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DISTANCE TECHNOLOGY TRANSFER COURSE CONTENT DEVELOPMENT

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DISTANCE TECHNOLOGY TRANSFER COURSE CONTENT DEVELOPMENT

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16. Abstract The Illinois Department of Transportation (IDOT) offers multiple technology transfer courses for engineering, project design, and safety training for state and local agency personnel. These courses are often essential to the agency mission. Because of resource constraints, IDOT has been limited in its ability to deliver courses to statewide participants in a timely, standardized, and cost-effective manner. With telecommunications advances and electronic course delivery technologies, universities have developed and implemented multiple methods to effectively deliver highly technical content online to a diverse population of students. Distance course delivery allows individuals to complete courses from almost any geographic location, enabling cost efficiencies and flexible scheduling. The objective of this research was to investigate the efficacy of the development and implementation of online course content for several high-benefit IDOT technology transfer training courses and short courses. This research project assessed learning management system (LMS) options and investigated multiple online methods to deliver course content incorporating Department knowledge and expertise. In addition, this research produced a summary of findings with recommendations for future electronic technology transfer course development efforts at IDOT.					
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EXECUTIVE SUMMARY

The Illinois Department of Transportation (IDOT) offers multiple technology transfer courses for engineering, project design, and safety training for state and local agency personnel. These courses are often essential to the agency mission. Because of resource constraints, IDOT has been limited in its ability to deliver courses to statewide participants in a timely, standardized, and cost-effective manner. With telecommunications advances and electronic course delivery technologies, universities have developed and implemented multiple methods to effectively deliver highly technical content online to a diverse population of students. Distance course delivery allows individuals to complete courses from almost any geographic location, enabling cost efficiencies and flexible scheduling.

The objective of this research was to investigate the efficacy of the development and implementation of online course content for several high-benefit IDOT technology transfer training courses and short courses. This research project assessed learning management system (LMS) options and investigated multiple online methods to deliver course content incorporating Department knowledge and expertise. In addition, this research produced a summary of findings with recommendations for development of future electronic technology transfer courses at IDOT.

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LIST OF ACRONYMS

AASHTO	American Association of Highway and Transportation Officials
BLA	Bureau of Land Acquisition
CDT	Course development team
COLRS	Center for Online Learning, Research and Service
DOT	Department of Transportation
FAQ	Frequently asked questions
IDOT	Illinois Department of Transportation
KMSI	Knowledge Management Systems, Inc.
LMS	Learning management system
LTAP	Local technical assistance program
OCEE	Office of Continuing Engineering Education
SCORM	Sharable content object reference model
SME	Subject-matter expert
STTP	Specific task training program
TRP	Technical Review Panel
UIS	University of Illinois Springfield
UIUC	University of Illinois at Urbana-Champaign

CHAPTER 1 RESEARCH PLAN

1.1 BACKGROUND

The Illinois Department of Transportation (IDOT) Division of Highways offers technical training through multiple programs and bureaus including the Program Development (PD) series from the Bureau of Design and Environment, the Specific Task Training Program (STTP) series from the Bureau of Construction, the Local Technical Assistance Program (LTAP) series from the Bureau of Local Roads and Streets, QC/QA series from the Bureau of Materials and Physical Research, safety training from the Bureau of Safety Engineering, and bridge inspection training from the Bureau of Bridges and Structures. These courses, some mandated, are essential to the agency mission. Because of resource constraints, IDOT has been limited in its ability to deliver courses to statewide participants in a timely, standardized, and cost-effective manner. With telecommunications advances and electronic course delivery technologies, universities have developed and implemented multiple methods to effectively deliver highly technical content online to a diverse population of students. Distance course delivery allows individuals to complete courses from almost any geographic location, which provides the benefits of cost efficiencies and flexible scheduling.

1.2 RESEARCH OBJECTIVE

The objective of this research was to investigate the efficacy of the development and implementation of online course content for several high-benefit IDOT technology transfer training courses and short courses. In addition, this research produced a summary of findings with recommendations for future technology transfer course development efforts in the Department.

1.3 RESEARCH APPROACH

The deployment of courses in an online environment requires careful course content analysis with a focus on knowledge transfer and learner characteristics. Implementing effective online course design principles (graphic design, course structure/sequencing, intuitive functionality, etc.) is integral to optimal learner outcomes. Since technology transfer course participants have varying degrees of technological literacy, abilities, and Internet access capabilities, design must be accessible and responsive to a variety of learners.

This research project investigated multiple online methods to deliver course content incorporating Department knowledge and expertise. To accomplish the objectives of this project, the project team, in conjunction with the Technical Review Panel (TRP), performed four major tasks:

1. Assessed learning management system (LMS) options
2. Developed distance technology transfer course content for specific courses
3. Assisted in incorporating the content into IDOT's LMS
4. Identified lessons learned and developed recommendations for future IDOT online course activities

This project was a collaborative effort between the University of Illinois Springfield (UIS), the University of Illinois at Urbana-Champaign (UIUC), and IDOT. UIS staff has extensive experience in structuring online courses and training geared toward a wide variety of students. Through the Center for Online Learning, Research and Service (COLRS), UIS staff also has the capability to incorporate a wide variety of instructional mechanisms into online course delivery. UIUC has a long tradition of offering online short courses through the Office of Continuing Engineering Education (OCEE), and it has world-renowned information technology and high performance computing capabilities. Since both universities have high levels of expertise in various aspects of online course development, frequent communications between the UIS and UIUC teams, as well as with IDOT representatives, were employed for course development. The chapters in this report present the results of the research project.

