



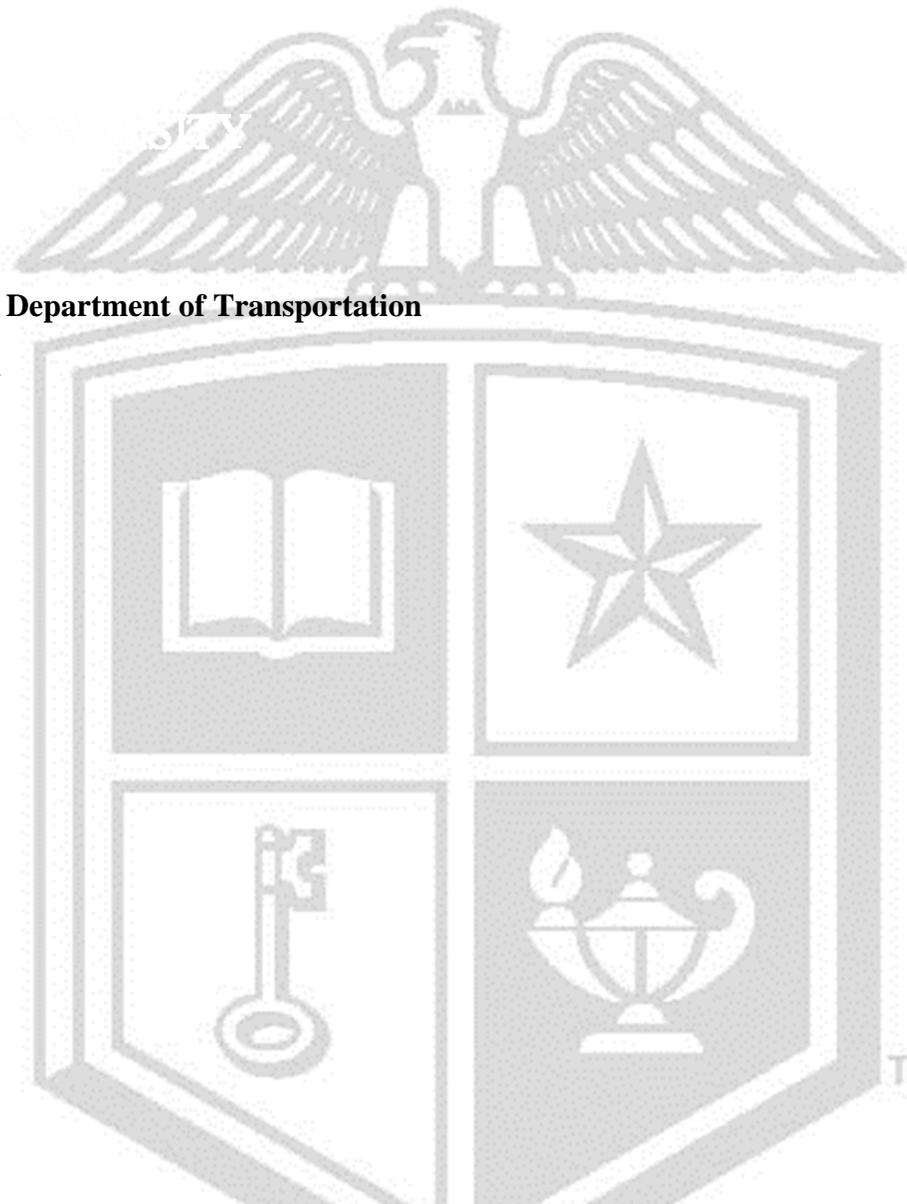
Texas Tech University
Multidisciplinary Research in Transportation

Winter Weather Management and Operations Curriculum Development and Instruction

William D. Lawson

Performed in Cooperation with the Texas Department of Transportation
And the Federal Highway Administration

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**WINTER WEATHER MANAGEMENT AND OPERATIONS CURRICULUM
DEVELOPMENT AND INSTRUCTION**

by

William D. Lawson

Texas Tech University
Project Report 5-9044-01-1
Project Number 5-9044-01

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and the
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Products

This report contains no products.

