ANSI/ASSE A10.47-2009
Work Zone Safety
for Highway Construction

American National Standard
for Construction and Demolition Operations
The information and materials contained in this publication have been developed from sources believed to be reliable. However, the American Society of Safety Engineers (ASSE) as secretariat of the ANSI accredited A10 Committee or individual committee members accept no legal responsibility for the correctness or completeness of this material or its application to specific factual situations. By publication of this standard, ASSE or the A10 Committee does not ensure that adherence to these recommendations will protect the safety or health of any persons, or preserve property.
ANSI®
ANSI/ASSE A10.47 – 2009

American National Standard
Construction and Demolition Operations
Work Zone Safety
for Highway Construction

Secretariat

American Society of Safety Engineers
1800 East Oakton Street
Des Plaines, Illinois 60018-2187

Approved November 24, 2009
Effective February 24, 2010

American National Standards Institute, Inc.
Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus and other criteria for approval have been met by the standards developer. Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered and that a concerted effort be made toward their resolution. The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he/she has approved the standards or not, from manufacturing, marketing, purchasing or using products, processes or procedures not conforming to the standards. The American National Standards Institute does not develop standards and will in no circumstance give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretation should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

Caution Notice: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute requires that action be taken periodically to reaffirm, revise or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Published January, 2010 by

American Society of Safety Engineers
1800 East Oakton Street
Des Plaines, Illinois 60018-2187
(847) 699-2929 • www.asse.org

Copyright © 2009 by American Society of Safety Engineers
All Rights Reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Printed in the United States of America
Foreword

(This Foreword is not a part of American National Standard A10.47-2009.)

This standard is one of a series of safety standards that have been formulated by the Accredited Standards Committee on Safety in Construction and Demolition Operations, A10. It is expected that the standards in the A10 series will find a major application in industry, serving as a guide to contractors, labor, and equipment manufacturers. For the convenience of users, a list of existing and proposed standards in the A10 series for Safety Requirements in Construction and Demolition Operations follows.

A10.1 Pre-Planning for Construction Safety and Health (under development)
A10.2 Safety, Health, and Environmental Training (under development)
A10.3 Powder-Actuated Fastening Systems
A10.4 Personnel Hoists and Employee Elevators
A10.5 Material Hoists
A10.6 Demolition Operations
A10.7 Transportation, Storage, Handling, and Use of Commercial Explosives and Blasting Agents
A10.8 Scaffolding
A10.9 Concrete and Masonry Construction
A10.10 Temporary and Portable Space Heating Devices
A10.11 Personnel and Debris Nets
A10.12 Excavation
A10.13 Steel Erection
A10.15 Dredging
A10.16 Tunnels, Shafts, and Caissons
A10.17 Safe Operating Practices for Hot Mix Asphalt (HMA) Construction
A10.18 Temporary Roof and Floor Holes, Wall Openings, Stairways, and Other Unprotected Edges
A10.19 Pile Installation and Extraction Operations
A10.20 Ceramic Tile, Terrazzo, and Marble Work
A10.21 Safe Construction and Demolition of Wind Generation/Turbine Facilities (under development)
A10.22 Rope-Guided and Non-Guided Workers’ Hoists
A10.24 Roofing – Safety Requirements for Low-Sloped Roofs
A10.25 Sanitation in Construction
A10.26 Emergency Procedures for Construction Sites (under development)
A10.27 Hot Mix Asphalt Facilities
A10.28 Work Platforms Suspended from Cranes or Derricks
A10.29 Aerial Platforms in Construction (under development)
A10.31 Digger-Derricks
A10.32 Personal Fall Protection Used in Construction and Demolition Operations
A10.33 Safety and Health Program Requirements for Multi-Employer Projects
A10.34 Public Protection
A10.36 Railroad Construction Safety (under development)
A10.37 Debris Nets
A10.38 Basic Elements of a Program to Provide a Safe and Healthful Work Environment
A10.39 Construction Safety and Health Audit Program
A10.40 Reduction of Musculoskeletal Problems in Construction
A10.41 Equipment Operator and Supervisor Qualifications and Responsibilities (under development)
A10.42 Rigging Qualifications and Responsibilities in the Construction Industry
A10.43 Confined Spaces in Construction (under development)
A10.44 Lockout/Tagout in Construction
A10.46 Hearing Loss Prevention
A10.47 Highway Construction Safety
One purpose of these standards is to serve as guides to governmental authorities having jurisdiction over subjects within the scope of the A10 Committee standards. If these standards are adopted for governmental use, the reference of other national codes or standards in individual volumes may be changed to refer to the corresponding regulations.