The project's TRP selected specific courses for conversion to an online format, assigning either UIS or UIUC as the lead agency for content development. The TRP also designated a Course Development Team (CDT), led by a subject-matter expert (SME) from IDOT. The CDT then investigated the general characteristics of each selected training course, including content analysis and learner characteristics. This investigation addressed such issues as the following:

- Online course format and delivery framework
- Conversion of existing course materials
- Methodologies for course registration and completion
- Quizzing and testing
- Compiling, recording, and reporting test results
- Course management and support
- Documentation (e.g., professional development certificates)

The university's project team then designed each course for online deployment by acquiring and converting course materials from existing IDOT training courses and creating additional content to complement the online format and learning objectives.

Each course prototype was assessed throughout the development process. As the course materials were developed, IDOT members of the CDT were able to access the courseware online to assess functionality and provide comments. Upon completion of the prototype, the project team met with IDOT personnel to demonstrate the look, feel, and functionality of the online training course. IDOT also identified stakeholders to evaluate course prototypes for functionality and understandability.

The project team made any additions and modifications to the online prototype as required by the CDT and ultimately the TRP. The project team then uploaded the course content to IDOT's LMS.

The following chapters present the results of the research project.

CHAPTER 2 LEARNING MANAGEMENT SYSTEM INVESTIGATION

The Department's investigation and adoption of an LMS was a primary step to enable the delivery of online technology transfer courses to internal and external learners. The LMS provided the base for structuring online course content and for enrollment management. However, given the multiple vendors and platforms available, this task was complex.

The project team assisted the TRP and IDOT in developing selection criteria and assessing options for the LMS. IDOT had multiple levels of course management and delivery needs, beyond technology transfer. TRP assessments were given to IDOT upper management for their use in the ultimate selection of an LMS vendor.

Among the criteria used to assess LMS capabilities were the following:

- Live hosting capability
- Authoring tools availability
- Ability to incorporate a variety of course content
- Sharable Content Object Reference Model (SCORM) compliance
- Section 508 compliance
- Reliability
- Accessibility
- Ease of use
- Cost

SCORM compliance refers to the ability to incorporate online course content that enables content transfer across systems. Section 508 compliance ensures that electronic and information technology products are accessible to persons with disabilities. Given the wide variety of internal and external users, usability and access were key criteria, as well as the ability to assess, monitor, and record course completion.

Subsequently, IDOT selected the Knowledge Management Systems, Inc. (KMSI) product as the LMS for Department online training activities.

CHAPTER 3 DISTANCE TECHNOLOGY TRANSFER COURSE DEVELOPMENT

The purpose of this task was to acquire, prepare, and organize the content for selected online technology transfer training courses.

Over the project time frame, the TRP identified specific IDOT courses that would yield high benefits for distance learning conversion. The TRP used such criteria as training importance, impact on operations and anticipated technology transfer learner groups. Once selected, the project team followed this general pattern in developing course content.

1. Select the lead university (UIS or UIUC)
2. Form a Course Development Team (CDT)
3. Meet with subject-matter expert (SME)
4. Develop modular course content
5. Develop and present course prototype
6. Finalize course content
7. Transfer course content to IDOT's LMS

The CDT consisted of university course development staff and course content experts from IDOT. To begin course development, the TRP assigned an SME lead for the project. Typically, the SME was the instructor responsible for teaching the classroom version of the course. The CDT included other knowledgeable IDOT personnel. In addition, either the UIS or the UIUC principal investigator led the course content development efforts. However, there was consistent cross-university collaboration on specific course development aspects to share expertise. The CDT collaborated to review the structure and goals of the course, assess existing training materials, and identify characteristics of the training audience such as backgrounds and expertise.

The university project team then developed course content consistent with the distance training needs of IDOT and LMS capabilities. The project team typically redesigned the course using digital course content including text, PowerPoint, audio, video, and online quizzing. Each project included beta testing of the delivery mode. The team developed training outlines and modular training materials for assessment by the CDT.

The TRP, and potential users, assessed the functionality of the prototyped courses. Over the research project's time frame, five courses were selected by the TRP based on IDOT needs, course complexity, anticipated development time frame, and budgetary resources:

1. Flagger Training
2. Aggregate Gradation Training
3. Pavement Design
4. Waiver Valuation
5. Work Zone Safety
6. AASHTO Winter Training—Snow and Ice

The following summarizes the online course content developed and/or deployed as part of this project. Selected examples of the online course content are shown in Appendix A.

3.1 FLAGGER TRAINING

3.1.1 Course Investigation

Work zone safety is a primary concern of IDOT. The purpose of the Flagger Training course is to train highway flaggers to ensure the safe passage of traffic in a work zone. The primary flagger responsibility is to direct traffic using the STOP/SLOW paddle, following IDOT-approved techniques.

The TRP selected Flagger Training as the first course to convert because there was high statewide demand by local agency personnel for technology transfer. Typically, local agency Flagger Training course attendees number more than several hundred per year, with the potential for many more with online access. The on-ground Flagger Training course is a half-day session with approximately 20 to 35 learners in attendance. A test is given at the end of the session. Learners who pass the test receive a certificate of completion, which is tracked via a centralized database. Afterward the initial course, flaggers are required to undergo refresher training every two years. This refresher training is usually several hours and incorporates any new items.