ABSTRACT

This project produced two training programs on the topic of winter weather roadway maintenance for the Texas Department of Transportation, one for management and one for operations personnel. The winter weather *management* training program consisted of curriculum development, instructional design, a pilot training course, and delivery of seven statewide training events. The winter weather *operations* training program consisted of curriculum development, instructional design, a pilot training course, and delivery of two 12-hour, instructor-led, “train-the trainer” training events. The curriculum has been designed so that the training is sustainable; that is, the winter weather training classes can be offered to TxDOT personnel by qualified trainers in future years.

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INTRODUCTION

The Texas Department of Transportation (TxDOT) authorized implementation project 5-9044-01 for the purpose of creating instructional materials and delivering training on the topic of winter weather roadway maintenance, statewide, to TxDOT management and operations personnel. This report summarizes the work performed in support of the curriculum development process, the winter weather management and operations curricula produced from this effort, and the training provided to TxDOT and other personnel.

Realization of the need for this project arose in the wake of the historic February 2011 winter storm (National Weather Service 2012, National Oceanic and Atmospheric Administration 2011) which blanketed most of Texas with snow and ice during the period when Texas was hosting Superbowl XLV in the Dallas-Fort Worth Metroplex. Whereas northern TxDOT districts such as Amarillo, Lubbock, and Childress are routinely called on to fight winter storms as part of their roadway maintenance effort, the extreme winter weather of February 2011 revealed the importance of a more coordinated, statewide winter maintenance response.

Initiated through an administrative directive to the Maintenance Division in February 2011, TxDOT formally authorized implementation project 5-9044-01 on May 31, 2011, with project oversight through RMC-P, Administration. The project budget was \$212,007 and the project duration was 15 months.

DESCRIPTION OF WORK

The project director and project advisors worked with the researchers to create a research plan to satisfy four specific administrative and functional requirements:

Training must be delivered to TxDOT maintenance professionals, statewide, *prior to* the 2011-2012 winter season.

Winter weather training must be provided at two distinct levels: management and operations.

The training project must be coordinated with and complement research project

0-6669, "Best Practices for Emergency Operations," being concurrently performed by researchers at Prairie View A&M University and the Texas Transportation Institute.

The training must be sustainable, that is, the winter weather training curricula must support ongoing instruction of maintenance personnel through TxDOT's workforce development group.

Within this broad framework, the work plan for implementation project 5-9044-01 was laid out and accomplished in eight tasks (TxDOT 2011). The first two tasks focused on collecting and synthesizing winter weather training materials and information. Tasks 3 and 4 focused on developing the curriculum and delivering the winter weather management training. Tasks 5 and 6 focused on developing the curriculum and delivering the winter weather operations training. The final two tasks focused on deliverables and project management.

WINTER WEATHER MANAGEMENT TRAINING

The key to effective winter weather maintenance response is proper planning, and relative to the implementation study, this meant that the research team should focus on management training first. The TxDOT Maintenance Supervisor and his/her Assistant Maintenance Supervisor were designated as the primary audience for the management training curriculum. The winter weather management training course is also suitable for Maintenance Management personnel, regional Fleet Managers and Equipment Supervisors, Area Engineers, Regional Directors, the Public Information Officers, and District Engineers, all of whom have a role in TxDOT's winter weather management response.

Management Curriculum Development

Design and production of the winter weather management training curriculum took place during Summer 2011. The Winter Weather Management Training curriculum represents a synthesis of TxDOT maintenance policy, national best practices research, evaluation of published winter weather maintenance training resources, interviews with TxDOT maintenance management and operations personnel, and interviews with national and international subject matter experts on winter weather roadway maintenance.