Revisions: The A10 Committee welcomes proposals for revisions to this standard. Revisions are made to the standard periodically (usually five years from the date of the standard) to incorporate changes that appear necessary or desirable, as demonstrated by experience gained from the application of the standard. Proposals should be as specific as possible, citing the relevant paragraph number(s), the proposed wording, and the reason for the proposal. Pertinent documentation would enable the A10 Committee to process the changes in a more timely manner.

Interpretations: Upon a request in writing to the Secretariat, the A10 Committee will render an interpretation of any requirement of the standard. The request for interpretation should be clear, citing the relevant paragraph number(s) and phrased as a request for a clarification of a specific requirement. Oral interpretations are not provided.

No one but the A10 Committee (through the A10 Secretariat) is authorized to provide any interpretation of this standard.

Approval: Neither the A10 Committee nor American National Standards Institute (ANSI) "approves," "certifies," "rates," or "endorses" any item, construction, proprietary device, or activity.

Appendices: Appendices are included in most standards to provide the user with additional information related to the subject of the standard. Appendices are not part of the approved standard.

Committee Meetings: The A10 Committee meets twice a year. Persons wishing to attend a meeting should contact the Secretariat for information.

Standard Approval: This standard was processed and approved for submittal to ANSI by the American National Standards Committee on Safety in Construction and Demolition Operations, A10. Approval of the standard does not necessarily imply (nor is it required) that all Committee members voted for its approval. At the time this standard was approved, the A10 Committee had the following members:
<table>
<thead>
<tr>
<th>Organization Represented</th>
<th>Name of Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accident Prevention Corporation</td>
<td>Frank Burg, CSP</td>
</tr>
<tr>
<td>Aegis Corporation</td>
<td>Michael Serpe, ASP</td>
</tr>
<tr>
<td>Aerial Work Platform Training, Inc.</td>
<td>Matthew J. Burkart, P.E.</td>
</tr>
<tr>
<td>Alstom Power</td>
<td>Judith Burkart</td>
</tr>
<tr>
<td>American Insurance Services Group</td>
<td>Dennis W. Eckstine</td>
</tr>
<tr>
<td>ASCE - Construction Institute Committee</td>
<td>Robert Renney</td>
</tr>
<tr>
<td>American Society of Safety Engineers</td>
<td>Ted P. Sharp</td>
</tr>
<tr>
<td>Asbestos Workers International Union</td>
<td>Edward Campbell</td>
</tr>
<tr>
<td>Associated Builders and Contractors, Inc.</td>
<td>James G. Borchardt, CSP, CPE</td>
</tr>
<tr>
<td>Associated General Contractors of America, The</td>
<td>Harlan Fair, P.E.</td>
</tr>
<tr>
<td>Association of Union Constructors, The</td>
<td>Laura Ciampa</td>
</tr>
<tr>
<td>A-Z Safety Resources, Inc.</td>
<td>Allen Macenski, CSP, J.D.</td>
</tr>
<tr>
<td>Barton-Malow Company</td>
<td>A. David Brayton, CSP, CPC</td>
</tr>
<tr>
<td>Black &amp; Veatch</td>
<td>Terry Lynch</td>
</tr>
<tr>
<td>Building &amp; Construction Trades Department</td>
<td>Jim E. Lapping, MS, P.E., CSP</td>
</tr>
<tr>
<td>Center for Construction Research &amp; Training, The</td>
<td>Michael W. Hayslip, Esq., P.E., CSP</td>
</tr>
<tr>
<td>Capital Safety Group</td>
<td>Chris Williams</td>
</tr>
<tr>
<td>Clark Construction Group</td>
<td>James Brown</td>
</tr>
<tr>
<td>Cole-Preferred Safety Consulting, Inc.</td>
<td>Kevin Cannon</td>
</tr>
<tr>
<td>DTE Energy Services</td>
<td>William Treharne, P.E.</td>
</tr>
<tr>
<td>ECI Safety Services Co.</td>
<td>Wayne Creasap, II</td>
</tr>
<tr>
<td>Edison Electric Institute</td>
<td>Jane F. Williams, CPEA, CCA</td>
</tr>
<tr>
<td>E. I. Du Pont de Nemours &amp; Company</td>
<td>Mark Klimbal, CSP, ARM</td>
</tr>
<tr>
<td></td>
<td>Clayton Shafer</td>
</tr>
<tr>
<td></td>
<td>Richard F. King, CSP</td>
</tr>
<tr>
<td></td>
<td>John H. Borowski, CIH, CSP</td>
</tr>
<tr>
<td></td>
<td>Pete Stafford</td>
</tr>
<tr>
<td></td>
<td>Jim Platner, Ph.D., CIH</td>
</tr>
<tr>
<td></td>
<td>Mike McCann, Ph.D., CIH</td>
</tr>
<tr>
<td></td>
<td>Pete Stafford</td>
</tr>
<tr>
<td></td>
<td>Scott C. Casebolt</td>
</tr>
<tr>
<td></td>
<td>J. Thomas Wolner, P.E.</td>
</tr>
<tr>
<td></td>
<td>Tim Sirofchuck, CSP</td>
</tr>
<tr>
<td></td>
<td>Jack Duley</td>
</tr>
<tr>
<td></td>
<td>Barry Cole</td>
</tr>
<tr>
<td></td>
<td>Philip L. Colleran</td>
</tr>
<tr>
<td></td>
<td>Trent L. McClellan, CSP</td>
</tr>
<tr>
<td></td>
<td>Tony Tarrance, CSP</td>
</tr>
<tr>
<td></td>
<td>Anthony Merisola</td>
</tr>
<tr>
<td></td>
<td>Patrick Brennan, MA, CHSM, CSSM</td>
</tr>
<tr>
<td></td>
<td>R. Lee Reed, Jr.</td>
</tr>
<tr>
<td></td>
<td>Charles Kelly</td>
</tr>
<tr>
<td></td>
<td>Gary Birchall</td>
</tr>
<tr>
<td></td>
<td>Ronald Probasco, CSP</td>
</tr>
</tbody>
</table>
Elevator Industry Preservation Fund
John Quackenbush
Rod Gilles

