Newsletter for the
Light Gauge Steel Engineers Association
April 2000

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Upcoming Events

LGSEA Committee Meetings Las Vegas, NV *Info.: (615) 279-9251*	Apr 29-30
Association of Wall & Ceiling Contractors (AWCI) - Convention/TradeShow Las Vegas, NV *Info.: (703) 534-8300*	Apr 29 - May 3
Cold-Formed Steel Design Seminars Las Vegas Philadelphia New York City *Info.: (615) 279-9251*	 May 1 May 19 May 20
LGSEA Meetings and Seminars San Francisco Bay Area *Info.: (615) 279-9251* Honolulu, HI	June 29-30
LGSEA Meetings and Seminars Atlanta, GA *Info.: (615) 279-9251*	Oct 31- Nov 2

CHAPTER MEETINGS

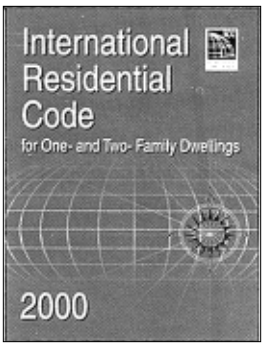
For information, call:

Hawaii Chapter	*(808) 485-1400*
Atlanta/Southeast Chapter	*(615) 242-0023*
Europe Chapter	*(615) 279-9251*
	or 34 610 474 582

New Building Codes and Their Impact on Cold-Formed Steel Framing

by H. W. Martin, PE, Sr. Regional Director of Construction Codes and Standards
American Iron and Steel Institute

As you read this edition of the LGSEA Newsletter the International Building Code and International Residential Code will be available. Yes, the first editions are finally on the street. The publishing of these documents culminates five years of hard work by hundreds of dedicated individuals. This article will briefly discuss what is new in these codes as they relate to cold-formed steel framing.

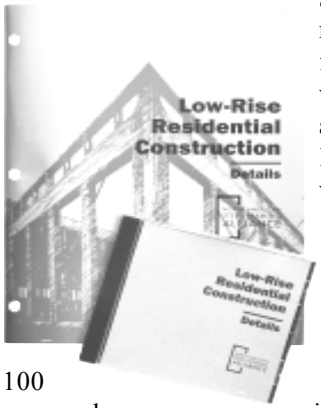


The IBC and IRC were developed by the International Codes Council. The ICC was established in 1994 by the three model code organizations, Building Officials and Code Administrators International, the International Conference of Building Officials and the Southern Building Code Congress International. The goal of the ICC was to develop a single set of comprehensive and coordinated national codes. With the publishing of the IBC and IRC the three model code organizations have ceased publishing their respective codes as well as the One and Two Family Dwelling Code.

Continued on page 2

New Standard Engineering Details Released

A new comprehensive set of efficient construction details for residential steel framing, have recently been released. Developed by the Light Gauge Steel Engineers Association (LGSEA) for the North American Steel Framing Alliance (NASFA), the ***Low-Rise Residential Construction Details*** are based on best practices observed in the field for the past ten years.



The ***Details*** is available as a book (item NT6-00) and includes more than 100 practical drawings covering general applications, floors, load bearing walls, non-load bearing walls, roofs and miscellaneous figures. The publication is also available in CD-ROM format (item NT7-00), containing DWG (AutoCAD version 14 required), DXF and WMF files, and a PDF file of the printed version.

NASFA published the ***Details*** because it saw a need among engineers and builders for useful and accurate details that work not only on paper, but also in the field. "The learning curve associated with designing and building light gauge steel framed structures can be one of the most cost-intensive and daunting aspects of steel framing for builders, framers and engineers," said Don Moody, NASFA President. "While most builders and framers are familiar with wood framing details, very few have a similar understanding of how to use steel framing."

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Newsletter for the Light Gauge Steel Engineers Association

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The LGSEA Newsletter is published by LGSEA

Building Codes and Cold-Formed Steel

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The IRC is a new code for the construction of one and two family dwellings and townhouses three stories or less in height. Unlike it's predecessor code, the One and Two Family Dwelling Code, the IRC is mandatory for the dwellings within its scope. The IRC provides prescriptive framing rules and does not include engineering design requirements. Where a structure is to be engineered that portion requiring engineering is to be done in accordance with the IBC, the remainder however will still fall under the IRC.