The curriculum design process involved articulation of learning objectives, followed by creation of learning modules through a series of drafts. Curriculum quality review included a dress rehearsal presentation to selected project advisors and researchers responsible for complementary project 0-6669. This was followed by a pilot training event in September 2011 for the full project monitoring committee and maintenance directors from across Texas.

In final form, the Winter Weather Management Training curriculum is a six-hour training program designed to assist TxDOT maintenance and supervisory personnel to more effectively address the issues and challenges associated with planning, organizing and responding to winter storms. This practical, common-sense, implementation-type workshop discusses snow and ice control plans, level of service, emergency operations for winter storms, weather data needed for winter maintenance decision-making, the materials and equipment used to control snow and ice, pre-season planning and preparation, and winter storm operations.

Instructional Materials

The instructional materials produced for the Winter Weather Management Training curriculum included learning objectives, lecture presentations, student manual, instructor manual, instructional aids, and end-of-course assessment exams (Lawson 2011a-f) collectively comprising Product P1 for the project. The centerpiece of the curriculum is the Student Manual, a 405-page document which presents the training in eight learning modules (Figure 1). The learning modules are:

- Module 1. Introduction
- Module 2. Level of Service
- Module 3. Organization
- Module 4. Weather
- Module 5. Materials
- Module 6. Equipment
- Module 7. Pre-Season Planning and Preparation
- Module 8. Winter Storm Operations

The typical learning module is built around lecture presentations for each topic. The instructor delivers the training through a combination of images and text presented on the slides. Learning exercises in each module provide in-depth discussion, analysis, and reflection. The modules include supplemental reference material to facilitate further study and learning. Each module closes with an application summary, accompanied by assessment and review questions.

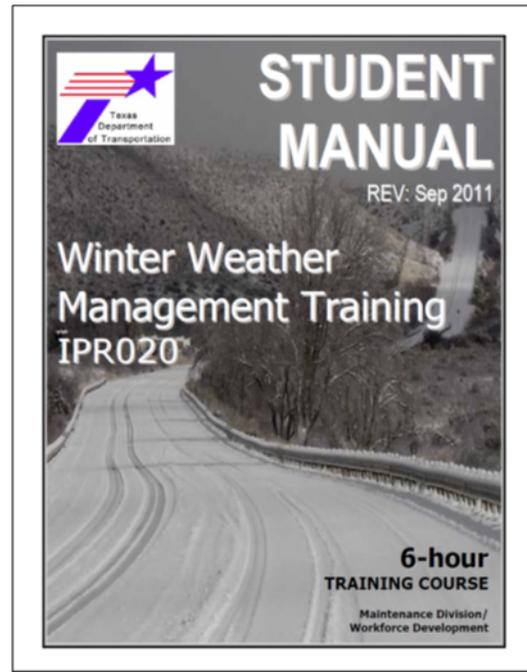


FIG. 1. Student Manual, Winter Weather Management Training

Regional Training Events

In accordance with the implementation research plan, the research team delivered the Winter Weather Management Training course statewide through a series of five regional training workshops (Figure 2). Training events were conducted both face-to-face and by video-teleconference in September through November 2011. The workshop audiences included maintenance personnel from Northwest Texas, Northeast Texas, Central Texas, Southwest Texas, and the Texas Gulf Coast. All totaled, the research team delivered the course to 692 maintenance management personnel. Assessment results showed a student completion percentage of 97 percent for the course.

