NCHRP
National Cooperative Highway Research Program

RESEARCH RESULTS DIGEST

March 1995 Number 206

Subject Area: IIIB Materials and Construction

Responsible Senior Program Officer: Amir N. Hanna

Training for Highway Construction Personnel

An NCHRP digest of the findings from the final report on NCHRP Project 20-25(2), "Training for Highway Construction Personnel," conducted by SNI International Resources, Inc. Mr. Lupe Carbajal served as Principal Investigator.

INTRODUCTION

Budget restrictions, loss of skilled personnel, increased responsibility placed on quality assurance personnel, the changing role of the contractor with respect to quality control, and demands to construct projects faster have all affected the highway construction process in the United States. Training of field and office personnel involved in highway construction activities is an effective approach to improving the quality of highway construction and reducing life-style costs. However, current training programs for these personnel are neither comprehensive nor widely available. There is a need to develop comprehensive training packages to support a nationally applicable training program for highway-agency, consultant, and contractor personnel. NCHRP Project 20-25(2) was initiated to address this need.

An initial phase of research was conducted under NCHRP Project 20-25, "Training Needs for Highway Construction Personnel," by the University of Maryland Transportation Studies Center and Bergstralh-Shaw-Newman, Inc. This research, completed in 1991, provided the following:

1. A comprehensive work analysis to define the activities and tasks undertaken by construction personnel.
2. A survey of existing training and certification programs and of the needs for training and certification to perform construction activities and tasks.
3. An evaluation of certification programs to determine how well they reflect construction work.
4. Development of a framework for a national construction training program with course/module titles and skeleton contents, showing the match between course/modules and both certification and the work analysis.

The national training program included 62 training courses categorized in the following 9 major areas:

1. General,
2. Traffic Control,
3. Construction Surveying,
4. Earthwork,
5. Concrete Construction and Paving,
6. Structures,
7. Asphalt Paving,
8. Landscaping, and
9. Equipment Operation.

The evaluation of certification programs concluded that the National Institute for Certification in Engineering Technologies (NICET), founded by the National Society of Professional Engineers (NSPE), is the most reliable yardstick available for measuring highway construction knowledge and ability. The examinations are rigorous and the certification by NICET is a respected credential.

A second phase of research was conducted under NCHRP Project 20-25(2), "Training for Highway Construction Personnel," by SNI International Resources, Inc. In this research, completed in 1994, the 62 courses identified in the initial research were consolidated into 45 courses by appropriately addressing issues related to equipment operation as part of the courses included in the other 8 categories, combining two of the courses in the general series, and combining the two courses in the structures series. Descriptions and lesson-plan outlines were developed for each of these courses. Also, comprehensive training packages were developed for teaching three courses: Project Documentation, Environmental Protection Procedures, and Bridges. In addition, a plan was developed for promoting and facilitating the use of the recommended training program for highway construction personnel.

This digest provides a description of the work performed in the second phase of research. The material in this digest is extracted from the final report on this project.

FINDINGS

As part of this project, course descriptions and lesson-plan outlines were developed for the course identified in the national construction training program, comprehensive training packages were developed for teaching three courses, and a plan was developed for promoting and facilitating the use of the recommended training program.

Course Descriptions and Lesson-Plan Outlines

The revised framework for a national construction training program included 45 courses categorized in 8 areas, as listed in Table 1. Descriptions and lesson-plan outlines were developed for each course. Each course description included the following elements:

1. Title and number,
2. Scope statement,
3. Behavioral objectives,
4. Target audience,
5. Overall course length (in hours),
6. Instructor's qualifications,
7. NICET Work Elements references, and
8. Related available training materials and references.

Each lesson-plan outline included the following elements:

1. An outline identifying course elements;
2. Time devoted to each course element;
3. Required training aids and other media;
4. Required logistical support; and
5. Related reference, training aids, instructor's materials, and NICET Work Elements.

Training Packages

Comprehensive training packages were developed for teaching these courses: Project Documentation, Environmental Protection Procedures, and Bridges and Minor Drainage Structures. Each training package included an instructor's guide and a participant workbook. The instructor's guide included the following material:

1. A macro outline (1 page);
2. A detailed lesson plan;
3. Audio-visual aids;
4. Training aids, such as charts, graphs, and maps;
5. Preparation checklists to assist the instructor in preparing for and conducting the course;
6. Laboratory/field checklists to assist the instructor in preparing for lab and field sessions; and
7. Instructor's self-evaluation to assist the instructor in evaluating his/her performance.

The participant's workbook included workbooks, practice exercises, and reference materials.