Because Flagger Training was the initial course effort, its development included a wide variety of pedagogical techniques to assess feasibility and effectiveness. UIS project staff met multiple times with the IDOT Flagger Training CDT to discuss student/class characteristics, pedagogical strategies, and assessment mechanisms in order to finalize the structure and convert course content for online delivery.

3.1.2 Course Conversion

To begin development, the entire existing Flagger Training classroom course, with approximately 30 students in attendance, was video-recorded at UIS in a three-camera video studio. The recording included audience interaction. The raw video was analyzed by the CDT, and components were integrated into the online Flagger Training course as appropriate.

The next step was to video-record flagger field situations. A demonstration work zone with flaggers was set up on the UIS campus, and various components of flagger field situations were video-recorded to provide visual components for integration into the online training.

Concurrently, the Flagger Training course was redesigned based on the original slides, with a focus on structured online delivery. The CDT identified the following modules to categorize content in logical sections and to facilitate the online course experience for the student:

- Introduction
- Flagger Operations
- Flagger Handbook
- Testing

Once developed, the modules went through a series of development validation reviews with key stakeholders. Initial slides were prepared and assessed by the Flagger

Training CDT, which included representatives from IDOT bureaus of Local Roads and Streets, Safety Engineering, and Operations, as well as districts and local agencies. The primary course delivery mechanism was narrated slides for each module with video-recorded content interspersed as appropriate. Knowledge assessment quizzes were incorporated at the end of each module for interactive review of selected course content. Finally, a graded online test was added at the end of the course to assess learning.

In general, the course design included the following components:

- Video-recording of classroom-based Flagger Training course
- Field video-recording of several typical flagger work zone situations
- Video-recorded course introduction by the Secretary of IDOT
- PowerPoint slides incorporating course content
- Script development and narration of PowerPoint slide content
- Quizzes for knowledge testing at the end of each module
- Online course exam with automatic grading

Modules were uploaded to the KMSI learning management system at IDOT. The online course received additional review by a selected group of district and local agency personnel for usability and effectiveness.

3.2 AGGREGATE GRADATION TRAINING

3.2.1 Course Investigation

The project involved taking the half-day, face-to-face Aggregate Gradation Training course and converting it to an online course. The intent was to maintain, via video, the instruction and demonstration that were part of the face-to-face course and add other elements to enhance the online offering. Best practices in online courses include presenting material in various formats to engage multiple learning styles. Accordingly, the course investigation included discussion of innovative methods to present the material, as well as evaluation of interactive examples and tasks.

3.2.2 Course Conversion

The instructor was video-recorded giving the course in the lab. The video-recording included multiple takes and angles for viewers. The course was divided into components, or modules, so that the course would have several sections for online learners to work through at their own pace. The video was edited into short sections ranging from a few minutes to almost 13 minutes. Text was added to the videos to provide clarity, explanation, or emphasis, and all videos were closed-captioned.

The course was developed in Moodle, and the training text for the original classroom-based course was uploaded as a pdf for reference by students. Moodle is a free source learning management system software platform. Each module contained a summary of the material covered, images of the gradation testing, and a practice quiz related to the module. For two key areas, interactive skills test examples were prepared using Adobe Captivate so that students could practice the calculations necessary for gradation reporting. These examples made online learning more interactive, thereby engaging students and reinforcing course material. Practice quizzes were included at the end of each module, and

explanations were provided for incorrect answers. As with the interactive examples, these module quizzes reinforced the material and engaged students in active learning.

An introduction, general information, and frequently asked questions (FAQ) sections were added within Moodle and modified for conversion to IDOT's. The introduction was edited to give students clear instructions on how to take the course and what procedure to follow to complete the course.

3.2.3 Completion and Implementation

The course was reviewed by the instructor and other content experts, and final edits and changes were implemented. Since this e-Learning module contain multiple videos, the video files are hosted on the ICT server purchased as part of this research project. Other content was uploaded to the LMS. After implementation, there were some issues with the videos not playing properly due to server issues. However, these issues were resolved in a timely manner.

3.3 PAVEMENT DESIGN

3.3.1 Planning

Pavement Design was proposed as a new course. Planning discussions were held, and possible course outlines were proposed by the project team. Existing IDOT materials and other subject matter were used to research possible course content elements and modules. This research revealed that development of a Pavement Design course was beyond the scope of this project. Recommendations for development of a future Pavement Design course follow.

3.3.2 Recommendations for the Pavement Design Course

- Use existing National Highway Institute online and video training materials.
- Check other sources of possible shared information, such as Texas Department of Transportation (DOT) materials and training.
- Create original course content in IDOT's LMS that is specific to IDOT, such as documentation.
- Create original course content for IDOT's Pavement Technology Advisories.
- Alternatively, use other existing resources for online training and conduct one-day or half-day face-to-face training for the Pavement Design course.

3.4 WAIVER VALUATION TRAINING

3.4.1 Course Investigation

The purpose of the Waiver Valuation Training course is to instruct state and local agency personnel on the waiver valuation process for the acquisition of small land parcels. IDOT's Bureau of Land Acquisition (BLA) requested development of this course. The Waiver Valuation Training course is typically delivered several times a year to state and local agency personnel.

