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So That's Why It's Always Cold in Here

A Guide for Conducting Facilities Condition Assessment Surveys

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—***Cover Photo:*** *The Silver Creek Lookout with a bank full of blue gentians blooming in front is in the Boise National Forest's Emmett Ranger District.*

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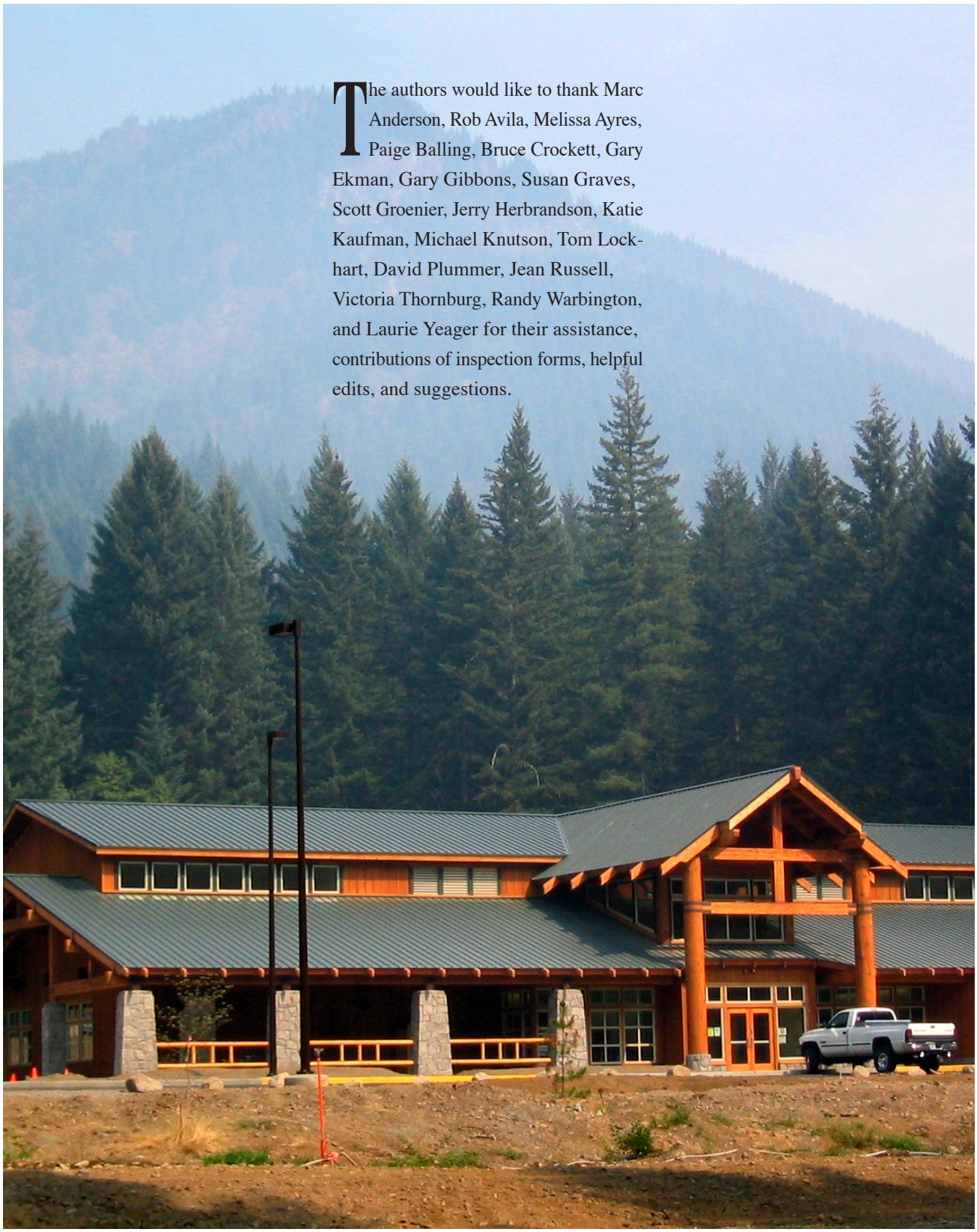

Wood adds a rustic touch to the Willamette National Forest's Detroit Ranger Station (Pacific Northwest Region).

