Facilities
Tech Tips

USDA United States Department of Agriculture
Forest Service
Technology & Development Program

March 2006
7300 0673–2314P–MTDC

Early 20th-Century Building Materials: Introduction

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This tech tip is the first in a series about innovative building materials developed in the first half of the 20th century and commonly used in U.S. Department of Agriculture, Forest Service buildings. The series will provide information that will help engineers, heritage staff, and others maintain and preserve historic facilities (figure 1). This tech tip provides general information about early 20th-century Forest Service buildings and identifies documents and Web sites with additional information.

Figure 1—The Judith River Ranger Station was built in 1908 by ranger Thomas "Guy" Meyers from a $450 kit and local logs. It is near the Middle Fork of the Judith River in the Little Belt Mountains of central Montana in the Lewis and Clark National Forest, Northern Region.

Highlights...

- Forest Service facilities built during the first half of the 20th century are being examined now for their historic significance and possible preservation.
- Knowledge of building materials used during a particular period is important when examining the historic significance of a facility and when rehabilitating it.
- This tech tip and others in this series will provide information on building materials used in Forest Service facilities during the early 20th century.

More To Come

Each of the other tech tips in this series will provide practical information about a particular group of materials. They will not tell you everything you need to know about rehabilitating historic buildings. However, they will help you identify the materials by describing their history, physical characteristics, composition, and method of manufacture. Each tech tip also will provide guidance on maintenance, repair, and replacement and will address common problems with the particular materials.

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Historical Overview

The early 20th century was a time of unprecedented innovation and development in building materials. Names, such as Homosote, Cushocel, Nucrete, Straublox, Formica, and Kentile, reflect the inventive origin and application of the new materials. Many of these materials were composites of natural and synthetic substances, while others represented new forms of materials that had been used for decades, if not centuries.

The following sections identify construction materials and trends by decade.

1900s and 1910s

In the early 1900s, the National Board of Fire Underwriters led a campaign for fire-resistant construction. This campaign encouraged development of new materials and products treated or made with asphalt, metal, gypsum, plastic, and asbestos.

Asbestos was considered a "miracle material" and was used extensively because it enhanced fire resistance and durability. In the 1970s, the health hazards of asbestos became apparent and the U.S. Environmental Protection Agency began regulating it. To determine whether your building contains asbestos, start by reviewing the asbestos surveys conducted at Forest Service facilities during the 1980s. For more information on working with and remediating asbestos, contact your environmental engineer or refer to the *Hazmat in Buildings* tool in MTDC's *Facilities Toolbox* at *http://fsweb.mtdc.wo.fs.fed.us/toolbox/haz/index.htm* on the Forest Service's internal network or on the Internet at *http://www.fs.fed.us/eng/toolbox/haz/index.htm*.

New technology also made it possible to reconfigure traditional materials. Rigid boards made of processed wood fibers were created for insulation, plaster lath, and finish materials. Common trade names for these materials include Fir-tex, Celotex, and Masonite.

Portland cement, an improvement over earlier cement formulations, was first produced in the 19th century. It was increasingly used in the early 20th century, when advancements in kiln technology led to better quality and widespread production. Eventually, Portland cement replaced lime in mortar mixes. It also became an important ingredient for concrete blocks, as well as asbestos-cement siding and roofing.

Other materials were developed for military applications during World War I. New types of plywood were created for airplane fuselages. Plastic laminates known as Micarta and Formica were used in electrical devices and gears. When the war ended, the surplus materials found their way into the civilian building market.

The Forest Service emphasized the use of forest products—specifically wood—rather than these new materials. The *1906 Use Book* contains the following statement, "Wherever possible cabins should be built of logs, with shingle or shake roofs." Because these were often the only materials available, many rangers had no problem conforming to this policy. By 1908, the Washington Office had issued a book of standard building plans for facilities, all of which were of log or frame construction (figure 2). The accompanying materials lists included other wood products, such as tongue-and-groove flooring and beadboard for walls and ceilings.