3.4.2 Course Conversion

Because the BLA requested a quick turnaround on course development, the project team video-recorded the entire Waiver Valuation Training course on site at IDOT facilities using one camera. The UIS team then reviewed the raw video and separated it into logical course modules. The audio portion of the video was transcribed electronically into text and initially reviewed for quality control and content. The UIS team then coordinated with BLA to finalize the script for each module.

Next, the video segments were sent to IDOT for final review and deployment. Although this course lacked features such as modular organization and quizzing, the development of the course provided an example of a simpler course conversion within a short time frame.

3.5 WORK ZONE SAFETY

Work Zone Safety was proposed as a new course. The CDT was developed and began working on course content. However, due to staffing changes at the department, this course was not able to be move beyond the planning stages.

3.6 AASHTO WINTER TRAINING—SNOW AND ICE

The American Association of Highway and Transportation Officials (AASHTO) training materials for winter snow and ice removal were reviewed to determine how they might be incorporated into IDOT's LMS. The AASHTO training materials were found to be SCORM compliant. Further discussions with AASHTO and IDOT enabled direct integration of materials to IDOT's LMS without modification.

CHAPTER 4 LESSONS LEARNED FROM COURSE DEVELOPMENT

This project investigated and incorporated a wide variety of methods to distribute course content online. Lessons learned as a result of this project are summarized for the following areas:

- Course selection
- Course structure and format
- Course content development
- Online course delivery components
- Course deployment and management
- Course maintenance

4.1 COURSE SELECTION

The transformation of a course to online delivery is often more complex than simply video-recording a lecture and posting the video online. Often, on-ground lectures are tailored to the makeup of the audience in the classroom and not as transferable online. In addition, lengthy viewing of a video is not always an effective learning model.

Thus, not all courses are readily transferrable to an online environment. Online course content development can require significant effort that may be more appropriately targeted for highly attended or high priority courses. In addition, courses with rapidly changing content can be difficult to maintain online. In general, courses of longer duration require more effort. For example, the conversion of a three-day course to an online environment requires much more development planning and effort than for a half-day course. Elements to consider in prioritizing online technology transfer course development include

- Course length
- Target audience characteristics—jurisdiction (e.g., state, local, private), background (e.g., technical, blue collar), experience
- Course content complexity—slides, lecture, technology tools (e.g., calculations, spreadsheets)
- Internet access capabilities of learners
- Learner assessment and testing requirements

4.2 COURSE STRUCTURE AND FORMAT

For effective deployment, the project team recommends that all course content be developed and deployed within specific standards/guidelines. These guidelines would serve the following needs:

- Ease of integration into IDOT's learning management system
- Ability to transfer course content and course modules between courses

- Maintaining a similar look and feel for internal and external learners
- Ability to update course content as necessary
- Ability to adapt to future changes in course delivery technologies

Examples of appropriate guidelines are

- Course and module organization
- Common slide templates
- Video integration processes
- SCORM-compliant online course content
- Quizzing and assessment mechanisms
- Testing and certification process

IDOT has already developed and adopted a representative modular course structure for the KMSI LMS. Examples of these modules are shown in Appendix B.

All courses are unique, to a certain extent, and there may be necessary exceptions to these guidelines. The project team recommends that IDOT specify an oversight function to ensure that course content is developed and maintained to help ensure compatibility, functionality, and maintainability.

4.3 COURSE CONTENT DEVELOPMENT

Online course content development requires a collaborative effort between course developers and subject matter experts. As such, it requires a formal plan for completion, with specific tasks performed over a defined time frame. The extent and time line of these efforts depend on the complexity of the course.

It is recommended that the project development team consist of individuals familiar with the course content and audience—typically, the course instructor and other knowledgeable personnel. In addition, the team should include technical online course content developers who are familiar with IDOT’s LMS and its features. A project lead should be selected to ensure project completion.

A time frame should be established, with frequent meetings to periodically review course development and to address issues that may arise.

4.4 ONLINE COURSE DELIVERY COMPONENTS

As previously presented, there is a variety of methods to deliver course content. The following sections identify strengths and weaknesses of these mechanisms. It is often useful to use different content formats for the same course to maintain learner interest. Also, specific content may be more appropriate for different types of material. For example, to emphasize specific points, a video presentation can often make a more powerful visual connection with the learner than other content formats can.

4.4.1 Slides

Almost all of IDOT's technology transfer courses use slides in some manner. In a typical classroom, slides outline the broad course ideas while the instructor provides further insights and instruction. Slides are used similarly in online content presentations.

Densely worded slides can distract the learner. Slides should be integrated with relevant yet succinct audio to promote effective knowledge transfer.

Grouping content into logical and sequentially appropriate modules provides an intuitive learning environment. This arrangement enables the learner to "take a break" and reflect on the course content.

IDOT has selected a PowerPoint template for slide development, which allows integration of worded scripts and narration to supplement the slide visual (Figure 1).



Figure 1. Slide template for IDOT online course content.

4.4.2 Narrated Slides

Narrated slides provide a means to integrate lecture content with slide content; many learners find this method to be effective. However, learners should have the ability to review previous slides to clarify or reinforce course concepts.

