

Training—the Key to Technology Implementation

Leland D. Smithson

Bureau of Research and Technology Transfer
Iowa Department of Transportation
800 Lincoln Way
Ames, IA 50010
leland.smithson@dot.state.ia.us

ABSTRACT

During the past decade, research has made great strides in providing new materials, methods and equipment for improving maintenance of transportation facilities. Topping the list of accomplishments is the way governmental agencies are approaching snow and ice control operations. The 1988 to 1993 Strategic Highway Research Program began the process with nearly 20 million dollars being spent in a maintenance operations research program. The International Technology Scanning Tour program followed in 1994 with a winter maintenance operations scan of Japan, Germany, and Austria, followed by a 1998 scan of Switzerland, France, Norway and Sweden and finally the latest winter operations and intelligent transportation systems applications scan in 2002 revisited Japan.

The American Association of State Highway and Transportation Officials established a pooled fund study to provide the necessary financial support to develop a national computer-based, anti-icing and road weather information system training program for state and local governments. Nearly all of the snow-belt states and the American Public Works Association (APWA) and the National Association of County Engineers (NACE) contributed to this pooled fund. The computer-based training (CBT) program developed to meet this need is fundamentally a menu-driven, hyper-linked, interactive, content manager. The user once logged in, can work through this stand alone training from beginning to end, like a book, returning to the menu at intervals, as desired, to select another path. The content is photographs, illustrations, text, video, charts, animation, interaction, narration and other means of communication. There are opportunities at various points to access the progress the user is making educationally, including quizzes, scenario-based problem cases, and exercises. The training can be individually administered or used in a group setting and can be the foundation for a certification program.

Two versions of the CBT program, one generic and the other customized, will be completed by the time this paper is presented. APWA and NACE selected the generic version while nearly all the states desired the customized version specifically tailored to the methods and chemicals used in their snow and ice control operations. Feedback from the state department of transportation maintenance personnel and trainers who are preparing their customization needs is the product exceeded their expectations. The CBT was easily installed on their computers and will fit well into their training program. The CBT will work well in either the group or individual training mode.

Key words: anti-icing—computer-based training—road weather information system—snow and ice control—technology transfer

BACKGROUND

During the past decade, research has made great strides in providing new materials, methods and equipment for improving maintenance of transportation facilities. Topping the list of accomplishments is the way governmental agencies are approaching snow and ice control operations. The 1988 to 1993 Strategic Highway Research Program (SHRP) began the process with nearly 20 million dollars being spent in a maintenance operations research program. The International Technology Scanning Tour program followed in 1994 with a winter maintenance operations scan of Japan, Germany and Austria, followed by a 1998 scan of Switzerland, France, Norway, and Sweden and finally the latest winter operations and ITS applications scan in 2002 revisited Japan.

This tremendous influx of new research knowledge and technological advances brings a societal obligation for government to increase the efficiency and effectiveness of private and public winter maintenance of transportation facilities. Environment Canada's recent declaration that chloride based chemicals should now be considered CEPA Toxic adds to this sense of urgency for the snow and ice community to focus on the proper handling, storage and application of commonly used anti-icing and de-icing chemicals.

Training for supervisors and field operators in understanding the new processes and equipment used in these proactive snow and ice control techniques has been slow in developing. Lack of effective and scientifically based training has hampered progress in the implementation of anti-icing (AI) and road weather information system (RWIS) technologies from the SHRP and International Scanning Tours.

The American Association of State Highway and Transportation Officials (AASHTO), recognizing these educational needs established a pooled fund study to provide the necessary financial support to develop a national computer-based, AI/RWIS training program for state and local governments. Nearly all of the snow-belt states and the American Public Works Association (APWA) and the National Association of County Engineers (NACE) contributed to this pooled fund.

The computer-based training (CBT) program developed to meet this need is fundamentally a menu-driven, hyper-linked, interactive, content manager. The user once logged in, can work through this stand alone training from beginning to end, like a book, returning to the menu at intervals, as desired, to select another path. The content is photographs, illustrations, text, video, charts, animation, interaction, narration and other means of communication. There are opportunities at various points to access the progress the user is making educationally, including quizzes, scenario-based problem cases, and exercises. The training can be individually administered or used in a group setting and can be the foundation for a certification program.

PROJECT DEVELOPMENT

The need for the development of an interactive computer-based, stand-alone, training program was identified during the AASHTO/Federal Highway Administration SHRP Implementation Program by the Lead States Team for the implementation of advanced anti-icing (AI) and proactive snow and ice control technology. When the Lead States program was sunset, the responsibilities for developing and implementing the computer-based training program was handed off to the AASHTO Snow and Ice Cooperative Program (SICOP). The Aurora Consortium, an RWIS research consortium, had training as one of its top program priorities. The Aurora Consortium and AASHTO SICOP agreed to partner in the development of a national AI/RWIS training program with Aurora taking the lead in developing the scope of work and obtaining a contractor to build the computer-based training program. SICOP agreed to raising the necessary funding and coordinating the project.