The steel framing portion of the code is limited to two story buildings and the requirements are similar to the ICC One and Two Family Dwelling Code except that in high wind areas where the wind speed is greater than 110 MPH (3 sec. gust) or in Seismic Design Category D and above there are entirely new requirements. These requirements include the option of building segmented or perforated shear walls. A segmented shear wall (Type I) is one without openings and has overturning anchors at the end of each wall segment. The design values for Type I walls are based upon the shear wall provisions in the IBC. A perforated shear wall (Type II) is a fully sheathed wall, is permitted to have openings and only has overturning anchors at the ends of the entire wall.

The design values for the perforated wall are based upon research performed by Dr. Dan Dolan at Virginia Polytechnic University and funded by AISI. These tests confirmed that the design approach developed by the wood industry is valid for walls framed with steel studs. Thus the design approach for Type II walls is consistent with the approach used for the design of wood framed shear walls.

The IRC contains a new way of sizing shear walls for steel framed dwelling construction. This new seismic design approach was developed under contract with AISI, and is not found in any other codes. To determine the required length of shear walls the user first determines span and the plan aspect ratio of a building between shear walls. Once this data is known the user enters a graph and determines the percent of a side wall that must be fully sheathed with Type I plywood or OSB walls.

If the designer wishes to use a Type II wall, a method of determining the required length is given. Also unique to steel framing the user is permitted to reduce the length of shear wall if they are using light weight roofs and or exterior walls. Since steel framing products are lighter than wood, a steel framed house

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New SSMA Catalogue

The Product Technical Information catalogue will be released released by the Steel Stud Manufacturers Association (SSMA) on June 1. Applicable to nearly 90 percent of the studs manufactured in North America, it contains such technical information as product identification and design tables for section properties, wall height, floor and ceiling spans, and combined axial and lateral load. Also included are channel properties, fasteners, architectural specifications and a member directory. For information, call (312) 456-5590. ■

RESEARCH AND TESTING UPDATE

The following is a partial list of current tests, research in progress, or programs that have recently been completed by institutions and organizations know for their achievements in the advancement of cold-formed steel design.

Canadian Cold-Formed Steel Research Group

Contact: Reinhold Schuster, Ph.D., P.E.
University of Waterloo
Phone: (519) 885-12511, ext. 3713
e-mail: rschuster@uwaterloo.ca

(and)

Canadian Sheet Steel Building Institute

Contact: Steve Fox, P.E.
Phone: (519) 650-1285
e-mail: sfox@cssbi.ca

1. Bearing Stiffeners for Cold Formed Steel Floor Joists (S.R. Fox and R.M. Schuster)
2. Testing and analysis of bearing stiffeners typically used in residential cold formed steel construction.
3. Lateral Strength of the Stud-to-Track Connection in Wind Load Bearing Construction (S.R. Fox and R.M. Schuster)
4. The web crippling strength of wind load bearing stud-to-track connections have been tested and design expressions developed.
5. Vibration Control Design of Floor Systems Using Cold-formed Steel Joists (L. Xu, W-C Xie and R.M. Schuster)
6. Evaluate the vibration performance of typical residential floor systems supported by cold formed steel joists.
7. Innovative Computerized Truss Design Using Cold Formed Steel (L. Xu and R.M. Schuster)
8. Bring advanced design optimization technology for the Canadian residential construction industry using cold-formed steel trusses made of C-section members.

NAHB Research Center

Contact: Nader Elhajj, P.E.
Phone: (800) 638-8556, Ext 581
e-mail: nelhajj@nahbrc.org

1. Cost and Energy Comparison between steel and wood framed homes built side by side, incorporating time-motion studies and monitoring of energy consumption over a one-year period to determine the overall R-value of each house.
2. Development of an economical model for built-up king and jack studs. Tests have been completed and a report will soon be issued.
3. Development of a top load bearing track that can distribute the loads when in-line framing technique is not utilized.
4. Development of a more thermally efficient stud.
5. Development of a Base Standard Document similar to the Prescriptive Method, to be published as an ANSI standard through the AISI Committee on Framing Standards.
6. Prescriptive Method, Year 2000 Edition. The Prescriptive Method is being revised to incorporate the latest changes and additions made during the past two years.
7. Testing project to determine adequate fastening schedules for attaching wood walls to steel framed floors.
8. Testing the integration of steel frame floors into the interior of ICF houses to reduce cost and ease construction.