Narrated slides can be more difficult to prepare because the script must be finalized and the narration timed and aligned with the slide. It can also be more difficult to update the narrative if content changes.

The script should be available in text form for learner reference and Section 508 compliance, as appropriate.

4.4.3 Video

The incorporation of video can be an effective strategy to highlight specific points or to demonstrate complex subject matter. Video was effectively incorporated in the Flagger, Aggregate Gradation, and Waiver Valuation Training courses.

Of course, an existing course can be recorded in totality and then streamed for online access, as was done for the Waiver Valuation Training course. This option provides a means for rapid deployment of information transfer in a widely accessible format.

However, learners may have difficulty maintaining interest throughout the video presentation without the benefit of interspersed learning assessments such as quizzes. Depending on the course, video may be more effectively applied in segments in conjunction with slides or as standalone modules.

The relative file size of video components may challenge the limits of the LMS, so it is important to assess functionality, especially because learners may be accessing course content from a variety of devices and types of Internet connections.

4.4.4 Interactive Worksheets and Alternative Technologies

The Aggregate Gradation Training course highlighted a powerful way for the learners to interact directly with the worksheet for hands-on learning and to help assess student comprehension of the materials. Adobe Captivate was used to create interactive skills tests for online students. The worksheet takes the student through each step of the required calculations, with explanations provided for both correct and incorrect answers.

Given the often-technical nature of IDOT course content, alternative technologies, such as the interactive spreadsheet, should continue to be investigated for incorporation into online training. These technologies can enable more learner interaction and understanding.

4.4.5 Knowledge Checks/Quizzes

It is useful to have a series of questions after appropriate modules so that learners can reflect on what they have learned. These knowledge checks or quizzes can be particularly relevant for areas the SME wishes to highlight. The learners should be provided feedback on right and wrong answers.

4.5 COURSE DEPLOYMENT AND MANAGEMENT

4.5.1 Course Organization: Formats and Standards

Course organization is critical to ensure the structured deployment of courses. A consistent format for course access and course content delivery ensures that users can readily navigate the courses.

In addition, standards should be adopted to guide consistent content development across courses and to ensure SCORM and Section 508 compliance.

IDOT has developed a mechanism to identify and organize technology transfer courses in their LMS. Technology transfer courses require registration in the Department's LMS.

4.5.2 Course Access and Management

IDOT determines when online learners have access to the course. Learner access can range from specific days and time periods to universal access at any day or time via the

Internet. It is important that the learner have some method to provide feedback to IDOT or the SME if there are problems with course access or delivery.

Learners may access the course from a wide variety of locations. It is advisable to provide a site where users can test their connection to make sure they can adequately access the course content.

4.5.3 Testing

Individual courses may require a test after course completion to verify they have learned the content. There are multiple options for testing. The test can be administered and taken online and could be accessible only during a specific time period. The SME can also structure the course so that the test can be taken multiple times to achieve a passing score. A paper exam may also be given in a proctored location and results then recorded in the LMS.

Security is an important issue for testing. A proctored exam can be presented online if it is taken in a proctored facility. Security procedures may differ, depending on the course. For example, course completion for certifications may require proctored exams. General courses for professional development may have less stringent examination/completion procedures.

4.6 COURSE MAINTENANCE

4.6.1 Learner Feedback

Feedback from learners is very important to improve course content and functionality. Learners should have a mechanism to communicate or send constructive comments, both positive and negative, to the SME. IDOT already provides this function through its LMS.

4.6.2 Updates to Course Content

Inevitably, course content will change over time with revisions and advances in laws, policies, standards/specifications, and technologies. It is important that an SME be assigned to oversee course development and maintenance of course content. The SME should have continuous access to the course content.

The SME does not have to update course content directly. It may be more appropriate for the SME to communicate with LMS support staff to update changes in the course. However, the LMS has sufficient functionality that the SME, with proper training, could update the content directly. This option may be preferable for courses where the content is updated more often.

CHAPTER 5 RECOMMENDATIONS FOR DEPARTMENT E-LEARNING INITIATIVES

This research project investigated and implemented components for online technology transfer for a variety of IDOT courses. Given the Department's interest in advancing e-learning, this chapter reflects on the research project results to provide recommendations about future development and deployment of online courses at IDOT. In particular, this chapter focuses on the process of developing online courses, ensuring organizational support for e-learning, and addressing intellectual property issues.

5.1 ONLINE COURSE DEVELOPMENT PROCESS

The conversion of an on-ground course to online may be problematic for a number of reasons:

- Potential major revisions and upgrades of course content
- Technical challenges in audio and video content development
- Revisions to course materials over time
- Conversion to SCORM and Section 508 standards

To address these issues, and to ensure success for future online course development, the project team recommends the following basic implementation components for courses that are selected for development or conversion to online delivery.

5.1.1. Lead Course Content Developer

Once a course is identified for online deployment, a lead course content developer should be assigned to manage the project. This lead developer should be familiar with IDOT's LMS and have advanced knowledge in preparing course materials, in particular for online deployment.

5.1.2 Subject-Matter Expert

The SME determines the content for the online course and is typically the current instructor for the on-ground version. Besides content knowledge, the SME should have at least a basic knowledge of the principles of online course delivery.

5.1.3 Course Development Team

In addition to the lead course content developer and the SME, the CDT should include additional experts and stakeholders who have an interest in the course. These other team members may include personnel from other bureaus, districts, local agencies, and the private sector, as appropriate.