A request was made to all state departments of transportation (DOTs), APWA, and NACE to make nominations for a team of experts in anti-icing and snow and ice control operations and instructors familiar with teaching maintenance field personnel. A technical working group (TWG) was organized from those nominations to develop the content of the training program and guide the contractor in building the training program.

The contract for the project was signed in March 2001. By September 2001, 800 pages of storyboards had been drafted for TWG review. By spring 2002, the contractor had draft copies of the first lessons on CD-ROM ready for TWG review. The state DOTs received CD-ROMs of the first three lessons in September 2002 and were asked to make recommendations for customizations to tailor the training to their individual state needs.

COURSE CONTENT

The course consists of seven lessons containing a total of 38 units. The content outline is listed below:

Lesson I: Introduction to Anti-icing and Winter Maintenance

- Unit 1: The New World of Anti-icing
- Unit 2: Benefits of Anti-icing
- Unit 3: Anti-icing in a Nutshell
- Unit 4: Units of Measure

Lesson II: Winter Road Maintenance Management

- Unit 1: Components of a Successful Anti-icing Program
- Unit 2: Preparing for the Winter Season
- Unit 3: Level of Service
- Unit 4: Data Collection and Record-keeping
- Unit 5: Anti-icing Communications and Legal Matters

Lesson III: Winter Roadway Hazards and Principles of Overcoming Them

- Unit 1: Water and its Winter States
- Unit 2: Road Surface Heat
- Unit 3: Condensation and Dew Point Temperatures
- Unit 4: Pavement Temperature—It's the Key!
- Unit 5: Snow, Ice and the Roadway
- Unit 6: Snow/Ice Bonds and Freezing-Point Depressants
- Unit 7: Dilution of Solution
- Unit 8: Chemical Concentrations and Application Rates
- Unit 9: Friction

Lesson IV: Weather Basics

- Unit 1: Weather and Winter Road Maintenance
- Unit 2: Air, Atmosphere, Heat and Humidity
- Unit 3: Weather Systems
- Unit 4: Regional Weather Influences
- Unit 5: Precipitation Hazards
- Unit 6: Non-Precipitation Hazards

Lesson V: Weather and Roadway Monitoring for Anti-icing Decisions

- Unit 1: Radar
- Unit 2: Weather Observation and Data Gathering
- Unit 3: An Introduction to Road Weather Information Systems
- Unit 4: The Importance of VAMS
- Unit 5: Eight Critical Questions
- Unit 6: Combining Anti-icing and the Traditional Approach

Lesson VI: Computer Access to Road Weather Information

- Unit 1: An Introduction to the RWIS Screens
- Unit 2: Navigating Through the System
- Unit 3: Other Online Resources

Lesson VII: Anti-icing Practice in Winter Maintenance Operations

- Unit 1: Preparing for the Season
- Unit 2: Equipment Types, Preparation and Maintenance
- Unit 3: Material Preparation and Storage
- Unit 4: Chemical Application Rates
- Unit 5: End-of-Season Tasks

COURSE DOCUMENTATION

- *AI/RWIS CBT Setup Guide* is a manual describing how to set up the CBT on your PC. The guide is written for the information technology staff.
- *AI/RWIS CBT User Guide* is the primary reference manual for the CBT. This manual is meant for the CBT users. The User Guide explains in detail how to use the software and provides a detailed description of each of the CBT's features and functions.
- *Training Manager Guide* is a guide for training managers. It details the Training Manager Tool.
- *Course Editor Guide* details the use of the Course Editor Tool. The Course Editor is designed for training managers.
- *Implementation Guide* is written particularly for training managers. It explains how to roll out the CBT and how to best monitor student performance both with the CBT and on the job.

USING THE CBT

The CBT structure and flow is explained below:

- A splash screen appears each time the CBT is launched. It is a composite of small images reflecting training program content. As the images appear, music plays in the background. The splash screen requires about 15 seconds to build. If the student desires to bypass this screen, pressing the space bar or enter key will advance to the log-in screen.
- A log-in screen must be completed each time so student progress can be recorded. Log-in requires first name, last name, password and job title. Thereafter the Microsoft Agent "Jake", an online assistant, will address the student by their first name. Jake is an animated conversational personality that walks the student through the tutorial (discussed below) and provides assistance when the student needs help. In addition to the role of a guide, Jake will appear on occasion to drive home a point or sometimes to just entertain.
- A welcome video will present a brief video introduction to the course. The welcome video will play the first time the student uses the CBT.