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Introduction

In the past, the U.S. Department of Agriculture (USDA) Forest Service had the luxury of training new facilities engineers by having them assist experienced facilities engineers. As budgets and staffing have tightened, fewer and fewer national forests can afford assistant facilities engineers, and the pipeline that produced facilities engineers has dried up. Now USDA Forest Service facilities professionals are frequently hired directly from college or from outside agencies or firms. If they have previous USDA Forest Service engineering experience, it may be in roads or other specialties. They may not have in-depth knowledge of building codes or of issues affecting most agency structures.

The term *facilities engineers*, as used in this report, means architects, professional engineers, and engineering technicians who provide engineering support for their unit's buildings and utility systems. Although facilities engineers have many duties, among the most important is ensuring that appropriate maintenance is performed so USDA Forest Service structures meet the needs of their occupants and remain useful for their full service life. The facilities condition assessment survey is the primary tool for ensuring that appropriate maintenance is performed. This guide is intended to help new facilities engineers become proficient at conducting a facilities condition assessment survey. The term *facilities condition assessment survey*, or just *condition survey*, refers to surveys conducted by the USDA Forest Service. The term *building inspection* refers to similar surveys conducted outside the USDA Forest Service.

Many of the Web addresses referenced in this guide are on the USDA Forest Service's internal computer network, which can be accessed only by USDA Forest Service and U.S. Department of the Interior Bureau of Land Management employees. Web addresses that begin with *fsweb* rather than *www* are on the Forest Service's internal computer network.

Responsibilities of a USDA Forest Service Facilities Engineer

Facilities engineers provide a wide variety of technical support for national forest recreation and administrative sites. They help manage buildings and other structures, water supplies, and wastewater systems. The USDA Forest Service's diverse and often unique structures (figure 1), the aging infrastructure, and the continual scarcity of maintenance funds ensure that facilities engineers seldom experience a dull day in the office. Some of their responsibilities are described in the *Forest Service Handbook* 7309.11, chapter 40:

- Keep facilities safe, sanitary, neat, attractive, and in good working order both inside and outside.
- Insofar as practical, preserve the original condition of buildings and related facilities owned by the USDA Forest Service.
- Prevent major unplanned repairs, reconditioning, or replacement costs by developing and implementing a preventive maintenance program.

To carry out these responsibilities, facilities engineers use information gathered during periodic inspections. Facilities condition assessment surveys, also referred to as maintenance condition surveys or building inspections, provide

Figure 1—This historic barn was built by the Civilian Conservation Corps at the Bitterroot National Forest's Sula Ranger Station.

most of the information needed for technical support and maintenance. Condition surveys are also an accountable target, which means managers are responsible for seeing that they are completed. The data gathered can be a basis for the allocation of funds. As a bonus, the facilities engineer becomes very familiar with the facilities that are inspected regularly, which improves response time and accuracy when problems occur and emergency engineering expertise is needed.

What a Facilities Condition Assessment Survey Is and What It Is Not

A facilities condition assessment survey is an inspection and record of the physical condition of an existing building. An instruction letter about common definitions for maintenance and construction terms from the acting deputy chief for the National Forest System dated September 29, 1998, provides this definition: *A periodic inspection of fixed assets and associated resources to determine and document their condition and estimated costs to correct any deficiencies*.

Condition surveys are sometimes confused with other inspections. The *Forest Service Handbook* (7309.11) requires several other types of inspections and evaluations of existing structures, including inspections for safety and health, facility performance, energy conservation, accessibility, vulnerability, and asbestos management. Table 44.1-Exhibit 01 (*http://fsweb.wo.fs.fed.us/directives/fsh/7309.11/7309.11,40.rtf*) of the Building and Related Facilities section of the handbook describes the required inspections and evaluations and how often they must be performed. Although several inspections may be conducted at the same time, each inspection has special requirements, including specific expertise for the inspector. For example, safety and health inspections cover high-risk areas, such as electrical and mechanical systems, hazardous materials, and U.S. Department of Labor Occupational Safety and Health Administration (OSHA) requirements. Health and safety inspectors must have extensive training and experience in these areas. Typically, electrical and mechanical experts conduct specialty inspections during health and safety inspections. Specially trained Forest Service employees usually perform hazardous materials inspections and other safety inspections. Building construction inspections are performed on buildings under construction by personnel who have passed specialized construction administration tests and are certified for that work.

