomenon in distributed learning. The National Highway Institute, along with other organizations, has chosen this technology for their distributed learning medium. Breeze allows for narrated PowerPoint® presentations, including testing, to be accessed from a Breeze server. A multimedia computer and broadband Internet connection would be required. The cost of producing these presentations (other than development time) is minimal, however the cost of hosting them on a server can be significant.

Electronic Books

An **e-book** (also: **eBook**, **ebook**) is an electronic (or digital) version of a book. The term is used ambiguously both to refer to either an individual work in a digital format, or a hardware device used to read books in digital format. Some users deprecate the second meaning in favor of the more precise “e-book device.” However the term interplay works out colloquially in the long run, e-books are an emerging and rapidly changing technology, and since at least 2004 have included newer experimental online magazines, pioneered in part by Baen’s Books in their release of the first *Grantville Gazette*.

The term e-text is often used synonymously with the term *e-book*, and is also used for the more limited case of data in ASCII text format excluding books in proprietary file formats. An exception to this rule is the academic e-text, which commonly includes components such as facsimile images, apparatus criticus, and scholarly commentary on the work from one or more editors specially qualified to edit the author or work in question.

An e-book is commonly bundled by a publisher for distribution (as an e-book, an ezine, or an Internet newspaper), whereas e-text is distributed in plain text, or in the case of academic works, in the form of discrete media such as compact discs. Metadata relating to the text are sometimes included with etext (though it appears more frequently with e-book). Metadata commonly include details about author, title, publisher, and copyright date; less common are details regarding language, genre, relevant copyright conventions, etc.

DOT Applications

Electronic books can be very useful for DOT personnel, mostly as reference material. Rather than purchasing, storing, and transporting large reference manuals, electronic versions allow individual access to the same information and allows for quicker searches as well. They can also be easily updated and distributed.

Threaded Discussions

In a threaded discussion, a group of individuals is connected via an electronic network, such as an e-mail list, listserv, or a bulletin board service. Examples of bulletin board services include Yahoo! Groups and MSN Groups. Nicenet is specifically designed for threaded discussion with the instructor in mind. This allows members of the group to communicate about common interests asynchronously, in their own time and at their own pace. An individual may post a message in the evening and another may respond the next day. Threaded discussion is a common tool in e-learning environments. Advocates of threaded discussion suggest that learners may stop and think about what their messages will be, taking into account the other messages in the discussion forum, before posting their thoughts. Such asynchronous communication permits deeper consideration of the ideas under discussion.

DOT Applications

Threaded discussions would be a great resource for new hires and other professionals who would like to ask questions or discuss issues with their peers. It allows for everyone to gain from the answers provided.

Videoconferences

A **videoconference** (also known as a *videoteleconference*) is a set of interactive telecommunication technologies which allow two or more locations to interact via two-way video and audio transmissions simultaneously.

DOT Applications

Videoconferences allow for instructors and students to be in separate locations, but in many other respects it is like classroom instruction. Oftentimes, videoconferences are supported by other media.

Weblogs (Blogs)

A **weblog**, which is usually shortened to **blog**, is a type of website where entries are made (such as in a journal or diary), displayed in a reverse chronological order. Blogs often provide commentary or news on a particular subject, such as food, politics, or local news; some function as more personal online diaries. A typical blog combines text, images, and links to other blogs, web pages, and other media related to its topic. Most blogs are primarily textual although many focus on photographs, videos or audio. The word *blog* can also be used as a verb, meaning adding an entry to a blog.

DOT Applications

Blogs could be used to document an individual's experience in their job (like a journal) or could be used to provide daily guidance to a group of individuals. Blogs require readers to actively seek the information and access the website. An internet connection would be required for this medium.

Simulations

A **simulation** is an imitation of some real thing, state of affairs, or process. The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system.

A computer simulation is an attempt to model a real-life situation on a computer so that it can be studied to see how the system works. By changing variables, predictions may be made about the behavior of the system.

Simulation is used in many contexts, including the modeling of natural systems or human systems in order to gain insight into their functioning. Other contexts include simulation of technology for performance optimization, safety engineering, testing, training and education. Simulation can be used to show the eventual real effects of alternative conditions and courses of action.

Key issues in simulation include acquisition of valid source information about the referent, selection of key characteristics and behaviors, the use of simplifying approximations and assumptions within the simulation, and fidelity and validity of the simulation outcomes.