Oregon State University

Contact: Thomas H. Miler, Ph.D., P.E.
Phone: (541) 737-3322
e-mail: Thomas.Miller@orst.edu

1. Finite Element Modeling of Cold-Formed Steel Lipped-Channel Stub Columns with Web Perforations.
2. Limiting Height Evaluations for Composite Cold-Formed Steel Wall Studs with Gypsum Sheathing, subject to Uniformly Distributed Out-Of-Plane Loading.
3. Theoretical Deflection Predictions for Composite Wall Tests.
4. Nominal Axial Strength Evaluations for Gypsum-Sheathed Cold-Formed Steel Wall Studs.

Research Institute of Industrial Science & Technology, *Steel Structure Technology Division*

Contact: Lee, Sueng-Eun
Phone: (82-339) 370-9570
e-mail: leese@rist.re.kr

1. Shear resistance test for light-gauge steel framed shear wall with sheathing panels to determine shear resistance of OSB or plywood sheathing panel manufactured in Korea.
2. Load capacity test for new cold-formed steel truss section, named PRY Truss, to expand truss span.
3. Experimental modal analysis for steel framing floor system. Vibration Measurement & Analysis of steel framing floor system.
4. Thermal performance testing for steel framing wall system. Test thermal resistance and dew condensation of light-gauged steel framed wall.

Center for Integrated Systems for Housing

Contact: Dan Dolan, Ph.D., P.E.
Virginia Polytechnic University
Phone: (540) 231-8839
e-mail: jddolan@vt.edu

1. Testing to determine the performance of perforated shear walls.
2. Additional testing on perforated shear walls, investigating the effect of reduced anchorage, different bottom track attachment, sheathing lay-up, and gusseting of openings with sheathing

University of Missouri/Rolla

Contact: Roger LaBoube, Ph.D., P.E.
Phone: (573) 341-4481
e-mail: LaBoube@novell.civil.umr.edu

1. Behavior of hat shaped truss chords.
2. Stuctural performance of ceiling grid systems.
3. Behavior of slip clips. ■

TECHNICAL EXCHANGE

The Light Gauge Steel Engineers Association needs you and your experience. Please mail or fax your opinions, questions, and design details that are relevant to the cold-formed steel industry (fax to Dean Peyton at (253) 941-9939). Upon editorial review, your submission may be printed in the Technical Exchange Section of this Newsletter.

Strength of Bearing Stiffeners Attached to Cold Formed Steel C-Sections

By Steven R. Fox, P.Eng., General Manager, Canadian Sheet Steel Building Institute

This article describes some of the findings from an ongoing research project that is investigating the behavior of bearing stiffeners in cold formed steel (CFS) C-sections. These stiffeners are stud or track sections either attached to the back of the joist web or cut to fit between the flanges of the joist (Figure 1). Connections are made between stiffener and joist with self-drilling screws.