Ellis Fall Safety Solutions
J. Nigel Ellis, P.E., CSP, CPE
John Whitty, P.E.

Gilbane Building Co.
Anthony O’Dea, CSP, CHST
Charles Praul, Jr.

Richard D. Hislop
Richard Hislop

Institute of Makers of Explosives
Lon D. Santis
J. Christopher Ronay

International Association of Bridge, Structural, Ornamental and Reinforcing Iron Workers
Frank Migliaccio, Jr.

International Brotherhood of Boilermakers
Roger Erickson

International Brotherhood of Electrical Workers
James Tomaseski

International Brotherhood of Teamsters
Michael W. Watson, CIH, CSP

International Safety Equipment Association
Cristine Fargo

International Union of Bricklayers & Allied Craftworkers
Michael Kassman, CHST
Eileen Betit

International Union of Operating Engineers
Emmett Russell
Steve Brown

Jack L. Mickle & Associates
Jack Mickle, Ph.D., P.E.
Steve Stock, P.E., PLS

Laborers’ International Union of North America
Scott Schneider, MS, CIH
Walter A. Jones, MS

Marsh USA, Inc.
Timothy Bergeron, CSP

Maryland Occupational Safety & Health
Mischelle Vanreusel

Mechanical Contractors Association of America
Roger Campbell, MS, CSP

MYR Group, Inc.
Peter Chaney, MS, CSP

National Association of Home Builders
Joseph Branco

National Association of Railroad Safety Consultants & Investigators
Robert Matuga

National Electrical Contractors Association
Lewis Barbe, P.E., CSP, CRSP

National Institute for Occupational Safety & Health
Michael J. Johnston

National Railroad Contractors & Maintenance Association
Jerry Rivera

National Roofing Contractors Association
Thomas G. Bobick, Ph.D., P.E., CSP, CPE

National Society of Professional Engineers
Matt Gillen, CIH

Operative Plasterers and Cement Masons International Association
Jeffrey D. Meddin, CSP, CHCM

Phoenix Fabricators and Erectors, Inc.
Harry Dietz

Powder Actuated Tool Manufacturer’s Institute
Tom Shanahan

Power Consultants, Incorporated
E. Ross Curtis, P.E., DFE

Professional Safety Consultants, Inc.
Paul Swanson, P.E.
Subgroup A10.47 had the following members:

Scott Schneider (Chairman)
Camille Villanova (Liaison)
David Ackerman
Timothy J. Bergeron, CSP
James G. Borchardt, CSP, CPE
Janice Comer Bradley, CSP
James E. Bryden, P.E.
Frank Burg, CSP
Julie Carter-Simon
Una Connolly
Tim Cox
Tapan K. Datta, Ph.D., P.E.
Donald Elisburg
Cristine Fargo
David E. Fosbroke
Mike Gostovich

John Barnhard
Brian Becker
Ellen B. Stewart, CSP
Patrick Finn, P.E.
Leslie Bermudez
Mark Fullen
Brandon Takacs
Thomas Trauger
Larry Freiert
Greg Thompson
Jeffrey D. Meddin, CSP, CHCM
# Contents