Figure 2—The Koosharem Ranger Station dwelling in central Utah on the Fishlake National Forest in the Intermountain Region was built in 1910 from Standard Plan No. 12 in the Washington Office's 1908 book of standard plans.

1920s and 1930s

The 1920s saw a postwar building boom and increased scientific research, both of which were tempered by the Great Depression of the 1930s. New products included batt insulation (some with aluminum or copper reflective faces), advanced plastics, perforated acoustical tiles, and Plexiglas. The Forest Service's Forest Products Laboratory made significant contributions to plywood technology, including the development of stressed-skin panels. The construction

industry was greatly influenced by these products, as well as the emergence of standardized dimensions and common acceptance and use of a 4-foot width as a standard size for panel-type construction materials.

Unlike the private sector, the Forest Service benefited from scores of construction projects during the Great Depression. The Civilian Conservation Corps, the Works Progress Administration, and other New Deal relief programs constructed recreation and administrative facilities, bridges, roads, and other improvements from 1933 until 1942 (figure 3).

The Washington Office, responding to the increased construction activity, published the *Improvement Handbook* in 1937. Although synthetic materials became increasingly available, the handbook continued to encourage the use of wood-based products in construction. Other materials could be used instead of wood only when they were clearly more suitable and durable, if required by the structure's design, if the initial and life-cycle costs would be significantly lower, or if building codes did not allow lumber construction.

In addition to promoting wood framing and log construction where regionally appropriate, the handbook directed forests to use wood shingles or shakes for roofing and wood siding or shingles for cladding. For interiors, acceptable wall and ceiling materials included wood-based products, such as fiberboard and hardboard. Although log construction continued, frame construction with wood siding (figure 4) became more common.

Figure 3—Since 1936, the Tellico Office has been the headquarters of the Tellico Ranger District of the Cherokee National Forest. The office is near the town of Tellico Plains, TN, in the Southern Region. Recently, the office was restored to its 1930s condition.

Figure 4—The Cle Elum Ranger Station office was built in 1936 to serve the Cle Elum Ranger District of the Wenatchee National Forest. Cle Elum, WA, is on the east slope of the Cascade Mountains in the Pacific Northwest Region.

1940s and 1950s

In the 1940s and 1950s, the cycle of wartime restrictions followed by a postwar construction boom was repeated on a larger scale than during the 1920s. The Wartime Production Board restricted construction and the use of many building materials during World War II, beginning with rubber and metals. This led to minimal use of reinforcing in concrete, elimination of reflective foil on insulation, substitution of fiberglass for asbestos in many applications, and use of gypsum board lath instead of metal lath for plaster. Many wartime structures were built with asbestos-cement siding and roofing because it was easy to assemble and was fire resistant.

Manufacturing boomed during the war. Factories were built to make aluminum that was vital to aircraft production, as well as other materials and products. As a resource agency, the Forest Service was charged with providing the raw materials for increased production of lumber and minerals and was assigned special projects, such as extracting rubber from the guayule plant. The Forest Products Laboratory helped meet the need for stronger, lighter wood products by developing improved laminated timber and plywood.

When the war ended, the U.S. military was left with thousands of buildings it no longer needed. Many of these surplus facilities were sold to civilians or transferred to local,

State, and Federal agencies. The Forest Service acquired its share of Quonset huts, prefabricated housing, and metal radio boxes.

The postwar civilian housing shortage created a market for cheap houses that could be erected easily and quickly. Many houses were built with modern materials, such as concrete block, hardboard, plywood, gypsum board, composition shingles, and plastic laminate. Construction costs were reduced and architectural styles changed as roof pitches were lowered, overhangs and porches were eliminated, and open floor plans were adopted.

As the Nation recovered from World War II, the prosperity of the 1950s was reflected in sturdier construction and larger houses, particularly the sprawling, one-story, ranch-style home. A revived interest in color led to interesting hues of paint, flooring, plumbing fixtures, and appliances. Forest Service structures from the period reflected those trends.