A panel should be assigned to review content as it is developed and provide insights from practitioner and learner perspectives. A review by a sampling of target learners would provide insights about the efficacy of the training so that changes can be incorporated before course finalization.

5.1.4 Project Development Time Frame

To ensure completion, a clear project time frame should be developed in advance, with key milestones identified.

5.1.5 Task Focused E-Learning Development

An additional method to develop e-learning capabilities is as a task-focused process. The Department should include an online course component for any new research- or course-based initiative developed as part of a project. For example, development of a new or revised bridge inspection process should include an e-learning training requirement so that knowledge transfer materials can be deployed online. The principal investigator should develop this knowledge-based course content in conjunction with IDOT standards so that it can be directly incorporated into the Department's LMS.

5.2 ORGANIZATIONAL SUPPORT FOR E-LEARNING

The Department and local governmental agencies have increasing needs for training and knowledge transfer while facing significant staff and budget limitations that limit their ability to offer typical on-ground classes. In addition, significant turnovers in staff increase the demand for knowledge and certifications in technically complex areas. Online technology transfer initiatives can greatly assist in knowledge transmission. However, the project team believes there are also significant institutional issues to address in order to advance IDOT's online technology transfer efforts in the future. The issues are as follows:

- Limited budgets for online course development
- Staff constraints for SME activities and course management
- Lack of assigned responsibilities
- Lack of a coordinated effort
- General resistance to e-learning

5.2.1 Organizational Responsibility

A major issue is organizational responsibility. Online course development requires a defined organizational structure and assigned responsibilities to ensure the courses are properly prioritized, structured, and deployed. Basic questions to address are

- Who manages the Department's LMS (e.g., operation, security, accessibility, storage management)
- Who will manage the components of online course content?
- Who will update the online course content?
- Who will prioritize and resource online course development?

One method to address these issues is to form a formal e-learning group within the Department. This group could set content standards, help prioritize courses for online development and/or conversion, and provide a focal point for resolving issues and recommending improvements to online course delivery capabilities.

The research team for this project recommends that an organizational area be assigned responsibility for the LMS and course content management. This position would

manage the operational aspects of course updates and the incorporation of new e-learning courses. The position would also coordinate with course SMEs to identify issues and to determine whether any course changes are necessary.

SMEs also have an important role in regularly monitoring course functionality and feedback to identify and address any course content/testing issues.

5.2.2 Institutional Barriers

There is often resistance to e-learning initiatives, and many believe that e-learning is not as effective as on-ground courses. However, properly designed online courses have proven to be very effective and have the added benefit of reaching many more potential learners. As learners successfully complete online courses, these concerns can lessen. However, the Department could take additional steps to positively promote e-learning.

It is important that learners have the ability to contact SMEs to resolve questions and concerns about course content. To ensure continuous improvement in online courses, learners should also have an opportunity to communicate both the positive and negative aspects of the course after they have completed it. SMEs and course content developers should also have a forum to share tips and techniques.

5.2.3 Task Focused E-Learning Development

An additional method for developing e-learning capabilities is on a task-focused basis. The Department should include an online course component for any new research- or course-based initiatives as part of the project. For example, the development of a new or revised bridge inspection process should include an e-learning component so that knowledge transfer materials can be deployed online. Accordingly, if a particular online course is developed externally, the principal investigator should develop the course content, with signoffs from appropriate IDOT staff. Essentially, the principal investigator and/or the SME should be part of this team from the beginning and partner with online course delivery experts to develop the components for online course delivery.

5.3 INTELLECTUAL PROPERTY/COPYRIGHT ISSUES

Because course materials are deployed electronically and online, it is important that the incorporated materials meet the appropriate copyright/intellectual property requirements. In addition, the online deployment of technology transfer resources, not developed by IDOT or IDOT contractual staff may be subject to copyright restrictions.

Intellectual property requirements can be complex. For reference, the UIS library provides UIS copyright requirements for materials incorporated into course reserves as follows:

<http://libguides.uis.edu/content.php?pid=356096&sid=2923728>

The research team recommends that IDOT develop a policy to ensure e-learning course materials meet appropriate intellectual property requirements. Contracts for externally developed course content should include language specifying ownership of course materials.