DOT Applications

Simulations can be used for a number of DOT applications. Simulations do not have to be computer-based and many have been used in the DOT for years. Computer-based simulations also could have many applications for DOT situations, but they can be costly to develop and need to be updated as situations or equipment change. This is an area that will change significantly in the future as virtual reality technologies are developed. Simulations can be done on a multimedia computer or may require a unique piece of equipment.

Podcasts

Podcasting is the method of distributing multimedia files, such as audio programs or music videos, over the Internet using either the RSS or Atom syndication formats, for playback on mobile devices and personal computers. The term **podcast**, like ‘radio,’ can mean both the content and the method of delivery. The host or author of a podcast is often called a **podcaster**. Podcasters’ web sites may also offer direct download or streaming of their files; a podcast however is distinguished by its ability to be downloaded automatically using software capable of reading RSS or Atom feeds.

Usually a podcast features one type of ‘show,’ with new episodes released either sporadically or at planned intervals such as daily or weekly. In addition, there are podcast networks that feature multiple shows on the same feed.

DOT Applications

Podcasts could be used for many things by DOTs. Executive announcements, policy changes, employee reminders, and general announcements are only a few examples. It could also be used for audio and video training. A library of mobile devices could be controlled by the DOT with a specific computer serving as the host. Training podcasts could either stand alone or could supplement other types of training. They could also serve as audio or video reference manuals. Users subscribe to a podcast and new episodes are delivered automatically. Producing podcasts can be inexpensive and using podcasts only requires a piece of (free) software, such as iTunes. A mobile device is often used, but not required to access podcast material. A series produced for district safety meetings would be one application.

Learning Management Systems

A **Learning Management System** (or **LMS**) is a software package, usually on a large scale (that scale is decreasing rapidly), that enables the management and delivery of learning content and resources to students. Most LMS systems are web-based to facilitate “anytime, anywhere” access to learning content and administration.

At a minimum, the LMS usually allows for student registration, the delivery and tracking of e-learning courses and content, and testing, and may also allow for the management of instructor-led training classes. In the most comprehensive of LMSs, one may find tools such as competency management, skills-gap analysis, succession planning, certifications, virtual live classes, and resource allocation (venues, rooms, textbooks, instructors, etc.). Most systems allow for learner self-service, facilitating self-enrollment, and access to courses.

Some LMS vendors do not distinguish between LMS and LCMS, preferring to refer to both under the term “LMS,” but there is a difference. The LCMS, which stands for “Learning Content Management System,” facilitates organization of content from authoring tools, and presentation of this content to students via the LMS.

LMSs are based on a variety of development platforms, from Java EE based architectures to Microsoft.NET, and usually employ the use of a robust database back-end. While most systems are commercially developed, free and open-source models do exist. Other than the most simplistic, basic functionality, all LMSs cater to, and focus on different educational, administrative, and deployment requirements.

Open source LMS is growing fast in the education and business world.

DOT Applications

Learning Management Systems allow DOTs to track, offer, and manage organizational training opportunities as well as record employees’ career development and training experiences in a large centralized database. Some even offer web-based training development modules. PeopleSoft has a LMS module and there are other stand-alone alternatives. LMS allows for a “transcript” for individual employees as well as analysis of courses for managers, developers, and instructors.

EVOLUTION OF THE TRANSPORTATION LEARNING NETWORK (TLN)

The Transportation Learning Network (TLN), formerly Tel8, has been engaged in videoconferencing for nearly 15 years. It has undergone some significant changes over those years, some of which have come in the past year or so. The following describes the organization in more detail.

TLN Make-up and Intent

The Transportation Learning Network is a partnership of state departments of transportation and Mountain-Plains Consortium (MPC) universities. Its current members are:

- Montana Department of Transportation
- North Dakota Department of Transportation
- South Dakota Department of Transportation
- Wyoming Department of Transportation
- Colorado State University
- North Dakota State University

- University of Utah
- University of Wyoming
- South Dakota State University

TLN was developed to serve the transportation interests of the region through enhancement of knowledge transfer and communications. The system began as a pooled fund research project to investigate the feasibility of satellite communication technology for sharing and distributing information among several entities. Although this was the state of the art at the time, the system was not without its drawbacks. Transmission did not allow synchronization of audio and video, manual changing of site transmission was required, limited hookups were available because of satellite dish costs, and it was cumbersome to operate. It was functional however, and did provide a valuable communication link. Coordination of training began under this initial system.