Condition surveys are general inspections that include a cursory look at specialized systems and requirements. They are not intended to replace more focused inspections, although there is some overlap. Condition surveys include examinations of the building envelope (everything that keeps the weather out), structural elements, and interior soundness. They also include checks to see whether systems and equipment operate

effectively and appropriately. As with most facilities engineering work, condition surveys are complex and require some knowledge in many areas of expertise. Because of the breadth of knowledge required, few facilities engineers are experts in all areas. When facilities engineers identify an item of concern that is beyond their expertise, they should consult a specialist.

According to the *Forest Service Handbook*, a condition survey has two primary purposes:

- To ensure the accomplishment of routine maintenance and servicing of equipment and building systems. This may require reviewing preventive maintenance records.
- To list items noted during the inspection that need correction, repair, replacement, or similar action.

Home Inspections and Condition Surveys

Because commercial home inspections are similar to USDA Forest Service facilities condition assessment surveys, it is worth looking at industry standards for an overview. The American Society of Home Inspectors and the California Real Estate Inspection Association (see Professional Organizations in appendix A) have published standards of practice to assist home inspectors. These standards require inspectors to inspect structural components (foundation, framing, and so forth) and to probe structural members for soundness. Inspectors must examine interior and exterior wall coverings and finishes, flashing, trim, doors, windows, decks, steps, railings, walkways, eaves, soffits, fascias, vegetation, grading, surface drainage, retaining walls, roofing, roof drainage systems, chimneys, walls, ceilings, floors, cabinets, countertops, paint, carpeting, window treatments, appliances, insulation, any visible vapor barriers, ventilation systems, electrical systems, and mechanical systems. Inspectors must identify the presence or absence of seismic anchoring and bracing and drainage systems within the foundation footprint. In short, the inspector must describe the condition of the facility and all of its parts (Casey and O'Malley 2000).

There are some differences between a commercial home inspection and a USDA Forest Service condition survey. Facilities engineers are much more involved with solving problems and working with the occupants of buildings than are home inspectors. USDA Forest Service facilities engineers take the lead in correcting deficiencies they discover, perform engineering or architectural services such as structural analysis, and give advice on fixing problems. Home inspectors do not. Facilities engineers typically consult with maintenance personnel and building occupants to learn about problems that need to be investigated and noted in the condition survey report. Facilities engineers also are expected to review and maintain records validating completion of routine maintenance and required inspections. These records include operation and maintenance manuals for equipment, sanitary surveys for water and wastewater systems, potable water testing records, past condition survey reports, and other specialized reports, such as asbestos inspections.

Knowledge, Skills, and Tools

A Basic Understanding of Buildings and Systems

Knowledge of buildings and building systems is needed to conduct a condition survey. The education of most civil engineers and architects, along with building construction inspection experience and some familiarity with practical home renovation and repair, generally provide enough basic engineering knowledge. Engineering technicians who are certified and capable building inspectors or contracting officer's representatives also may have enough basic engineering knowledge.

Additional expertise is required to recognize indicators of hidden problems during a condition survey. Don't have this skill? Don't worry, there is help. Many commercially available books explain how to conduct building inspections, what to look for, and what different indicators could mean. Several of these books are listed in the references and appendix A.