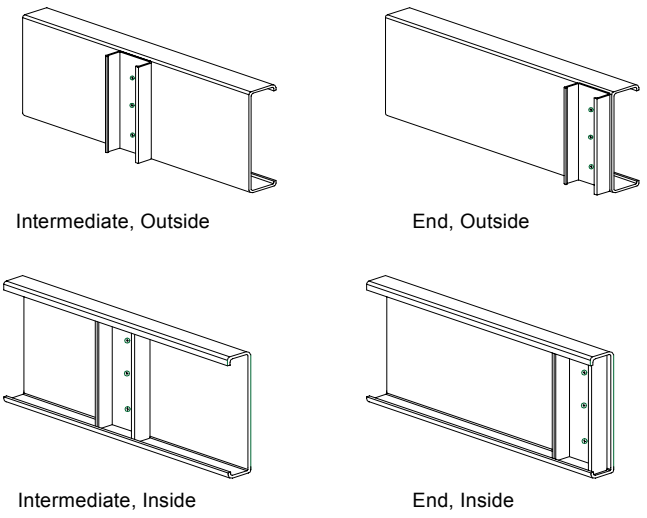


Figure 1: Stiffener Configurations

Floor joists commonly used in cold-formed steel framing are C-sections ranging in depth from 6 to 14 inches. The thin sheet steel makes these sections prone to web crippling when subjected to concentrated loads, which occur at every bearing support or location where a floor joist supports a loadbearing wall above. To avoid the capacity reductions that the web crippling would impose, bearing stiffeners (or web stiffeners) are commonly attached to the joist to stiffen the joist web and transfer these loads.

The current design provisions for bearing stiffeners are given in the AISI *Specification*. These provisions stipulate that the flat width of any element in the stiffener shall not exceed the limit for local buckling. A CFS stud or track section as a bearing stiffener will be subject to effective width reductions at modest stress levels and fall outside the provisions of the design specifications.

In an effort to determine the general behavior of common bearing stiffener assemblies, a research project is ongoing. There are a number of variables that affect the capacity of the assembly, but in general, tests so far have determined that a simple expression for the nominal axial resistance of the stiffener can be calculated using the following expression:

$$P_n = RF_yA_e$$

Where,

- R = reduction factor depending on stiffener type and location
- F_y = yield strength of stiffener steel
- A_e = effective area of stiffener under uniform compression determined at $f = F_y$ reduction.

NOTE: This testing has indicated an applicable reduction factor in the range of .79 to .87 depending upon the stiffener type and location.

This expression was developed with stiffener sections having a nominal thickness of 0.033 in. and with joist slenderness ratios over 150.

Additional studies have been conducted looking into the effects of the following parameters:

- Thicker joist and stiffener sections;
- Effect of the gap between the end of the stiffener and the joist flanges (end, inside location);
- Bearing widths narrower than the stiffener;
- Pattern of the screws connecting the stiffener to the joist;
- Fastening the joist flanges to the bearing support; and,
- Capacity of smaller bridging channel stiffeners.

Many of the results of these studies can be found in the reports noted below, and in future publications.

Conclusions

In many cold-formed steel framing applications the design of the bearing stiffener can follow the design expression given above. Until additional testing has expanded our understanding of the behavior of these assemblies, a conservative design approach is warranted.

This work is being conducted at the *University of Waterloo,* and is co-funded by the *American Iron and Steel Institute* and the *Canadian Sheet Steel Building Institute*.

For further discussion on this subject, refer to "*First Summary Report: Bearing Stiffeners in Cold Formed Steel C-Sections*," American Iron and Steel Institute, February, 2000; and "*Strength of Bearing Stiffeners in Cold Formed C-Sections"*, to be presented at the 15th International Specialty Conference on Cold Formed Steel Structures, University of Missouri-Rolla, October 2000. Both reports are authored by S.R. Fox and R.M Schuster. ■

Building Codes and Steel

Continued from page 2

will require a shorter length of shear wall.

The design approach for wind is similar to that adopted by the wood industry in the Wood Framed Construction Manual. The loads were validated for steel framing by Gary Walker PE under contract with AISI.

Both of the above methods for wind and seismic design will be further refined by the AISI COFS Subcommittees as they are incorporated into the High Wind and High Seismic Design Specifications.

Another Building Code?

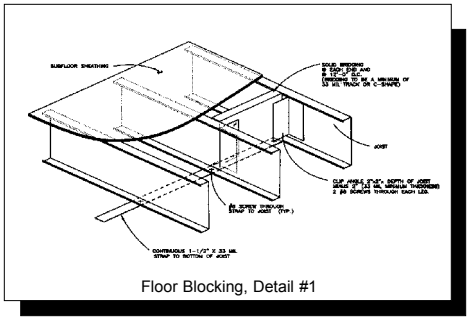
The development of the IRC and IBC appeared to be finally bringing about a rational, integrated approach to the codes and standards system in the United States, marked by a single set of codes. Unfortunately, it now appears that the building industry may still have to contend with a competing code to be developed by the National Fire Protection Association (NFPA).