**APPENDIX A EXAMPLES OF LEARNING MANAGEMENT SYSTEM
ONLINE COURSE COMPONENTS**

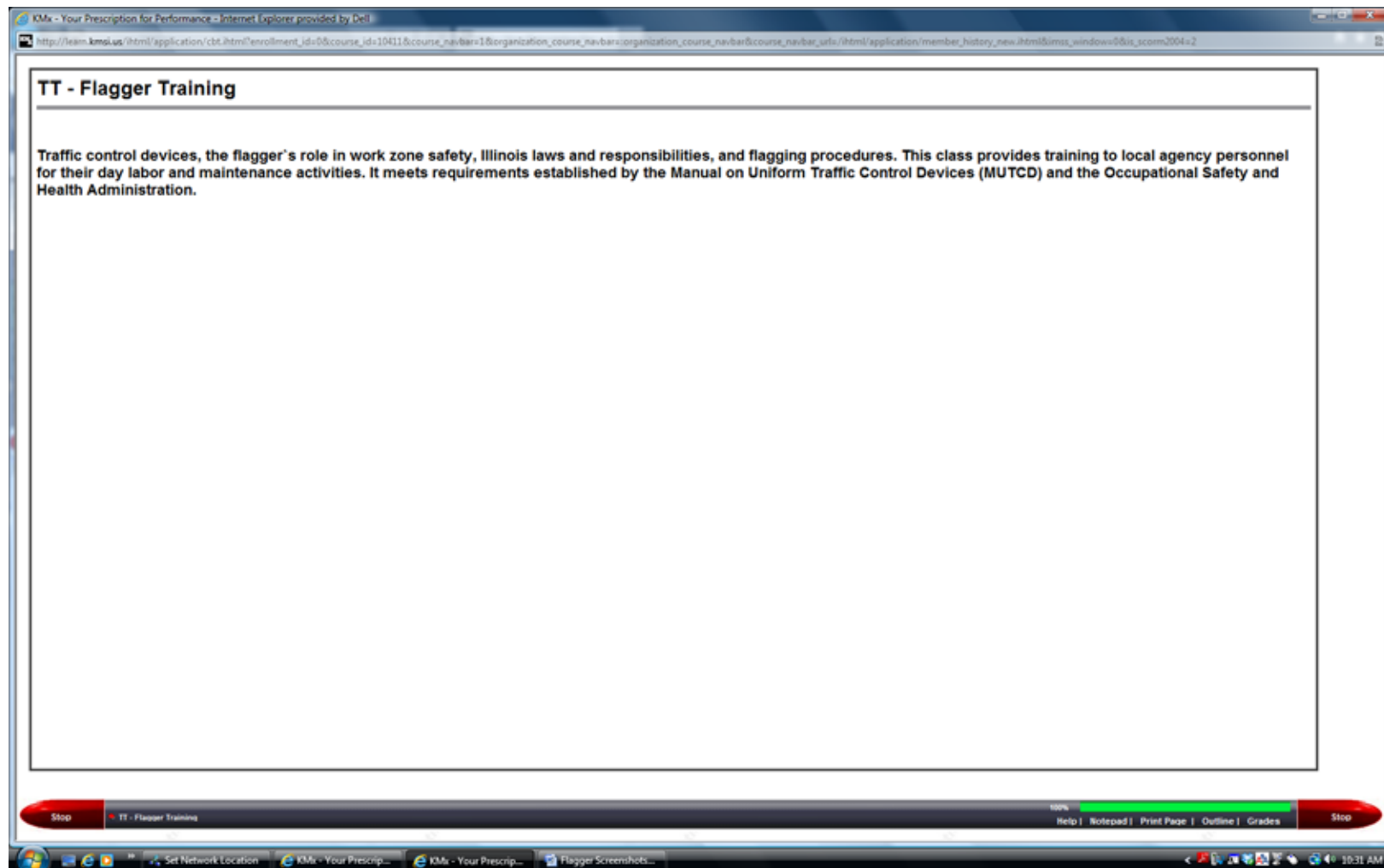
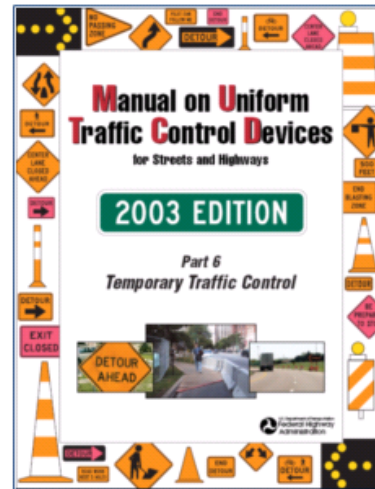


Figure A-1. Welcoming screen for the flagger refresher training course.

Part 6 Temporary Traffic Control (TTC)

- Pedestrian/ Worker Safety
- Flagger Control
- TTC Devices
- Typical Applications



Illinois Department of Transportation

Slide 8 of 15

Back

Manual on Uniform Traffic Control Devices (MUTCD)

36%

Help | Notepad | Print Page | Outline | Grades

Next

Figure A-2. Flagger course PowerPoint streaming example.

Stopping Traffic



Slide 10 of 22

Back | Flagger Handbook | 86% | Help | Notepad | Print Page | Outline | Grades | Next

Figure A-3. Flagger course video streaming example.

**Stop/Slow
Traffic
Control
Paddle**

Sign – 18" Across
Letters – 6" High

STOP

- White Letters & Border
- Red Background

SLOW

- Black Letters & Border
- Orange Background

 Illinois Department of Transportation

The illustration shows a flagger in a high-visibility vest and hard hat holding a sign on a white pole. On the left, the sign is red with white text and a white border. On the right, the sign is orange with black text and a black border. The background is white with blue borders on the sides and bottom.

Figure A-4. Flagger course graphic illustration example.

The screenshot shows a web browser window with the title "KMi - Your Prescription for Performance - Internet Explorer provided by Dell". The address bar contains a URL: "http://learn.kmi.us/html/application/cbt.html?enrollment_id=0&course_id=7982&course_navbar=1&organization_course_navbar=organization_course_navbar&course_navbar_url=/html/application/member_history_new.html&imss_window=0&is_scomm2004=2".

Introduction

This online training course provides the half-day classroom portion of IDOT gradation training, which will train students to split (reduce) aggregate samples and to conduct a washed sieve test.