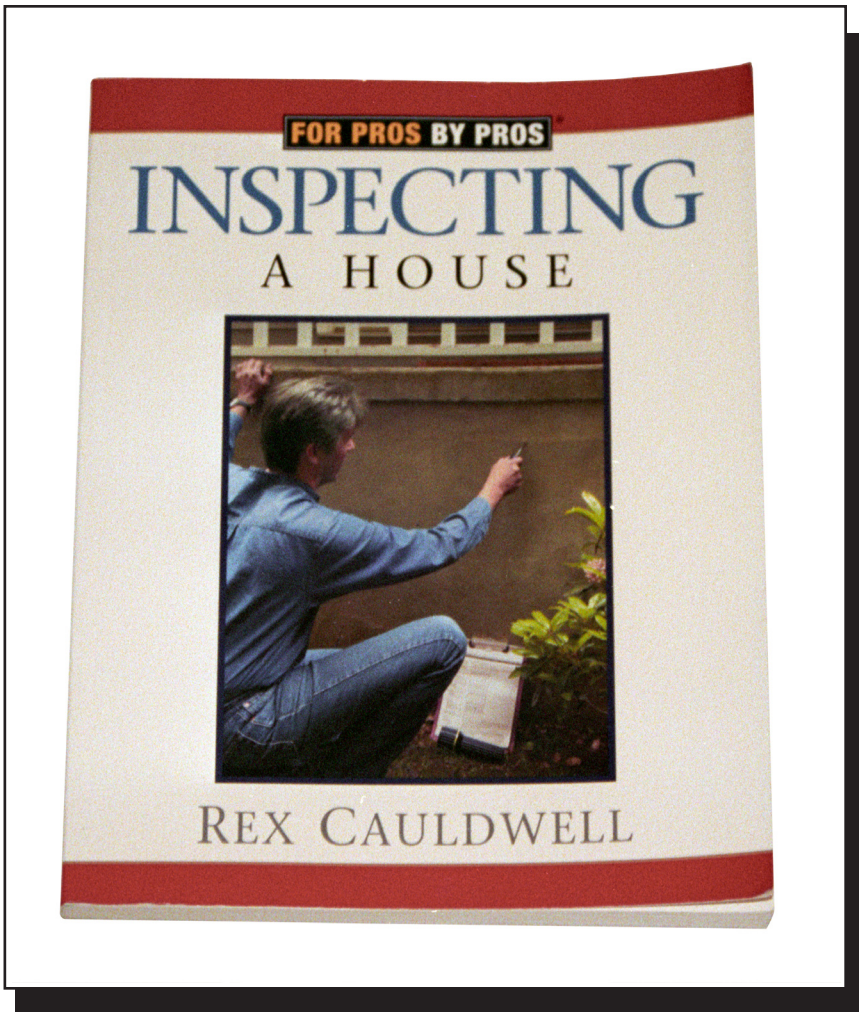

Figure 2—Inspecting a House by Rex Cauldwell.

Inspecting a House by Rex Cauldwell (2001) is particularly helpful (figure 2). The text is well organized, easy to understand, and even humorous at times. The author covers all the basics, including the tools of the trade and detailed descriptions of what to look for during an inspection. Real-life situations are used as examples and numerous photographs clarify the text.

The Internet can be another source of information. Several Web sites have information on publications, training, and software, as well as answers to questions about building maintenance and inspection. Appendix A includes a partial list of pertinent Web sites. The National Association of Certified Home Inspectors (NACHI) has a good Web site (*http://www.nachi.org/toc-tips.htm*) with detailed illustrations of common problems encountered during an inspection. Formal building inspection training is available through private companies. Several training providers are listed in appendix A.

Because effective publications and training are readily available, this report does not duplicate that information. Before conducting their first condition survey, new facilities engineers should buy and read *Inspecting a House* or one of the other comprehensive publications listed in appendix A or found on the Web sites listed there. The *Code Check* series (figure 3) of laminated, spiral-bound guides from The Taunton Press is recommended for those who want to brush up on the code requirements for a specialty area such as plumbing, electrical, or HVAC. For those not entirely sure how to deal with deficiencies, *House Check: Finding and Fixing Common House*