This code may be available by 2002, and the AISI will participate in the NFPA code development process to assure that current technology for the design of cold-formed steel structures is included in this new code.

Editor's Note: The LGSEA Newsletter will continue to cover the development of this new construction code, as well as all codes and standards that affect cold-formed steel. ■

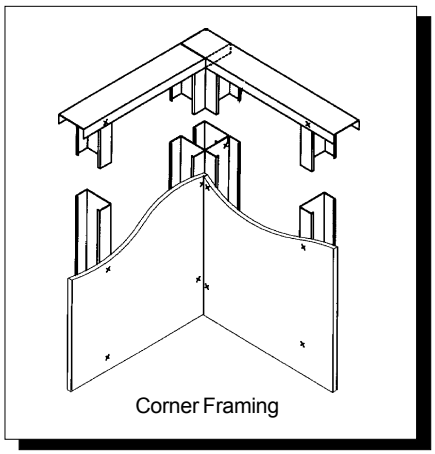
Details *from page 6*

"Each member of the team who identified or developed these ***Details*** has extensive experience building and designing commercial and residential structures throughout the United States," notes Larry Williams, LGSEA Managing Director. "The details in this set was selected on the basis of cost-effectiveness and practical application." Nader Elhajj, P.E., who drafted the details also pointed out that figures such as the L-Header, a recent innovation that has helped reduce the cost and improve efficiencies in steel framing applications, have been included.



Floor Blocking, Detail #1

To obtain the new details, visit www.SteelFramingAlliance.com and either download the details for a small fee,



Corner Framing

or order the book or CD-ROM from the on-line order form that is provided,call (800) 79-STEEL or the LGSEA at (615) 279-9251. You may also visit LGSEA's web site, www.lgsea.com, for more information. ■

Directory of Cold-Formed Steel Design Guides

In recent years, the volume of cold-formed steel technical and design information has significantly grown. The following is a partial list of the guides that are currently available. This list is not intended to be all inclusive, but is rather an overview of the most-frequently referenced design guides. These publications are available through the authors, and contact and ordering information is provided below. Prices indicated are current as of April 2000, and are subject to change without notice. Readers are encouraged to contact the authors for more information about specific publications. ■

SUBJECT: Design Guides / Manuals

Publication Name	Published by*	Cost
Prescriptive Method for Residential Cold-Formed Steel Framing, second edition, NT3-98 (3/98)	AISI/HUD	$20 or free download from www.steelframingalliance.com (Commentary: NT4-98, $25.00)
Low-Rise Steel Construction Details and Guidelines, NT6-00 (see article, page 1 of this newsletter)	NASFA	CD-ROM: $40.00** Publication: $50.00**
Cold-Formed Steel Design Manual, SG-973 (1997) (includes design specification, which is the standard for light gauge steel design in the United States)	AISI	$95
Residential Steel Design and Construction: Energy Efficiency, Cost Savings, Code Compliance (ISBN 0070254753), 1/98	Hacker/Gorges, McGraw	$59.95
Cold-Formed Steel Design, second edition (ISBN 0471619701), 1991 (Textbook style manual explaining design theory and development of equations)	Wei-Wen Yu, Wiley	$140.00
Residential Steel Framing Handbook (ISBN 0070572313), 1/96 (a collection of information, pictures, and tables from manufacturers on both light commercial and residential construction with light gauge steel)	Scharff, McGraw-Hill	$59.95
Design of Cold-Formed Load Bearing Steel Systems and Masonry Veneer/Steel Stud Walls, 11/98 (TI 809-07)	USACE	Free download from http://www.hnd.usace.army.mil/techinfo/ti.htm
Structural Steel Designer's Handbook (In addition to cold-formed steel, also covers roadways, building floors and roofs, domes, and alltypes of bridges). 1,250 pages (ISBN 0070087822)	Brockenbrough/ Merrit McGraw-Hill	$ 125.00

SUBJECT: Stud/Track Specification and Design Tables

Publication Name	Published by*	Cost
ASTM C955-98: Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases	ASTM	$25.00, download from www.astm.org or by fax or mail.
ASTM C645-00 Standard Specification for Nonstructural Steel Framing Members	ASTM	$30.00, download from www.astm.org or by fax or mail.
Product Technical Information (This catalogue includes industry standard information on product identification, and design tables for section properties, spans, loads and more. Information is applicable to all members of the SSMA).	SSMA	$ 5 (New catalogue available June 1, 2000)