As technology evolved a conversion was made to a videoconferencing system using phone line technology with bridge service. This was a large improvement in operational clarity and simplicity. It also allowed for voice-actuated video. Strides were made in providing more training opportunities with this new system. But, unlike the original satellite system, the more the system was used the more it cost. Limited hookups due to bridge capacity were also an issue.

The latest evolution is conversion to an IP network with ability to connect to legacy ISDN sites. Each videoconference site consists of in-room video and audio equipment that receives and transmits live pictures and sound. Each site is capable of participating in individual point-to-point or system-wide videoconferencing. TLN operates a videoconferencing bridge providing connections to multi-site conferences. A huge advantage with the latest TLN system is that the cost is basically set for whatever use is made of the system; it is a fixed cost. The previous systems were a “pay for use” process, where the more they were used, the more they cost.

Presently the TLN network has regular access to approximately forty-five (45) sites in the five MPC universities and four state DOTs. A listing of readily accessible sites and a map of their locations is included in Appendix E. TLN can connect however, to any location that has an IP or ISDN connection.

TLN’s relationship with the MPC is a partnering arrangement. MPC is a separate organization serving as a regional/national resource and focal point for the support of research and training concerning the transportation infrastructure and the movement of passengers and freight. The agreement MPC has with TLN allows students interested in TLN graduate courses to enroll in their local university, pay local tuition, and graduate from that institution while taking courses from professors from each of the MPC universities. Faculty at MPC universities also serve as a resource for TLN training initiatives.

TLN Organization and Management

TLN operates under bylaws that its members have agreed to. Each member organization is represented by one individual on the TLN board of directors. Three officers are elected every two years to lead TLN: president, vice-president, and secretary/treasurer. The president is a DOT representative. The board is established in such a manner that the state DOTs have principal charge and responsibility for the establishment and management of the Transportation Learning Network.

TLN is currently staffed with a full-time executive director, a part-time network technician, and a part-time web specialist. The staff, as well as the network control center, is located at North Dakota State University.

The proposed budget for TLN for FY 2007 is approximately \$590,000. This amount is divided disproportionately among the five MPC and four DOT members dependent primarily on the differing equipment and training consumption (DOTs pay more than MPC universities). A copy of the budget is shown in Appendix F. The budget continues to be handled as a pooled fund study with the NDDOT the administering agency.

TLN Challenges and Changes

Just as DOTs face the challenge of miscommunication of training needs between technical and soft side training, TLN has experienced the same challenge. To date the predominant type training offered over the network has been of the non-technical nature. This is due in part to representation on the programming committee by predominantly non-technical staff. The individuals on the board are generally people well versed in training expertise, however they have not always been given the proper tools to interpret the technical training needs of the agencies. To partially remedy this issue, TLN is proposing the addition of a part-time position to be technical training advisor for the executive director and the programming committee. The new position would be responsible for communicating DOT technical training needs to the executive director and programming committee along with recommending potential training course availability to fulfill DOT needs for delivery from TLN. As a start to improve the level of technical training from TLN, concrete and asphalt associations have been contacted and several sessions have been scheduled for delivery in the near future. These also are eligible for PDH credits.

Up to this point, training packages have been delivered over live, interactive video with instructor-led training. Timing of the training has not always coincided with the availability of the all interested trainees. The DOTs have indicated the most preferable type training would be training that could be obtained on-demand and at their convenience. To partially address that situation, TLN is in the process of installing a Content Server on the TLN videoconference network. This will allow member agencies to access on-demand video presentations, distance education classes, and training sessions that have been given over videoconference and archived on the system.

A tremendous number of technical training packages have been developed, are being developed, or are being discussed for development. Predominant development of technical training packages usually occurs through vendors, trade associations, consultants, special groups such as TCCC, APWA, FHWA, NHI, LTAP/TTAP, and ARTBA, educational institutes, and agencies themselves. Because the demand for technical training is usually impulsive, the risk of redeveloping and duplicating existing training or selecting training that may sound appropriate yet may not be what was anticipated, can be very high. Duplication of similar training is a waste of limited development monies and most DOTs do not have the luxury of having staff to screen available training effectively. A system or process should be established and coordinated to log and screen course content and availability. This could be accomplished through a shared activity by several DOTs, with each being responsible for monitoring a particular technical subject, such as planning training, design training, materials training, etc. or it could be accomplished by sharing costs to have similar services provided by an outside entity. Upper Great Plains Transportation Institute has recently been awarded a contract through ARTBA to establish a records system for tracking LTAP/TTAP training activities. The feasibility of a similar undertaking could be investigated for tracking other technical training content and availability.