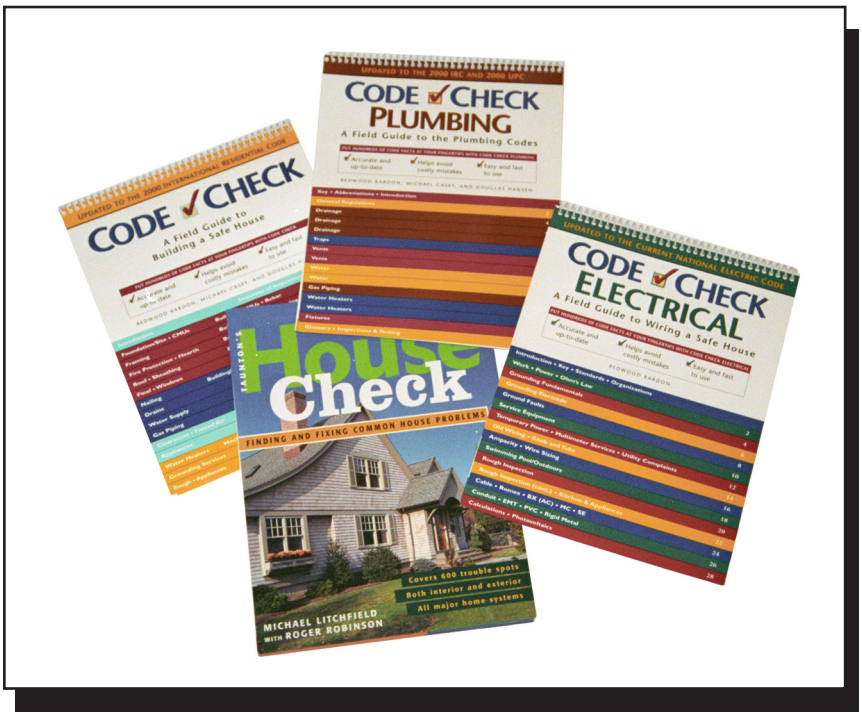

Figure 3—A few of the Code Check series of books from The Taunton Press.

Problems by Michael Litchfield with Roger Robinson (2003) provides quick reference to symptoms, causes, and fixes in a handy field guide form similar to the *Code Check* series.

What the Books Don't Tell You

A number of situations commonly encountered during condition surveys are not covered by ordinary building inspection publications or training. Some USDA Forest Service buildings, such as fire lookouts, are unique. Backcountry facilities frequently have no access to utilities, or public utility service is unreliable. As a result, facilities engineers need to be able to recognize common problems affecting solid- or gas-fueled heaters and appliances, water systems, and wastewater systems.

Safety Issues

It's important to bring obvious safety issues discovered during condition surveys to the attention of unit personnel, even though the condition survey is not an official safety or Occupational Safety and Health Administration (OSHA) inspection. Common structure-related safety issues include:

- Obstructions or uneven floor surfaces that are tripping hazards.
- Low-clearance "head bumpers" that aren't marked.
- Electric panels or shutoff switches that are obstructed or can't be "locked out."
- Overhead storage areas that don't have rails and toeboards to prevent materials from falling off.
- Missing or inadequate handrails on stairways.
- Unprotected light bulbs or fluorescent tubes in warehouses and shops.

These are just a few of the safety issues that may be encountered. More complete facilities safety information is in chapter 30 of the *Forest Service Safety and Health Code Handbook* 6709.11, available electronically at *http://fsweb.wo.fs.fed.us/directives/fsh/6709.11*.

Housekeeping and Storage

Forest Service facilities are typically centers for several different functions including office, residential, storage, equipment maintenance, and carpentry. Because many of the buildings have been occupied for a number of years, housekeeping and storage can be safety concerns. Mezzanines and platforms must be structurally rated for the loads they carry. The maximum load limit should be posted. Facilities engineers should periodically check storage areas to discourage overloading. Materials and equipment must be stored in a neat, safe, and secure manner to avoid injuries.

Hazardous and Flammable Materials

Hazardous and flammable materials have particular storage requirements. The USDA Forest Service's *Everyday Hazmat User's Training Guide* (Erickson and others 2004b) and the companion *Everyday Hazmat Designer's Training Guide* (Erickson and others 2004a) describe how to identify and manage these materials. These publications should be a part of every facilities engineer's reference library. Both are

available electronically at *http://fsweb.mtdc.wo.fs.fed.us/everyday_hazmat*. Flammable and combustible materials (figure 4), which include some paints, are strictly regulated and must be stored only in certain quantities under specific conditions. Certain products are incompatible and must be stored separately. The use or spillage of some hazardous materials results in toxic wastes that require specific, regulated disposal.

Figure 4—This flammable materials sign, while amusing, doesn't meet the required standards.

Storing, handling, and disposing of hazardous materials requires extensive records that should be reviewed periodically for compliance by the facilities engineer. All of the issues noted here, and many more, are covered in greater detail in the *Everyday Hazmat User's Training Guide* and the *Everyday Hazmat Designer's Training Guide*.

Wood Stoves

Wood stoves are common in Forest Service buildings such as saddle shops, backcountry cabins, and residences at ranger stations. *Inspecting a House* describes some of the items to look for when inspecting a wood stove installation. Detailed drawings showing proper clearances between wood-burning appliances and combustible materials are available in the National Fire Protection Association (NFPA) publication *NFPA 211: Burning Standards for Chimneys, Fireplaces, Vents, and Solid Fuel Appliances*, available electronically at *http://www.nfpa.org/catalog* (search for "chimneys"), and the International Code Council (ICC) *Hearth Handbook for Building Officials: Solid Fuel Hearth Systems*, available at *http://www.iccsafe.org* (search for "solid fuel hearth").