Plan for Promoting Use of the Training Program

A plan has been developed to promote and facilitate the use of the training program and project products by highway agencies, contractors, consultants, and other construction agencies, and to improve the skills of highway construction personnel. The plan stipulates involvement by all organizations involved in construction and training activities, including the Federal Highway Administration, state highway agencies, contractors,

TABLE 1 Framework for a national construction training program

General Series

GEN-1: Contents of Standard References
GEN-2: Interpreting Contract Plans
GEN-3: Construction Mathematics
GEN-4: Project Documentation
GEN-5: Governmental Requirements
GEN-6: First-Aid Procedures
GEN-7: General Safety
GEN-8: Environmental Protection Procedures

Traffic Control Series

TRC-1: Work Zone Traffic Control Devices I
TRC-2: Work Zone Traffic Control Devices II
TRC-3: Work Zone Traffic Control
TRC-4: Guardrail and Median Barrier
TRC-5: Guardrail Installation
TRC-6: Median Barrier Installation
TRC-7: Electrical Systems for Signs, Signals, and Lighting
TRC-8: Foundations for Signs, Signals, and Lighting
TRC-9: Breakaway Sign Installation
TRC-10: Traffic Signals and Lighting
TRC-11: Pavement Markings
TRC-12: Fences and Screens

Construction Surveying Series

SRV-1: Surveying I
SRV-2: Surveying II
SRV-3: Surveying III

Landscaping Series

LND-1: Roadway Landscaping I
LND-2: Roadway Landscaping II

Earthwork Series

EWK-1: Soils and Aggregates
EWK-2: Clearing and Grubbing
EWK-3: Excavation
EWK-4: Embankment

TRANSPORTATION RESEARCH BOARD
National Research Council
2101 Constitution Avenue, N.W.
Washington, DC 20418

000021-02 *
Materials Engineer
Idaho DOT
P O Box 7129
Boise ID 83707-1129

TABLE 1 Framework for a national construction training program (continued)

Concrete Series
PCC-1: Forms, Falsework, and Reinforcement PCC-2: Concrete Delivery and Testing PCC-3: Standard Concrete Operations PCC-4: Concrete Paving Equipment Requirements PCC-5: Concrete Paving Operations PCC-6: Concrete Pavement Joint Construction PCC-7: Central-Mix and Concrete Batch Plants
Structures Series
STR-1: Bridges and Minor Drainage Structures
Asphalt Pavement Construction Series
ASP-1: Asphalt Paving Equipment ASP-2: Surface Preparation ASP-3: Asphalt Paving Operations ASP-4: Asphalt Pavement Joints ASP-5: Roller Operations—Asphalt ASP-6: Asphalt Materials and Testing ASP-7: Bituminous Batch and Drum Facilities ASP-8: Asphalt Plant Calibration

consultants, and associations. The plan has identified the following seven action items as necessary for achieving the goals of the program:

1. Place the training program materials in depositories for easy access by end-users. The National Highway Institute (NHI) has been suggested as a candidate for a central depository with the national offices of the Associated General Contractors (AGC) and the American Public Work Associations (APWA), and selected highway agencies as candidates for secondary depositories.
2. Create a "promotion" team, consisting of representatives of state highway agencies, construction contractors, and associations, to develop and present a "road show" to promote use of the training program and materials.
3. Present and describe the training program and materials at national conferences, workshops, and meetings, such as those of the Transportation Research Board (TRB), APWA, and AGC.
4. Enlist training personnel of state highway agencies, associations, and other organizations to assist with the different aspects of the training program.
5. Enlist state transportation executives' support and advocacy for the training program.
6. Encourage minority and women's associations and organizations, including individual contractors and consultants, involved in the different aspects of construction to use the training program and materials.
7. Establish a "news release" system to provide regular updates to training program users.

Finally, the plan calls for formulating a strategy to implement the recommended action items through a meeting of officials from AASHTO, NHI,

NCHRP, AGC, APWA, and other organizations involved in construction and training activities. This strategy will identify the role of each involved organization, the funds needed to ensure dissemination of related information, and potential sources of funds.

CONCLUSIONS

The need for training field and office personnel involved in highway construction activities as a means to improve the quality of highway construction and reduce life-cycle costs has been recognized by state highway agencies, construction contractors, consultants, and other organizations. The initial phase of research laid the groundwork for a training series that can provide considerable benefit to highway construction workers and inspectors nationwide and in turn to the traveling public and taxpayers.

A framework for a national construction training program that encompasses 45 courses categorized in 8 major areas has been developed. Descriptions and lesson plans for each of these courses and comprehensive training packages for three courses were developed. Also, a plan was developed for promoting and facilitating the use of the recommended training program for highway construction personnel.

To support a fully developed national training program, it is necessary to develop comprehensive training packages for the remainder of the 45 courses. In a step toward accomplishing this objective, training packages will be developed for 12 additional courses under a third phase of research to be conduced under NCHRP Project 20-25(3), "Development of Training Material for Highway Construction Personnel."

FINAL REPORT

The agency final report, titled "Training for Highway Construction Personnel," gives a detailed account of the project, the findings, and the conclusions. The report has been prepared in eight parts: a summary report, course outlines, and an instructor guide and a participant workbook for each of the three courses: Project Documentation, Environmental Protection Procedures, and Bridges. The report has been distributed to NCHRP sponsors (i.e., the state transportation departments) and the T^2 centers. The report is available for loan or purchase ($75.00) to others on request to the Transportation Research Board, Box 289, Washington, DC 20055. Also, as part of this project, the agency has produced two short videotapes pertaining to project documentation and environmental protection issues. Copies of the videotapes have also been distributed to NCHRP sponsors and all the T^2 centers, and for a limited time, copies will be available on a loan basis or for purchase ($10.00 each) on request to the Transportation Research Board.

ACKNOWLEDGMENTS

The research summarized herein was performed under NCHRP Project 20-25(2) by SNI International Resources, Inc., Phoenix, Arizona. Mr. Lupe Carbajal served as Principal Investigator.