<table>
<thead>
<tr>
<th>SECTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. General</td>
<td>11</td>
</tr>
<tr>
<td>1.1 Scope</td>
<td>11</td>
</tr>
<tr>
<td>1.2 Purpose</td>
<td>11</td>
</tr>
<tr>
<td>1.3 Exceptions</td>
<td>11</td>
</tr>
<tr>
<td>2. Referenced Standards</td>
<td>11</td>
</tr>
<tr>
<td>2.1 Related American National Standards</td>
<td>11</td>
</tr>
<tr>
<td>2.2 Other Standards</td>
<td>12</td>
</tr>
<tr>
<td>3. Definitions</td>
<td>12</td>
</tr>
<tr>
<td>4. Traffic Control</td>
<td>15</td>
</tr>
<tr>
<td>4.1 General Requirements</td>
<td>15</td>
</tr>
<tr>
<td>4.2 Transportation Management Plan (TMP)</td>
<td>15</td>
</tr>
<tr>
<td>4.3 Communicating Plans</td>
<td>15</td>
</tr>
<tr>
<td>4.4 Positive Protection Measures</td>
<td>15</td>
</tr>
<tr>
<td>4.5 Set Up and Removal of Traffic Control Devices</td>
<td>15</td>
</tr>
<tr>
<td>4.6 Inspections of Traffic Control Set Up</td>
<td>16</td>
</tr>
<tr>
<td>4.7 Removal of Traffic Control Devices When Work is Inactive</td>
<td>16</td>
</tr>
<tr>
<td>4.8 Speed Reductions/Management</td>
<td>16</td>
</tr>
<tr>
<td>4.9 Construction Vehicles</td>
<td>17</td>
</tr>
<tr>
<td>4.10 Aerial Lifts</td>
<td>17</td>
</tr>
<tr>
<td>4.11 Use of Automated Flagger Assist Devices (AFADs)</td>
<td>19</td>
</tr>
<tr>
<td>5. Flagger Safety</td>
<td>17</td>
</tr>
<tr>
<td>5.1 Use of Flaggers</td>
<td>17</td>
</tr>
<tr>
<td>5.2 Positioning</td>
<td>17</td>
</tr>
<tr>
<td>5.3 Visibility</td>
<td>17</td>
</tr>
<tr>
<td>5.4 Escape Path</td>
<td>17</td>
</tr>
<tr>
<td>5.5 Requirements for Flaggers</td>
<td>17</td>
</tr>
<tr>
<td>5.6 Advance Warning Signs</td>
<td>18</td>
</tr>
<tr>
<td>5.7 Stop/Slow Paddles</td>
<td>18</td>
</tr>
<tr>
<td>5.8 Flagger Training Requirements</td>
<td>18</td>
</tr>
<tr>
<td>5.9 Training Records</td>
<td>18</td>
</tr>
<tr>
<td>5.10 Communication Between Flaggers</td>
<td>18</td>
</tr>
<tr>
<td>5.11 Use of Automated Flagger Assist Devices (AFADs)</td>
<td>19</td>
</tr>
<tr>
<td>5.12 Response to Frustrated Motorists</td>
<td>19</td>
</tr>
<tr>
<td>5.13 Intrusion Warning Devices</td>
<td>19</td>
</tr>
<tr>
<td>6. Runover/Backover Prevention</td>
<td>19</td>
</tr>
<tr>
<td>6.1 Mirrors</td>
<td>19</td>
</tr>
<tr>
<td>6.2 Backing Construction Vehicles and Equipment</td>
<td>19</td>
</tr>
<tr>
<td>6.3 Internal Traffic Control Plans (ITCP)</td>
<td>20</td>
</tr>
<tr>
<td>6.4 Access and Egress to Work</td>
<td>20</td>
</tr>
<tr>
<td>7. Equipment Operator Safety</td>
<td>20</td>
</tr>
<tr>
<td>7.1 Inspection and Maintenance of Equipment</td>
<td>20</td>
</tr>
<tr>
<td>7.2 Lockout/Tagout</td>
<td>20</td>
</tr>
<tr>
<td>7.3 Roll-Over Protection Structures (ROPS) and Seatbelts</td>
<td>20</td>
</tr>
<tr>
<td>7.4 Operator Qualifications</td>
<td>21</td>
</tr>
<tr>
<td>7.5 Multiple Person Occupancy</td>
<td>21</td>
</tr>
<tr>
<td>8. Excavation Safety</td>
<td>21</td>
</tr>
<tr>
<td>9. Electrical Safety (Underground Utilities and Overhead Power Lines)</td>
<td>21</td>
</tr>
<tr>
<td>9.1 Underground Installations</td>
<td>21</td>
</tr>
<tr>
<td>9.2 Overhead High Voltage Lines, Installations, and Equipment</td>
<td>22</td>
</tr>
<tr>
<td>10. Power Tool Safety</td>
<td>23</td>
</tr>
<tr>
<td>10.1 Guarding</td>
<td>23</td>
</tr>
<tr>
<td>10.2 Vibration</td>
<td>23</td>
</tr>
</tbody>
</table>
11. Fall Prevention .................................................................................................. 23
   11.1 Walking and Working Surfaces ............................................................... 23
   11.2 Working at Heights .................................................................................. 24
   11.3 Floor Openings/Holes .............................................................................. 24
   11.4 Access/Egress to Equipment .................................................................. 24
   11.5 Ladders .................................................................................................... 24
   11.6 Scaffolds .................................................................................................. 24
   11.7 Excavations ............................................................................................. 24
12. Reduction of Musculoskeletal Problems ........................................................... 24
   12.1 General .................................................................................................... 24
13. Protection from Health Hazards ........................................................................ 24
   13.1 Health Hazards ........................................................................................ 24
   13.2 Potential Major Health Hazards ............................................................... 24
   13.3 Hierarchy of Controls ............................................................................... 25
   13.4 Administrative Controls ............................................................................ 25
   13.5 Personal Protective Equipment ............................................................... 25
   13.6 Extreme Temperatures ............................................................................ 25
   13.7 Dermal Hazards ....................................................................................... 25
   13.8 Concrete/Masonry Cutting ....................................................................... 25
14. Illumination Requirements for Night Work ........................................................ 25
   14.1 Illumination Plan ...................................................................................... 25
   14.2 Illumination Levels ................................................................................... 25
   14.3 Vehicle Lights .......................................................................................... 26
   14.4 Glare Control ........................................................................................... 26
15. Personal Protective Equipment ......................................................................... 26
   15.1 High-Visibility Safety Apparel ................................................................. 26
   15.2 Head Protection ....................................................................................... 26
   15.3 Eye and Face Protection ......................................................................... 26
   15.4 Hearing Protection ................................................................................... 26
   15.5 Other Personal Protective Equipment ..................................................... 27
16. Paving Operations ............................................................................................. 27
   16.1 General .................................................................................................... 27
AMERICAN NATIONAL STANDARD A10.47
WORK ZONE SAFETY FOR HIGHWAY CONSTRUCTION