Wood stoves should be Underwriter's Laboratory (UL) listed and be installed according to the manufacturer's recommendations, which typically are attached to the back of the stove. Wood stoves must have adequate air for wood to burn properly, and to prevent the depletion of oxygen or the buildup of carbon monoxide. Usually, enough combustion air will be available in relatively "leaky" older structures. Stoves installed in newer, more airtight structures need a dedicated air supply from outside the building.

Chimneys

Chimneys must be inspected and cleaned on a routine basis and should be inspected during a condition survey, if possible. The facilities engineer should ensure that a certified chimney sweep performs regular inspections and that the chimney has been cleaned as required. Sweeps certified by the Chimney Safety Institute of America (*http://www.csia.org/*) follow NFPA chimney inspection guidance. Some local fire departments also conduct courtesy chimney inspections.

Firewood

Firewood storage is a common issue in Forest Service buildings. The year's supply of firewood should not be stored in basements or against buildings. Firewood can harbor insects that will chew on wood buildings.

Propane

Propane is commonly used in remote locations where natural gas or electricity is unavailable. Because propane is heavier than air, it is recommended (and mandated by law in some States) that gas plumbing, water heaters, and furnaces not be located within walls, in basements, or under buildings. Propane can accumulate in low spots and closed-

in buildings where it can displace air, possibly causing asphyxiation, or ignite. Along with the plumbing, appliances should be checked for leaks and proper maintenance. *NFPA 54: National Fuel Gas Code* (*http://www.nfpa.org/catalog*, search for *fuel gas*), and the *2003 International Fuel Gas Code*, (*http://www.iccsafe.org/dyn/prod/3600S03.html)* are good references when inspecting gas and propane installations. When in doubt, call in a mechanical engineer or local certified propane installer or supplier to inspect the system thoroughly.

Generators

Generators typically run on propane or diesel fuel and should be checked to ensure proper operation. Spill control and secondary containment (described in section III of the *Everyday Hazmat User's Training Guide*) should be in place for any potential fuel spills or leaks. Any fuel spills should be cleaned up promptly and appropriately, whether associated with a generator or not. Neither materials incompatible with the fuel nor other flammable or combustible materials should be stored near the generator or in a building housing the generator. Guidelines on incompatible hazardous materials can be found in section III of the *Everyday Hazmat User's Training Guide*. Electrical connections and wiring associated with a generator should be in good repair.

Temperature

Among the most common complaints of building occupants is that the temperature is not comfortable. Although the problem may lie with the heating, ventilating, and air conditioning (HVAC) system, occupants may have created their own problems. Boxes or furniture may be blocking registers, floor-to-ceiling partitions may be cutting off air flow, and windows may be open during the heating or cooling season. It's best to check for such problems before assuming something is wrong with the HVAC system.

When these problems are discovered, it's a good idea to ask the building occupants whether these actions were an attempt to solve another problem, such as drafts or stuffiness. A person who prefers very cool temperatures may share office space with a person who prefers warmer temperatures. In such cases, thermostat wars can be solved by shuffling office assignments so that occupants have similar temperature preferences.

Single-Zone HVAC Systems

Many older offices have only one thermostat and one heating/cooling supply system for the entire building. It is difficult to balance these single-zone HVAC systems to provide consistent temperatures throughout the structure, especially if the south and west sides of the building gain a significant amount of heat from the sun during part of the working day. When existing single-zone HVAC systems for buildings over 5,000 square feet reach the end of their useful life, it is almost always beneficial to replace them with a multizone system.

Potable Water Systems and Wastewater Systems

Even "simple" potable water systems and wastewater systems have plenty of "parts" and are governed by complex regulations. They must be maintained to the highest standards to provide safe drinking water for employees and visitors and to prevent contamination of lakes, ponds, streams, and rivers. When surveying water or wastewater treatment buildings, facilities engineers often check to make sure that system records are complete and up to date. While a facilities condition survey does not include an in-depth sanitary survey of water or wastewater systems, facilities engineers should be aware of drinking water and wastewater issues so they can note any apparent discrepancies. Obvious system deficiencies might include water sources that are open to surface water or animal contamination, leaky lines, malfunctioning controls, iron or other mineral deposits on fixtures, storage of hazardous materials in treatment buildings, corroded electrical connections or floats that do not function properly in water storage tanks, water storage tank lids that are not sealed and secured, and cross connections.