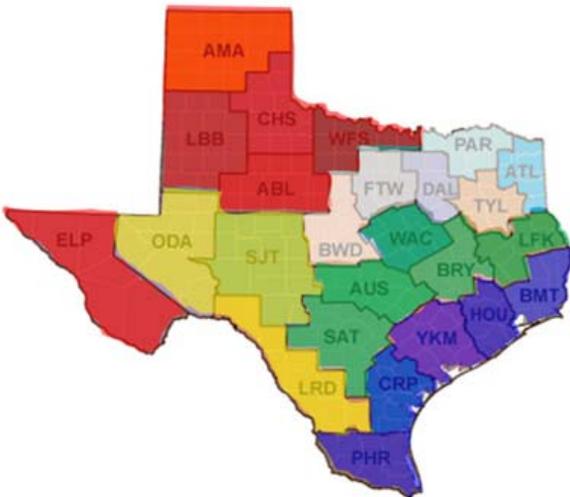


FIG. 2. Regional Events, Winter Weather Management Training

In addition to the regional training events, the research team delivered one session specific to issues associated with winter weather maintenance management in Metropolitan Areas. Furthermore, the research team made a summary presentation about the project to maintenance attendees at the 85th Annual Transportation Short Course. Collectively, the seven statewide training events comprised Product P2.

WINTER WEATHER OPERATIONS TRAINING

To complement the management training curriculum, this project also produced curriculum to help train operations personnel in accomplishing the diverse tasks associated with winter roadway maintenance operations. The Winter Weather Operations Training course was designed for operations personnel with one to three years of roadway maintenance experience. More experienced personnel including operators, crew chiefs, lead workers, assistant supervisors, and maintenance supervisors will also benefit from the instruction.

Operations Curriculum Development

Design of the Winter Weather Operations Training curriculum took place during Winter-Spring 2012. The operations curriculum builds on and extends the management curriculum, recognizing that the TxDOT Maintenance Supervisor holds the pivotal role for winter weather management and operations. Thus, the main thrust of the operations curriculum is to provide instruction on those basic tasks that Maintenance Supervisors require their personnel to perform relative to winter weather operations.

The operations curriculum development process relied heavily on information obtained from field visits, observations, and interactions with TxDOT maintenance personnel in selected areas of the State. The research team visited the Abilene, Amarillo, Atlanta, Austin, Childress, Fort Worth, and Lubbock Districts to observe and document information about snow and ice control equipment, materials, and operational practices. As with the management training, the operations curriculum design process involved articulation of learning objectives followed by creation of learning modules through a series of drafts. Curriculum quality review included a pilot training event in June 2012 for the full project monitoring committee and maintenance directors from across Texas.

While it is assumed that new maintenance employees will learn mostly through on-the-job experiences, the operations curriculum is intended to help supervisory personnel and lead workers leverage on-the-job training by providing a more generalized, systematic introduction to snow and ice operations. In final form, the Winter Weather Operations Training curriculum is a twelve-hour training program designed to instruct operations personnel on how to perform several tasks associated with responding to winter storms. Given the hands-on nature of winter maintenance activities, the operations curriculum is also more hands on with several field and equipment exercises. Safety is emphasized prominently and repeatedly throughout the training.

Instructional Materials

Similar to the management training, the instructional materials produced for the Winter Weather Operations Training curriculum include learning objectives, lecture presentations, student manual, instructor guide, instructional aids, and end-of-course assessment exams (Lawson 2012a-f) collectively comprising Product P3 for the course. The Student Manual (Figure 3) for operations is a 515-page document which presents the training in twelve learning modules. The learning modules are:

- Module 1. Introduction
- Module 2. Pre-Season Preparation
- Module 3. Mount a V-Box Spreader
- Module 4. Mount a Reversible Snow Plow
- Module 5. Pre-Trip Inspection
- Module 6. Snow and Ice Control Materials
- Module 7. Calibrate a V-Box Spreader
- Module 8. Calibrate a Liquid Spray Applicator
- Module 9. Preparing for Snow/Ice Removal
- Module 10. Snow Plowing Techniques
- Module 11. Post-Storm Cleanup
- Module 12. Course Summary and Assessment