This course is divided into topical areas that should be completed in order. Each area includes information and videos illustrating the proper testing techniques, followed by a practice quiz. The materials follow the course handbook. Students shall print off the course handbook to have available as a reference during the online and observation portions of this gradation course.

DOWNLOAD THE COURSE HANDBOOK [HERE](#).

Once you have completed your study in each of the topical areas and have passed all of the quizzes, you will be required to demonstrate your ability to correctly perform the laboratory procedures described in this training. To schedule the observation portion of gradation training, you will need to email – dot.bmpr.gradtrain@illinois.gov.

This course was developed as part of the Illinois Center for Transportation (ICT) project R27-73, "Distance Technology Transfer Course Content Development." Please forward comments about how we might improve this training site to Quality Assurance Supervisor Scott E. Hughes at dot.bmpr.gradtrain@illinois.gov.

Outline

- 1. Reduction of Field Sample**
 - Mechanical Splitter
 - Explanation & Video
 - Quartering
 - Explanation & Video
 - Minature Stockpile Sample
 - Explanation & Video
 - Ten Percent Calculation
 - Explanation & Video
 - Skill Practice
 - Quiz
- 2. Preparation of Test Sample**
 - Explanation & Video
 - Quiz
- 3. Wash Test**

At the bottom of the page, there is a navigation bar with "Back" and "Next" buttons, and a progress indicator showing "Introduction" is selected. Below the browser window, the Windows taskbar is visible with several open applications and the system clock showing 10:26 AM.

Figure A-5. Gradation course introduction.

KMx - Your Prescription for Performance - Internet Explorer provided by Dell

http://learn.kmxi.us/html/application/cbt.html?enrollment_id=0&course_id=7962&course_navbar=1&organization_course_navbar=organization_course_navbar&course_navbar_url=/html/application/member_history_new.html&msc_window=0&is_scom2004=2

Method B: Quartering

Purpose

- Reduction of field sample
- Used for fine aggregate

Specifications

- Illinois Modified AASHTO T248 - Reducing Sample of Aggregate to Testing Size

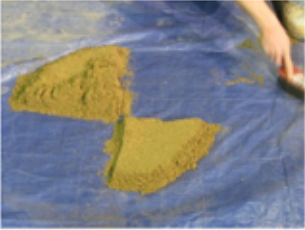
Procedure

- Thoroughly mix sample
 - Turn over the sample four (4) times with a shovel
- OR
- Lift each corner of the canvas and pull it over the sample diagonally toward the opposite corner
- Repeat four (4) times, creating a small, conical pile

• Flatten pile

- Apply a shovel to the apex of the conical pile
- Flatten the pile, targetting uniform thickness and diameter
- Ensure the diameter of the pile is four (4) to eight (8) times its thickness

- Divide flattened pile into four (4) equal quarters with a shovel or trowel
- Remove two diagonally opposite quarters (including all fines - use a brush to clean the cleared spaces)
- Remix and quarter as many times as necessary to achieve proper test sample size
- On the final split, the masses of the two halves shall be within +/- 10% of each other



Back Method B: Quartering 100% Help | Notepad | Print Page | Outline | Grades Next

Set Network Location KMx - Your Prescrip... KMx - Your Prescrip... 10:19 AM

Figure A-6. Gradation course illustration example.



Figure A-7. Gradation course video streaming example.

Reduction of Field Sample Quiz (See Pages 2 through 7 of the Gradation Handbook)

1. While conducting the miniature stockpile or quartering method your flattened sample is four(4) inches; the diameter of the sample should be:
 - eight (8) to sixteen (16) inches
 - four (4) to eight (8) inches
 - sixteen (16) to thirty-two (32) inches
2. When conducting the miniature stockpile method, what pattern is used to obtain your test sample?
 - square pattern
 - measure equal distances from sides
 - random "x" pattern
3. When conducting reduction of field sample using miniature stockpile or quartering methods, how many times do you turn over the entire sample?
 - sixteen (16)
 - eight (8)
 - four (4)

Figure A-8. Gradation course knowledge quiz example.

Sieve		Indiv. Wt. Retained	Cumul. Wt. Retained	Cumul. % Retained	Percent % Passing	Spec. Range % Passing
CA	FA					
63 (2.5)						
50 (2)	25 (1)					
45 (1.75)	9.5 (3/8)					
37.5 (1.5)	4.75 (#10)					
25 (1)	2.0 (#10)					
19 (3/4)	1.18 (#16)					
16 (5/8)	1.0 (#20)					
12.5 (1/2)	0.85 (#20)					
9.5 (3/8)	0.75 (#20)					
6.3 (1/4)	0.425 (#40)					
4.75 (#4)	0.3 (#50)					
2.36 (#8)	0.15 (#100)					
1.18 (#16)	0.075 (#200)					
0.6 (#30)						
0.425 (#40)						
0.3 (#50)	0.15 (#100)					
0.15 (#100)						
0.075 (#200)	0.075 (#200)					
Pan						
Total Dry Wt.		1532				
Total Washed Wt.		1520				
Diff. -0.075(-200)		12		% Washed - 0.075		

That's correct!

The differential is calculated as follows:

Total Dry Weight - Total Washed Weight = Differential

In this case:

1532 - 1520 = 12 g

Next >>

Figure A-9. Gradation course interactive spreadsheet example.