Cross Connections

Cross connections are connections between a tank, line, or fixture that contains potable water and something that contains contaminated water. Should the pressure of the potable water supply suddenly drop, contaminated water can be siphoned back into the potable water

supply, with disastrous results. The appendix of *Inspecting a House* describes cross connections in detail. Because fire hydrants are designed to drain back into the surrounding soil as they are shut off, cross connection potential is particularly high when fire hydrants connected to drinking water supply systems are used to fill fire tanker trucks. Stock watering tanks (figure 5) are at risk of cross connection if they do not have an air gap shielded from contact by animals between the potable water supply and the watering tank. Backflow commonly occurs when pesticide or fertilizer dispensers are connected to garden hoses. This is why vacuum breakers should be installed on all exterior hose bibs. Any potential cross connection is an extreme health hazard that should be corrected immediately.

Figure 5—This stock tank water supply is a cross-connection disaster waiting to happen.

Confined Spaces

Every USDA Forest Service unit is required to have a confined spaces plan, but compliance with this requirement has been somewhat inconsistent among units. Section 38.2 of the *Forest Service Safety and Health Code Handbook* 6709.11 (*http://fsweb.wo.fs.fed.us/directives/fsh/6709.11/6709.11,30.rtf*) details USDA Forest Service requirements for confined spaces. For their own protection, inspectors should be aware of potentially hazardous confined spaces, such as lift stations, storage tanks, utility vaults, and the basements of composting toilets. They also should note modifications that may be necessary to provide forced ventilation or other measures that may be needed for safe access by employees.

Septic Tanks and Drain Fields

Septic tanks and drain fields are common features at many smaller USDA Forest Service stations. Septic tanks usually need to be pumped every 2 to 5 years, depending on sludge buildup. The level of solids should be checked during condition surveys. Drain fields should be kept free of trees and shrubs whose roots might damage the drain lines. If the system uses two drain fields, the condition survey should include a check to make sure that discharge from the septic tank is properly rotated between the two drain fields to prevent one field from becoming saturated and failing. The report, *How To Operate and Maintain Septic Tank/Soil-Absorption Systems* (8271–4302–SDTDC), available at *http://fsweb.sdtdc.wo.fs.fed.us/pubs/pdfimage/82711302.pdf,* explains how to take care of septic tank and drain field systems, including how to measure solid waste buildup in the septic tank.

Lift Stations

Sewage lift stations, while necessary at many sites, provide more than their share of work for maintenance personnel. Lift stations should be checked for signs of deterioration or other problems during condition surveys. Check for corroded electrical wires and connections, and make sure that both pumps work.

Regional or zone environmental engineers can help when you are inspecting water or wastewater systems or whenever questions arise. They often are involved in sanitary surveys of water and wastewater systems. In-depth

inspections of water and wastewater systems are required by *Forest Service Manual* 7421.13 and by many States. Another source of information regarding regulations, requirements, and other issues affecting Forest Service drinking water and wastewater systems is the USDA Forest Service Washington Office Engineering Forest Service Web page available at *http://fsweb.wo.fs.fed.us/eng/programs/water/index.htm*.

Emergency Egress

A condition survey provides a good opportunity to note items in older buildings that should be brought up to current code standards, particularly those that could affect emergency egress from sleeping quarters. Facilities engineers should check egress from bedrooms, especially in basements (figure 6) and on upper stories (including fire lookout towers). Make sure the means of escape is adequate and that windows can be opened and are the correct size and in the proper locations. Chapter 10 of the *International Building Code* and chapters 24 and 26 of *NFPA 101: Life Safety Code Handbook*, describe the specific requirements for primary and secondary means of escape for one- and two-family dwellings and lodging or rooming houses. Check all smoke detectors to see that they are functioning and that they comply with the code.

Figure 6—This basement egress window at the Bitterroot National Forest's Darby Ranger Station meets code requirements.

Accessibility

Older facilities may not be accessible for persons with disabilities. An accessibility survey and transition plan are required for all USDA Forest Service buildings that are not accessible. The survey and transition plan will contain details of work required to make the buildings accessible. However, for budgeting and planning purposes, note basic building accessibility issues in the condition survey. Office entries and bathrooms are the most critical features for accessibility. More information is available at *http://fsweb.mtdc.wo.fs.fed.us/toolbox/acc*.

