

LC 1091

BUILDING SAFETY



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BUILDING SAFETY RESEARCH AT THE NATIONAL BUREAU OF STANDARDS

Introduction.

At the National Bureau of Standards' (NBS) Center for Building Technology (CBT), safety research is concerned with reducing the hazards of life and property during the construction and the use of buildings. CBT building safety research is pursued through a multi-disciplinary approach. Its products include performance requirements, criteria and test methods, retrofit recommendations, and design guides. They are used by owners, architects, and engineers in designing, constructing, and operating buildings. Results of CBT safety research are made available to the general public. This information provides the technical basis for improved building safety.

Research at CBT includes analytical, laboratory, and field activities. This work is supported by such Federal agencies as the Department of Housing and Urban Development, the Consumer Product Safety Commission, the Occupational Safety and Health Administration, the Department of Justice and the National Bureau of Standards.

The projects noted briefly describe NBS research in building safety.

Anthropometric dummy used in occupational safety tests.

Research Activities.

Stairs. CBT has evaluated stairs and their use to provide an understanding of the causes of stair accidents. Over 465,000 stair-related injuries are treated in U.S. emergency rooms each year. Recommendations presented by CBT to the Consumer Product Safety Commission include cautions against using distracting patterned carpet, guides for providing proper lighting, and suggestions for placement and selection of handrails. Separate recommendations for new construction and for upgrading existing buildings are being developed.

Slippery Surfaces. CBT research has led to the development of a portable tester for measuring the slip-resistance of surfaces, such as bathtubs, floor surfaces and stairs.



The device is being used to establish standards for flooring materials to control slipperiness. The tester can be taken to locations of slip accidents where measured values can be correlated with incidents. The American Society for Testing and Materials adopted the tester for use in establishing a bathtub and shower safety standard. Additional research will be conducted to develop a universal calibration procedure for all slip-resistance testers.

Doors and Windows. CBT developed criteria and test methods to evaluate the resistance of doors and windows to common burglary attacks. Doors present the primary opportunity for entrance by burglars. In addition, doors are among the ten most hazardous consumer products. Research sponsored by the Department of Justice has resulted in two National Institute of Law Enforcement and Criminal Justice (NILECJ) standards: "Physical Security of Door Assemblies and Components" and "Physical Security of Window Units." The test method developed for the NILECJ door standard was incorporated in the American National Standards Institute/American Society for Testing and Materials standard, "Standard Test Methods for Security of Swinging Door Assemblies," which is being promulgated by ASTM.

Glass. Non-safety glass that is used in buildings may result in an unreasonable risk of injury,

according to the Consumer Product Safety Commission. Experimental work at NBS determined that retrofitting measures such as coating the glass, adding stick-ons, and covering glass with curtains were useful in decreasing door glass injury in specified circumstances. For the Consumer Product Safety Commission, glass samples have been evaluated under impact tests to determine their inherent safety characteristics.

Guardrails. These CBT studies, aimed at improving the Occupational Safety and Health Administration's criteria, involved field investigations of subway construction, dry dock operations, and bridge and building construction to determine how guardrails were used in the construction industry. Some of these studies included an innovative use of anthropometric dummies to determine human loads on guardrails.

Construction Bracing (Shoring). CBT is developing guidelines for safe bracing and shoring systems for excavations. This work for the Occupational Safety and Health Administration includes classifying soil characteristics and studying forces induced in bracing, as well as establishing criteria for safe use of lumber in braced systems.

Concrete Construction. CBT is also working on criteria for safe design, erection, and removal of formwork for concrete building construction. Researchers are evaluating the strength gain characteristics of concrete at early ages using nondestructive test methods for determining the strength of concrete and determining the formwork strength as affected by field conditions.

Visual Alerting Standardization. CBT is attempting to further the development of a nationally unified system of safety color codes for signs, signals, labels, and markings used in buildings. CBT is acting as the secretariat for the American National Standards Institute committees on "Safety Color Code for Marking Physical Hazards" and "Accident Prevention Signs and Tags." This involvement includes standardization and coordination—among government, industry, standards organizations, and the public—of visual alerting systems for use in and around buildings.

Electrical. CBT is developing for the Department of Housing and Urban Development criteria for electrical circuits that will eliminate shock hazards and insure fire safety. The technical data from this research will be provided to the National Fire Protection Association for incorporation into future revisions of the National Electric Code.

Mobile Home Egress. For the Department of Housing and Urban Development, CBT is studying the operating characteristics of hatches and windows to determine if they are effective as emergency exits.

Building Exiting. CBT investigations for the Occupational Safety and Health Administration are underway that will result in criteria to improve systems for emergency escape from buildings. Such factors as building function, number of people using the building, and various escape routes are being investigated from a human factors viewpoint.



NBS-Brungraber Portable Slip Resistance Tester developed to measure the slipperiness of surfaces.

SELECTED PUBLICATIONS

Selected Publications.

Adler, Sanford C., *Architectural Glazing Safety Standard: Survey of Codes and Standards*, NBSIR 76-1109 (Washington, D.C.: NBS, June 1976). Available from NTIS, Springfield, VA 22161, PB 257-194, \$4.50.

Adler, Sanford, *Evaluation of the Egress Provisions of the HUD Mobile Home Construction and Safety Standard*, NBSIR 77-1246 (Washington, D.C.: NBS, May 1977). Available from NTIS, Springfield, VA 22161, PB 268-389, \$6.00.

Beausoliel, Robert W., and Meese, William J., *Survey of Ground Fault Circuit Interrupt Usage of Protection Against Hazardous Shock*, BSS 81 (Washington, D.C.: NBS, March 1976). Available from Superintendent of Documents, Washington, D.C. 20402, BSS 81-SN 003-003-01591-1, \$.45 .

Brungraber, Robert J., *An Overview of Floor Slip-Resistance Research with Annotated Bibliography*, Tech. Note 895 (Washington, D.C.: NBS, Jan. 1976). Available from Superintendent of Documents, Washington, D.C. 20402, Tech. Note-SN 003-003-01564-4, \$ 2.30.

Brungraber, Robert J., *A New Portable Tester for the Evaluation of the Slip-Resistance of Walkway Surfaces*, Tech. Note 953 (Washington, D.C.: NBS, July 1977). Available from the Superintendent of Documents, Washington, D.C. 20402, SN 003-003-01796-5, \$2.00.

Brungraber, Robert J., and Raper, Theresa, J.R., *A Comparison of Two Testers in Evaluating the Slip-Resistance of Bathtub and Shower Base Surfaces*, NBSIR 76-1005 (Washington, D.C.: NBS, October 1977). Available from NTIS, Springfield, VA 22161, PB273-120, \$5.25.

Fattal, S.G., Cattaneo, L.E., Turner, G.E., and Robinson, S.N., *A Model Performance Standard for Guardrails*, NBSIR 76-1131 (Washington, D.C.: NBS, July 1976). Available from NTIS, Springfield, VA 22161, PB 259-242, \$4.00.

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Lew, H.S., *Safety During Construction of Concrete Buildings-A Status Report*, BSS 80 (Washington, D.C.: NBS, January 1976). Available from Superintendent of Documents, Washington, D.C. 20402, BSS 80-SN 003-003-02183-1, \$1.15.

Stahl, Fred I. and Archea, John, *An Assessment of the Technical Literature on Emergency Egress from Buildings*, NBSIR 77-1313 (Washington, D.C.: NBS, October 1977). Available from NTIS, Springfield, VA 22161, PB 273-944, \$5.25.

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