The Forest Service constructed few facilities during World War II or the years immediately afterward. However, by the 1950s, the postwar demand for forest products and the accompanying increase in Forest Service staff prompted construction of numerous district offices and employee housing units. Many of the new structures were built from modern, standard plans (figure 5). The Forest Service continued to emphasize the use of wood for windows, doors, siding, and interior wainscot and trim, although modern materials, such as composition roofing, resilient flooring, and drywall, became more common.

Figure 5—The Murphy Lake District office was built in 1963 for the Fortine Ranger District of the Kootenai National Forest in northwestern Montana using a standard Northern Region plan. Dozens of district offices were built throughout the region in the late 1950s and early 1960s using this plan. This photo was digitally altered to remove distracting elements.

1950s and Afterward

Innovations in architectural styles and building materials continued during the second half of the 20th century. Particleboard and oriented-strand board (OSB) were adopted for sheathing. Lightweight metal framing became relatively common, as did cultured stone, metal-clad doors and windows, and fiberglass products, such as insulation, roofing shingles, and bathtubs.

Plastic-based materials replaced many earlier products. Aluminum siding fell out of favor after vinyl siding was introduced in 1963. Vinyl flooring captured the largest part of the resilient flooring market, while vinyl windows became ubiquitous in modern housing developments. As the Forest Service experimented with bold and dramatic building designs during the 1960s and 1970s, it continued to incorporate wood products, often prominently (figure 6).

Figure 6—The Sawtooth National Recreation Area visitor center and office on the Sawtooth National Forest in the Intermountain Region was constructed in 1976 near Ketchum, ID, and the Sun Valley resort. The innovative, modern design emphasizes wood products and echos the jagged peaks of the nearby Sawtooth Mountain Range.

Historic Preservation

A building typically must be 50 years old or older to be considered a "historic property," one eligible for listing in the National Register of Historic Places. Facilities constructed as late as the 1950s and 1960s are being examined now for their historic significance and possible preservation. This has led to the investigation of "modern" construction materials and methods and discussions about appropriate preservation techniques.

In 1995, the National Park Service cosponsored the first national conference devoted to preserving architecture of the recent past. This conference was followed by another conference in 2000, development of a *Recent Past Initiative* Web site, and creation of the nonprofit Recent Past Preservation Network. Since then, an increasing amount of historic and scientific research on 20th-century building materials has been published.

Many of us may shudder at the thought of aluminum siding as historic and worth preserving. However, historic significance is not a matter of preference or taste. Significance is defined by the trends, events, and products that contributed to our history. For instance, Victorian-era homes were considered hopelessly out of date and unfashionably gaudy during the early and mid-20th century. Thousands of them were demolished. The remaining Victorian homes are now valued for their intricate architecture, history, and beauty.

As people become more fascinated with buildings of the 20th century, increasing attention will be given to their preservation. The emerging popularity of mid-20th century modern design and the "international style" has stirred interest in preserving and renovating structures from the 1930s through the 1960s.

Over time, this interest is likely to produce more research, information, and appropriate replacement materials that will make it easier for the Forest Service to care for its stock of 20th-century structures so they can continue to support the agency's mission well into the 21st century.

Standards of Treatment

Any work on Forest Service facilities that are historically significant should be carried out following *The Secretary of the Interior's Standards for the Treatment of Historic Properties*, available at *http://www.nps.gov/tps/standards.htm*. There are four types of treatment: preservation, rehabilitation, restoration, and reconstruction. Most Forest Service facilities work, other than basic maintenance, can be classified as rehabilitation. Rehabilitation of historic properties may include alterations to meet continuing or changing uses. Alterations must follow the *Rehabilitation Standards* to ensure that the property's historic character is retained.

The Secretary of the Interior's Standards and Guidelines for the Treatment of Historic Properties allows for the use of substitute materials under certain conditions. If using the original type of material is not technically or economically feasible, a compatible substitute material may be considered. Substitute materials should convey the visual appearance of the material that is being replaced. In addition, they must be physically or chemically compatible. Consult with your heritage staff and State Historic Preservation Office to identify appropriate treatment methods and to determine whether the substitute materials you are considering are acceptable.