1. GENERAL

1.1 Scope. This standard covers workers engaged in construction, utility work, maintenance, or repair activities on any area of a highway.

1.2 Purpose. Establishes the minimum requirements for the construction and maintenance of public and private highways and roads to achieve the following objectives:

1. Prevent worker injuries and illnesses resulting from working in work zones.

2. Establish safe work practices in highway work zones.

3. Prevent vehicular crashes in highway work zones.

1.3 Exceptions. In cases of practical difficulties, unnecessary hardships or new developments, the enforcing authority may grant exceptions to literal requirements of this standard. These exceptions may permit the use of other devices or methods, but only when it is clearly indicated that equivalent safety and permanent installation are thereby secured.

2. REFERENCED STANDARDS

2.1 Related American National Standards. The following American National Standards are referred to, supplement or are related to this document. All provisions of the referenced standards that are applicable to demolition operations shall be observed. When the following American National Standards are superseded by a revision approved by the American National Standards Institute, the revision shall apply:

- ANSI S3.40, Anti-Vibration Gloves
- ANSI/ASSE A10.12, Safety Requirements for Excavation
- ANSI/ASSE A10.32, Fall Protection Systems for Construction and Demolitions
- ANSI/ASSE A10.40, Reduction of Musculoskeletal Problems in Construction
- ANSI/ASSE A10.33, Safety and Health Program Requirements for Multi-Employer Projects
- ANSI/ASSE A10.38, Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment
- ANSI/ASSE A10.44, Control of Energy Sources (Lockout/Tagout) for Construction and Demolitions Operations
- ANSI/ASSE A10.46, Hearing Loss Prevention in Construction and Demolition Workers
- ANSI/ISEA 107, High Visibility Safety Apparel and Headwear
- ANSI/ISEA Z87.1, Occupational and Educational Personal Eye and Face Protection Devices
- ANSI/AIHA Z88.6, Respiratory Protection - Respirator Use - Physical Qualifications for Personnel
- ANSI/ISEA Z89.1, Industrial Head Protection