A concern of the DOTs has been the ability to offer effective training to all areas of their agency. To do this utilizing the TLN videoconference network, even with the new system requires a decision on the part of each individual department. Budgets for travel and equipment have, in some instances, been frozen which further inhibits training accessibility and availability for some employees. To access TLN videoconference services, as a minimum, remote sites need the following equipment: high speed internet access, monitor(s), and an IP-based codec.

The concern always exists about the ability to keep current with new technology. Tel8 began as a pooled fund research project to investigate the use of new communication technology and applications. TLN is still considered a pooled fund research project to investigate new communication technology and applications. The advantage for states such as the TLN states has been the ability to pool resources to accomplish something that independently would have been cost prohibitive. UGPTI is presently experimenting with web-based training and web conferencing through NHI's Sandbox Project using Breeze software. If this is successful, these technologies will be considered for an additional service that TLN could provide. UGPTI is also experimenting with podcasting, a new technology for communicating information. If successful, short training topics can be delivered remotely with nothing more than a computer with free iTunes software and an Internet connection or a TV with an iPod hook-up. This too could become part of TLN's tool chest for improving communication and training.

SUMMARY AND RECOMMENDATIONS

One of the outcomes of the study was to obtain a more definitive priority listing of technical training needs for each DOT. As previously noted, no DOT has any formalized method of identifying and prioritizing technical training needs. Identification of training needed and selection of the source has generally been fragmented within the agencies. All DOTs appeared to utilize a de-centralized approach to technical training prioritization and selection. This approach has the advantage of putting the selection of training content in the hands of the user. However, when looking at an agency's overall employee development needs, availability of training across division lines should always be considered to allow broadening of the knowledge base for future staffing versatility and contingencies for the department's benefits. Although coordination for getting the training is many times coordinated by human resources training personnel, communication from the technical side of the organization as to actual content needed, is often not effective. Consequently, to come up with an objective method of obtaining technical training needs and priorities for all DOTs could not occur through the site visit process.

Another product intended to be obtained through this effort was to determine the availability of respective DOT developed technical training packages. This was somewhat successful as noted in the previously listed products. Although much of the training appeared to be specific to the respective DOTs, there appears to be the potential of avoiding some duplication through development of generic packages for much of the content and allowing follow-up addendums to be attached to accommodate some of the agency-specific material. A more in-depth review of the available material needs to occur to actually establish the effort needed to accomplish this. At a minimum, if each DOT wants to investigate the use of another DOTs material to enhance their own packages, this should occur.

Although no DOT has an implemented, formalized method for identifying technical training needs and priorities, Montana is working on a simpler process. We suggest a presentation by MDOT over TLN be made to all the other DOTs on their activities in this area.

A more sophisticated effort to obtain training needs in an organization is the use of a gap analysis study. This should be tied to a human resources strategic plan to assure the agency is not just looking at the present but also to the future. In simple terms, an agency needs to identify their core skills required

(present and future), their existing employee skills, and identify the gap between them. This then becomes the basis for identifying their training direction. Although this option may ultimately create the most effective results, it can initially be costly and time consuming. Regardless, some level of analysis in this endeavor needs to occur for all the DOTs.

Considerable training seems to occur in all departments; however, no method of determining the effectiveness of the training within the DOTs visited seems to exist. Without knowing a departments training needs for the present and the future, there is no way of knowing if appropriate training is being identified and properly targeted. There is a tendency to provide training-for-training's sake with effectiveness measured by dollars spent or employees trained. When this occurs an agency runs the risk of spending training dollars ineffectively. Methods to better identify training content appropriateness and effectiveness within an agency should be established. The cost to develop a process to pre-evaluate training content and measure effectiveness of training may be offset by the savings from elimination of less effective training. Options for establishing appropriate levels of screening and evaluation for training should be tailored to fit with training needs identification methods mentioned in the previous and following paragraphs.