SUBJECT: Shear Wall Design

Publication Name	Published by*	Cost
Shear Wall Design Guide, NT8-98 (2/98)	NASFA	$15 or free download from www.steelframingalliance.com
Shear Transfer at Top Plate: Drag Strut Design , TN 556a-4 (9/97)	LGSEA	$1 or Free to LGSEA members
Vertical Lateral Force Resisting Systems: Boundary Elements, TN 556a-6 (3/97)	LGSEA	$1 or Free to LGSEA members
Lateral Load Resisting Elements: Diaphragm Design Values, TN 558b-1 (5/98)	LGSEA	$1 or Free to LGSEA members
Monotonic Tests of Cold-Formed Steel Shear Walls with Openings, NT9-98 (9/98)	NASFA	$15 or free download from www.steelframingalliance.com

* Refer to "Publishers" table on following page. ** Special membership rates apply to purchases.

SUBJECT: Durability/Corrosion

Publication Name	Published by*	Cost
Durability of Cold-Formed Steel Framing Members, NT16-97, (6/97)	NASFA	$15 or free download from www.steelframingalliance.com
Fastener Corrosion, TN560-b5, (4/99)	LGSEA	$1 or Free to LGSEA members
ASTM B633-98 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel (for screw connectors)	ASTM	$30.00 download from www.astm.org or by fax or mail
ASTM A1003/A1003M Standard Specification for Steel Sheet, Carbon, Metallic and Non-Metallic Coated for Cold-Formed Framing Members	ASTM	Available summer 2000.

SUBJECT: Truss Design and Bracing

Publication Name	Published by*	Cost
Design Guide for Cold-Formed Steel Trusses, NT13-95 (2/98)	NASFA	$15 or free download from www.steelframingalliance.com
Design Guide: Construction Bracing of Cold-Formed Steel Trusses, TN 551d (10/96)	LGSEA	$1 or Free to LGSEA members
Design Guide: Permanent Bracing of Cold-Formed Steel Trusses, TN 551e (2/98)	LGSEA	$1 or Free to LGSEA members
Specifying Pre-Engineered Cold-Formed Steel Floor and Roof Trusses, TN 551f (10/98)	LGSEA	$1 or Free to LGSEA members
Field Installation Guide for Cold-Formed Steel Roof Trusses (10/99)	LGSEA	Prices vary according to quantity ordered

SUBJECT: Component Design

Publication Name	Published by*	Cost
Cold-Formed Steel Back-to-Back Header Assembly Tests, NT17-98 (7/98)	NASFA	$15 or free download from www.steelframingalliance.com
L-Shaped Header Field Guide, NT19-99F (9/99)	NASFA	$15 or free download from www.steelframingalliance.com
Design Guide for Cold-Formed Steel Beams with Web Penetrations, NT11-97 (11/97)	NASFA	$15 or free download from www.steelframingalliance.com

* Refer to "Publishers" table below. ** Special membership rates apply to purchases.

Publishers*

American Iron & Steel Inst. **AISI**
1101 17th Street, N.W., Suite 1300
Washington, D.C. 20036
(800) 79-STEEL www.steel.org

American Society of Testing and Materials **ASTM**
100 Barr Harbor Drive
West Conshohocken,
Pennsylvania, USA 19428-2959
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www.bookstore.mcgraw-hill.com

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North American Steel Framing Alliance **NASFA**
1726 M Street, N.W., Suite 601
Washington, D.C. 20036
(800) 79-STEEL
www.steelframingalliance.com

Steel Stud Manufacturers Association **SSMA**
8 South Michigan Avenue, Ste 1000
Chicago, IL 60603
(312) 456-5590 www.ssma.com

U. S. Army Corps of Engineers **USACE**
Engineering & Construction Div.
Directorate of Military Programs
Washington, DC 20314-1000
www.hnd.usace.army.mil/techinfo

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New York NY 10158
(212) 850-6077 www.wiley.com

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