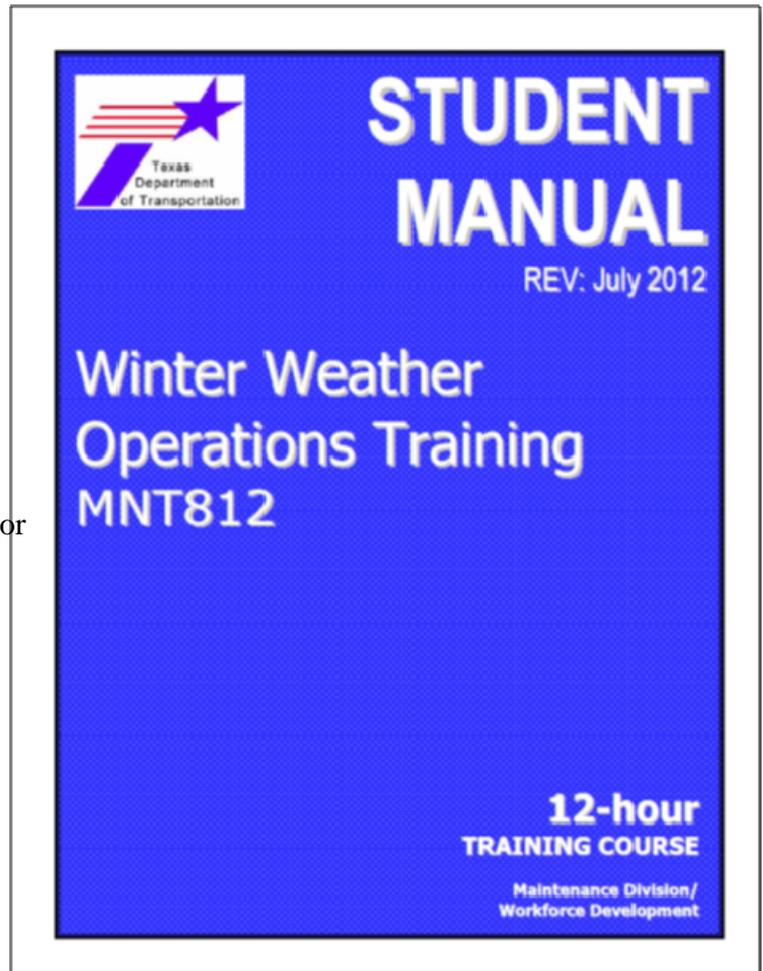


FIG. 3. Student Manual, Winter Weather Operations Training

These modules address winter maintenance tasks associated with pre-season preparation, pre-storm activities, winter storm response, and post-storm cleanup. Thus, the training identifies and provides instruction on operational tasks throughout the entire winter weather roadway maintenance cycle.

The typical learning module is built around lecture presentations for each topic. The instructor delivers the training through a combination of images and text presented on the slides. As has been noted, hand-on learning exercises feature prominently in the operations training (Figure 4). Another distinctive and popular element of the operations training is its extensive use of videos. The operations training curriculum incorporates 50 instructional videos, ranging from 00:18 to 06:07, average 2 minutes duration, and these videos provide unique instruction and commentary on various topics. Source material for the videos included purpose-made films by TxDOT personnel, training videos from the Iowa Department of Transportation, selected clips from AASHTO’s nationally-recognized Clear Roads training program, and more (Figure 5). Scripts for each video as well as other supplemental materials such as checklists and detailed descriptions of each learning exercise are included as reference materials in the Student Manual. Each module closes with assessment and review questions.



FIG. 4. Hands-on learning exercises, such as calibration of a liquid spray application rig, are a major part of the Winter Weather Operations Training curriculum.

VIDEO 3.2 (01:45)

Mount a V-Box Spreader from a Leg Stand Support

CREDIT
Childress District
Texas Department of
Transportation









MOUNT A V-BOX SPREADER

SLIDE 3.51

FIG. 5. The Winter Weather Operations Training features 50 brief instructional videos which provide unique instruction and commentary on various topics.