- A tutorial will familiarize the student to the features and functions of the CBT. The full tutorial requires 31 minutes. The student can go through the entire tutorial or select tutorial topics. When the student logs back into the program for a subsequent session, they can revisit the entire tutorial, select topics or skip the entire tutorial.
- A Road Map appears once the student exits the tutorial. The Road Map illustrates the student’s progress and directs them to units within each lesson. Each road sign on the screen represents a lesson in the course. Lessons must be completed in order. Completed lesson signs will be checked off as soon as the student works through all of the lesson content and earns a passing score on the Post-assessment quiz and scenario.
- Lesson Introduction—each lesson begins with a video introduction to the content in that lesson. The main topics discussed in the forthcoming lesson are displayed on the screen as a real person host mentions them.
- A pre-assessment quiz is administered after the Lesson Introduction. The purpose of the Pre-assessment is to evaluate what the student knows before going through the lesson so it can be compared to what they know after going through the lesson. The quiz contains questions in a variety of common formats (multiple-choice, true/false, and fill-in-the-blank). On the last question of the Pre-assessment a “Check My Score” button will appear. Clicking on that button will display a score panel with student results.
- The Lesson Content in each lesson is organized into units. Each unit is broken down into screens. Lessons contain anywhere from three to nine units. Each unit has as few as five, or up to 40-50, screens. The lesson content is presented using multimedia elements, including the following:
 - text
 - bullets (key points)
 - photographs
 - illustrations
 - charts, graphs or tables
 - screen element highlighting
 - narration
 - animation
 - digital video
 - sound effects
 - mouse and/or keyboard-controlled interactive exercises and simulations
 - review questions

Interactive exercises will “engage” the student and topic being discussed. Review questions will be presented about every 5 to 10 screens. These are designed to check the students understanding of the topic being discussed on the past few screens. Review questions are presented in a variety of formats, such as multiple choice, fill-in-the-blank, true/false, or drag-and-drop. Feedback will be provided so the student can see how they did and if they missed a question, what the correct answer is.

- The knowledge base is a warehouse of information related to AI/RWIS. The student should think of it as an online encyclopedia. Material in the knowledge base is arranged by tab groups discussion topics by subject or area or in an alphabetical index. In addition to text, knowledge base discussions may include photographs, diagrams, tables, web site links, digital videos, etc. Some discussions include links to other discussions. These are identified as blue underlined text. The student can click on these “hot terms” to jump to those discussions in the knowledge base.
- A glossary contains a list of AI/RWIS terms and their definitions.
- The post-assessment quiz is to evaluate what the student knows after going through the lesson. On the last question of the post-assessment a “Check My Score” button will appear. Clicking that button will bring results of the post-assessment quiz and pre-assessment scores so the student can

compare what they now know after going through the lesson compared with what they knew beforehand.

- Scenario—while the post-assessment quiz evaluated the student’s knowledge of AI/RWIS facts, the scenario evaluates their understanding of the lesson content by asking them to put the knowledge they have gained into practice. It is well known that working with theories is one thing; working within the constraints of the real world can be quite different. The scenario room gives the student hands-on practice in a simulated winter maintenance facility so that they can develop and refine their winter maintenance decision-making skills. The scenario room is set up to look like a field maintenance garage office. It provides the student with the tools most maintenance facilities have in some form or other to learn of an impending winter weather event. They should be able to research the particular nature of the event and make operational decisions based on that research. Everything the student does in the Scenario Room is tracked and evaluated. The student is encouraged to strive to use all of the pertinent tools available, yet do not waste time clicking on objects that will not aid for the particular event. Detailed feedback will be provided once the student has made an operational decision. If the student does not pick the optimal solution to the problem, they will learn what the optimal solution is. The results of their decision will be compared with the results of the optimal solution. This way the student will learn the consequences of making a less-than-optimal operational decision. The feedback will also list each step taken, the order they took each step, and the time needed to complete the step. There are two scenario modes: Practice and Evaluation. Practice mode lets the student work through the scenario without being graded. A student can take up to three practice scenarios before tackling the Evaluation, or graded scenario.
- EPSS Mode—The AI/RWIS CBT continues to be a valuable tool even after the student completes the course. When the student finishes the CBT, a new feature is activated. This feature is known as the Electronic Performance Support System (EPSS) or EPSS Mode. The student can know access this feature through the Road Map icon on the Road Map screen. The EPSS Mode screen is divided into two main panels. The panel on the left includes a scrolling alphabetical list of discussion topics in the CBT. The student locates the topic they wish to review, highlight the topic by clicking on it and then clicks on the “Go to Selected Topic” button to jump to the first screen of that discussion. Above the alphabetical list of topics there is a search field. Rather than scroll through the extensive list, the student can type the first few characters of the topic of interest and the list will automatically scroll to the first topic matching the characters the student typed in. On the right hand side of the screen, topics are organized into a content tree. If the student needs help, click the Help button. Jake will appear and provide the assistance needed.

END PRODUCT

Two versions of the CBT program, one generic and the other customized, will be completed by the time this paper is presented. APWA and NACE selected the generic version while nearly all the states desired the customized version specifically tailored to the methods and chemicals used in their snow and ice control operations.

Feedback from the State DOT maintenance personnel and trainers who are preparing their customization needs is the product exceeded their expectations. The CBT was easily installed on their computers and will fit well into their training program. The CBT will work well in either the group or individual training mode.

A metric version of the CBT is being prepared for use in the Canadian provinces.