Three other more simple options exist for determining individual DOT training needs and priorities. One option is for each agency to establish a technical training coordinator who understands technical terminology enough to interpret the actual training content needs to the human resource people. This individual, along with the human resource person, should discuss details of training content with the respective technical area personnel to assure a proper understanding of training content needed. Another option would be for a technical outside resource to visit with each DOT technical area and help identify each agency's technical content needs. This could be time consuming for one entity to do all agencies, yet it may have benefits in trying to identify areas of common training potential. A third option would be for each agency to establish a task force made up of both technical and human resource representatives to periodically discuss technical training needs and to maintain a recommended technical training priority list for the department. Regardless whether one of these options is selected or not, the issue of internal communication between human resource staff and the technical staff was identified as a concern for all DOTs and should be addressed.

To assure equal opportunities for training and development to all employees, a review of accessibility to proper communication equipment should be made. If travel continues to be an issue, investment in additional equipment may be more cost effective. New technology to deliver training is rapidly changing and becoming more affordable. TLN should continue to investigate new methods of delivery such as podcasting and web delivery. In addition, train-the-trainer courses on new delivery methods can be given by staff at TLN.

Quality in course development and presentation should always be an emphasis. The subject matter of training, the attitude and abilities of the presenter, the preparation of the training, and the delivery of the training all contribute to the training success. Lack of proper attention to any of these steps, even though the other steps are good, can doom the course.

On-demand training capability is a desire for all DOTs. Varying workloads and staffing demands make it difficult to establish schedules that meet everyone's needs. The installation of Content Server equipment through TLN will do much to help this situation. This will allow the archiving of any videoconference presentation offered by TLN to be recalled for partial or complete use upon demand, with instructor's permission. On-line training courses should be encouraged when receiving training through educational institutions as this method of course delivery is not site specific and can be demand flexible. Other techniques for on-demand training delivery should be used when appropriate, such as self-paced

workbooks, use of CDs, computer tutorials, etc. Keeping these types of training materials current is an on-going concern.

Because so much is being done in course development and such a variety of courses already exist in varying formats, additional investigation should occur to develop a screening process and inventory on course availability and content. There are some potential benefits for the four DOTs to approach this undertaking in a cooperative manner. Two approaches could be dividing up functional areas amongst the DOTs to investigate and share the information or by pooling resources for the outsourcing of the investigation through TLN or some other outside source. UGPTI is presently involved with a similar process for LTAP materials nationwide. More involvement with other training initiatives such as those occurring through TCCC should also occur through individual DOT involvement or through participation by TLN/UGPTI.

TLN should aggressively seek increased vendor training on the network as an initial stage of increasing technical training availability. Additionally TLN should solicit the top four technical training priorities for each DOT (content specific as possible), present recommendations to the TLN Board of Directors or to the Executive Advisory Group for best candidates to deliver technical training on, develop or adapt established training material to be offered through TLN.

Although many people professed a desire to “not change” present face-to-face instructor-led training practices, this method of training delivery is rapidly being modified to accommodate the changing work force environment and cost increases associated with this form of training delivery. That is not to say the traditional instructor-led training format should not be used, it is merely a realization that other more cost effective methods of training delivery need to be investigated to keep pace with training demands at an affordable cost. Video conferencing and webcasting can also be described as face-to-face instructor-led training, but it utilizes a modified method of delivery. TLN should continue to investigate and educate the DOTs about technologies that may improve the availability and delivery of appropriate training.

TLN is a good base to continue utilizing and building upon in improving development and delivery of cost-effective technical training. The resources of the MPC universities and TLN staff are available to provide development and delivery support. Montana State University should be approached about joining TLN. The technical interests of the DOTs should be more interactive with TLN Board representatives and programming committee to assure their training interests are addressed properly and to assure proper direction for TLN staff. The DOTs can mold and control the direction and activities for TLN. It is their creation.

In times of budget shortages, training is usually a budget line item easily targeted for reduction. Training is an easy target for administrators because specific training needs are usually not identified or prioritized, therefore it does not have a champion to lobby for its retention. Because of the staffing and workload challenges facing DOTs today and the apparent worsening of the situation in the future, the attitude of balancing budgets by disproportionately cutting training should be looked at closely. This may be attractive as an easy budget fix but the long-term ramifications on a department staffs' ability to maintain productivity, effectively, could be greatly impacted.

Appendices available upon request