Train-the-Trainer Training Events

Given TxDOT's desire for a sustainable winter weather operations course, the hands-on nature of operations training, limits on class size, and the large number of maintenance personnel who require instruction each year, it was recognized that TxDOT needed to identify and prepare a significant number of instructors to deliver the training course. The approach was to train the trainers; that is, the research team that developed the curriculum would present the Winter Weather Operations Training to qualified trainers who currently provide heavy equipment and related instruction to TxDOT maintenance personnel.

Because these trainers would not necessarily be familiar with TxDOT's winter weather operations, the 848-page Instructor Guide (Figure 6) provides detailed commentary for each image and learning exercise associated with the instruction in addition to providing answers to all assessment and review questions. The commentary, instructional videos and other features combine to make the winter weather operations curriculum instructor-friendly.

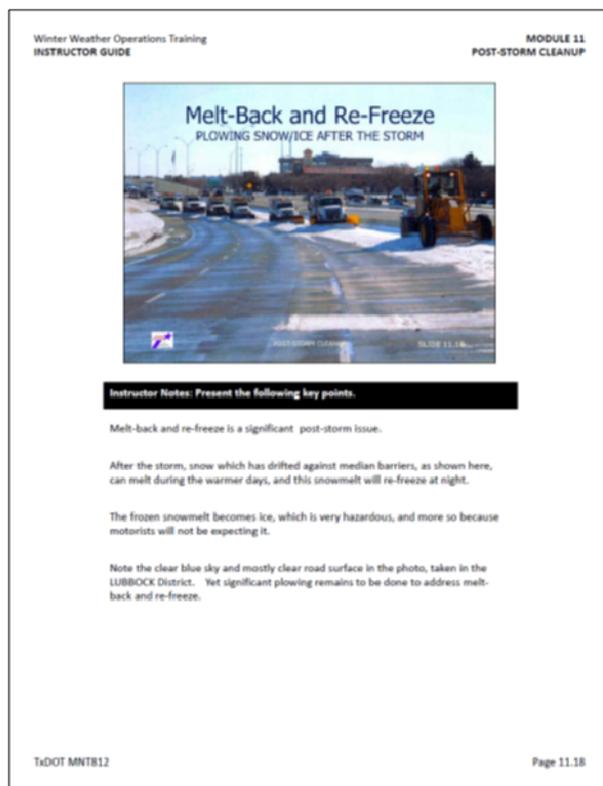
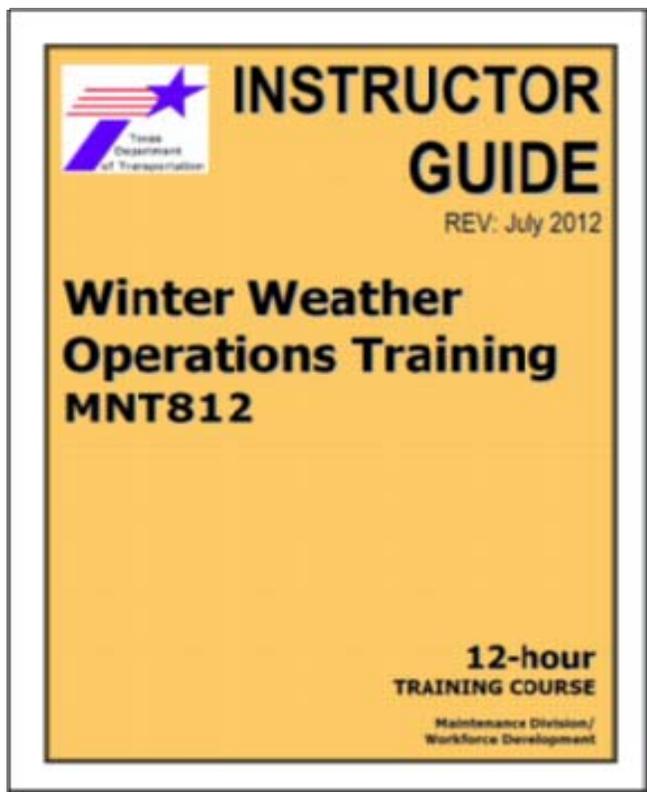