Rehabilitation Standards

Rehabilitation is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.
2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that damage historic materials will not be used.
8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.
9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.
10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

More Information

The following Web and print resources contain more information about early 20th-century building materials and the treatment of historic structures.

Web Sites

The MTDC *Facilities Toolbox* section on historic facilities, *http://fsweb.mtdc.wo.fs.fed.us/toolbox/his/index.htm*, contains general information on dealing with historic facilities. This material also is available on the Internet at *http://www.fs.fed.us/eng/toolbox/his/index.htm*.

Clem Labine's Traditional Building, *http://www.traditional-building.com/*, includes a database of products and suppliers.

Ian Evans' World of Old Houses, *http://www.oldhouses.com.au/*, contains a guide to maintenance and restoration.

National Trust for Historic Preservation's *Modernism and Recent Past* Web page, *http://www.preservationnation.org/information-center/saving-a-place/modernism-recent-past/,* provides information on modern architecture and materials.

The Recent Past Preservation Network, *http://recentpast.org/*, is a nonprofit organization dedicated to the study of modern architecture and materials.

The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings contains requirements for appropriate treatment of buildings and sites, including health and safety concerns, accessibility, materials, energy efficiency, and additions. It is available in print form or on the Web at *http://www.nps.gov/history/hps/tps/standguide/.*

Books, Journals, and Reports

The *APT Bulletin*, *http://www.apti.org/*, is the journal of the Association for Preservation Technology, focused on the science of preservation.

Heritage Preservation and National Park Service, 1998. *Caring for Your Historic House*. New York: Harry N. Abrams, Inc. National Park Service guidance on maintenance and repairs of historic features.

The *Journal of Architectural Conservation*, *http://www.donhead.com/journal_of_architectural_conservation.htm*, contains international academic and scientific research.

The *Old-House Journal*, *http://www.oldhousejournal.com/*, is a layperson's periodical guide to architectural styles, materials, and preservation.

Guedes, Pedro, ed. 1979. *Encyclopedia of Architectural Technology*. New York: McGraw-Hill Book Co. Explains the history and development of construction systems and materials.

Jandl, H. Ward. 1991. *Yesterday's Houses of Tomorrow: Innovative American Homes 1850 to 1950*. Washington, DC: The Preservation Press. Experimental construction and early materials.

Jester, Thomas C., ed. 1995. *Twentieth-Century Building Materials: History and Conservation*. New York: The McGraw-Hill Companies. Excellent source for specific building materials and product names.

Acknowledgments

The authors gratefully acknowledge the contributions of those who provided photographs for this publication:

Keith Lannom, Tellico district ranger, Cherokee National Forest, Southern Region

Kelly Keim, archeological technician, Lewis and Clark National Forest, Northern Region

Sandi French, forest archeologist, Lewis and Clark National Forest, Northern Region

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Kathleen Snodgrass came to MTDC as a project leader in 2001 from the Nez Perce National Forest, where she had been the facilities architect for about 7 years. Before becoming facilities architect, she had worked in facilities, landscape architecture, land line, and general engineering for the Nez Perce National Forest. Snodgrass also spent about 10 years working in highway design and construction with the Idaho Division of Highways after graduating from Washington State University in 1974 with a bachelor's degree in architectural studies.

Library Card

Wilson, Richa; Snodgrass, Kathleen. 2006. Early 20th-century building materials: introduction. Tech Tip 0673–2314P–MTDC. Missoula, MT: U.S. Department of Agriculture, Forest Service, Missoula Technology and Development Center. 8 p.

Provides an introduction to innovative building materials developed during the first half of the 20th century that were used in Forest Service buildings. This tech tip is the first of a series that will provide information to help engineers, people working in the heritage program, and others maintain and preserve historic facilities. Other tech tips will provide practical information about a particular group of materials.

Keywords: architecture, building construction, facilities, historic buildings, historic preservation, history, maintenance, rehabilitation

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