FIG. 6. The Instructor Guide, Winter Weather Operations Training

The research team conducted two Winter Weather Operations Training “train-the-trainer” events, one for trainers from the Transportation and Training Services group at the University of Texas at Arlington, and the other for trainers from the Industrial and Transportation Division at Amarillo College. This training comprised Product P4 for the course. Each of the trainers received a complete set of digital and hard copies of the Winter Weather Operations Training curriculum. They also received the formal training associated with this curriculum,

plus instruction and guidance on how to effectively deliver the training. Debriefing sessions with the Project Monitoring Committee and the researchers following the train-the-trainer sessions provided opportunity for questions, feedback, and further commentary.

SUMMARY AND CONCLUSIONS

In summary, this implementation project developed and produced two training programs on the topic of winter weather roadway maintenance, one for management and one for operations personnel. The work involved creation and production of curriculum for a 6-hour training course on management of winter weather events, and curriculum for a 12-hour training course on winter weather operations. Also included were statewide management training workshops and train-the-trainer events to facilitate ongoing operations training. The project was completed on time and within budget. Mike Taylor, Project Director, summed everything up at the project close-out meeting: “This was a great project and TxDOT got everything they were looking for.”

REFERENCES

- Lawson, William D. (2011a). "Learning Objectives," *Winter Weather Management Training (IPR020)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 09/14/2011.
- Lawson, William D. (2011b). "Lecture Presentations," *Winter Weather Management Training (IPR020)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 09/14/2011.
- Lawson, William D. (2011c). "Student Manual," *Winter Weather Management Training (IPR020)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 09/14/2011.
- Lawson, William D. (2011d). "Instructor Manual," *Winter Weather Management Training (IPR020)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 09/14/2011.
- Lawson, William D. (2011e). "Instructional Aids," *Winter Weather Management Training (IPR020)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 09/14/2011. Published with *Student Manual*.
- Lawson, William D. (2011f). "End-of-Course Assessment," *Winter Weather Management Training (IPR020)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 09/14/2011.
- Lawson, William D. (2012a). "Learning Objectives," *Winter Weather Operations Training (MNT812)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 07/28/2012.
- Lawson, William D. (2012b). "Lecture Presentations," *Winter Weather Operations Training (MNT812)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 07/28/2012.
- Lawson, William D. (2012c). "Student Manual," *Winter Weather Operations Training (MNT812)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 07/28/2012.
- Lawson, William D. (2012d). "Instructor Guide," *Winter Weather Operations Training (MNT812)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 08/29/2012.
- Lawson, William D. (2012e). "Instructional Aids," *Winter Weather Operations Training (MNT812)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 07/28/2012. Published with *Student Manual*.
- Lawson, William D. (2012f). "End-of-Course Assessment," *Winter Weather Operations Training (MNT812)*, Product P1: TxDOT 5-9044-01, TechMRT/TTU, Lubbock, TX, 07/28/2012.
- National Oceanic and Atmospheric Administration (2011). "The worst snow storms in history: Northeast Snow Impact Scale". NOAA Environmental Visualization Laboratory. Accessed 09/29/2012: <http://www.nnvl.noaa.gov/MediaDetail.php?MediaID=651&MediaTypeID=1>
- National Weather Service (2012). "Groundhog Day Blizzard, 2011". National Weather Service Weather Forecast Office, Milwaukee/Sullivan, WI. Accessed 09/29/2012: http://www.crh.noaa.gov/mkx/?n=020211_blizzard

Texas Department of Transportation (2011). "Work Plan: Winter Weather Management and Operations Curriculum Development and Instruction." Project Number 5-9044-01, May 20, 2011.



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