Mold

Mold in buildings has gained attention lately because of its serious potential health risks. Any moisture or mold problems should be noted during the condition survey. Mold can damage building materials, finishes, and home furnishings. Some molds can cause structural damage to wood and other building components. In addition, mold may cause health problems for some individuals. More information about mold is available at the Facilities Toolbox Forest Service Web site at *http://fsweb.mtdc.wo.fs.fed.us/toolbox/haz/haz04.htm*.

Asbestos

All Forest Service buildings should have been inspected for asbestos by an accredited asbestos inspector during the 1990s. If any materials containing asbestos were discovered, the building should be posted with warning signs and have an asbestos management plan. However, some buildings were missed and some asbestos-containing materials were overlooked during inspections. Composition flooring, popcorn ceiling texture, cloth- or plaster-covered pipe, duct insulation, or loose-fill vermiculite insulation installed before 1981 may contain asbestos. Check the asbestos inspection report if the material is deteriorating or before recommending any work that could disturb the material. If the material is not listed in the asbestos inspection report, have it inspected. See the Facilities Toolbox Forest Service Web site (*http://fsweb.mtdc.wo.fs.fed.us/toolbox/haz/haz02.htm*) for more information about asbestos.

Lead-Based Paint

Lead-based paint was used on all types of buildings before 1978. Lead-based paint that is in good condition usually is not a hazard. However, lead

dust can form when the paint is scraped, sanded, or heated. Lead exposure may cause a range of health effects, which can be particularly acute in children 6 years old or younger. Abatement of lead-based paint may be needed when painted surfaces are being renovated or when paint is deteriorating, particularly in family housing units. More information on lead-based paint is available at the Facilities Toolbox Forest Service Web site (*http://fsweb.mtdc.wo.fs.fed.us/toolbox/haz/haz03.htm*).

Preservative-Treated Wood

In 2004, CCA (chromated copper arsenate)-treated wood products were restricted to certain industrial and commercial uses, bringing preservative-treated wood to the public's attention. The arsenic and other toxic chemicals in wood that has been pressure treated to resist rot and insect damage are of particular concern in areas where children may come into contact with the wood. It may be prudent to assure that older pressure-treated lumber at USDA Forest Service family housing units or at day-care facilities in USDA Forest Service buildings is either completely covered with a good coat of paint or is replaced with material treated with less toxic chemicals. More information on pressure-treated wood is available at the Facilities Toolbox Forest Service Web site (*http://fsweb.mtdc.wo.fs.fed.us/toolbox/haz/haz15.htm*).

Fire Lookouts

Fire lookouts (figure 7) are unique structures in the USDA Forest Service's inventory of buildings. Many of them are quite old and in various states of disrepair. Lookouts may be staffed during the fire season, rented to the public, or unoccupied. Most are remote, exposed to severe weather, and do not have electricity or other commercial utilities.

Lightning protection is required on lookouts and should be checked during condition surveys. Structural support systems, including guy wires, should be tight and in good repair. Propane is often used at lookouts. Fuel tanks should be secured and located as required by code. The requirements differ based on tank size. The tanks also need to be located where they will not damage the lookout if they are vandalized. Information on lightning protection, propane systems, wood stoves, and guy cables for lookouts is available at *http://fsweb.r1.fs.fed.us/e/facilities/facilities_index.shtml*.

When lookouts are rented to the public, they must meet code requirements for public use. The requirements most likely to require attention are stairway tread and riser dimensions, guardrail height, and intermediate rail spacing. Because of liability concerns, the public

Figure 7—The Horn Lookout Tower in the St. Francis National Forest is a standard steel lookout tower built in the early 20th century.

should be prevented from unauthorized access to lookout towers. Fences, gates, and locks are appropriate.

Rodents

The location and nature of some USDA Forest Service facilities make them attractive places for critters. Mice and other rodents can damage buildings and create health hazards for humans. Especially if mouse droppings or nests are visible, precautions must be taken to avoid exposure to hantavirus during the inspection. Any rodent activity or presence should be noted during the condition survey. A tech tip, *Controlling Rodents in Forest Service Facilities: Reports from the Field* (0471–2332–MTDC) is available at *http://fsweb.mtdc.wo.fs.fed.us/pubs/htmlpubs/htm04712332*.

Learning From the Experts

There is no substitute for on-the-job training with experienced inspectors. Learning by doing and getting the opportunity to see first hand how to conduct a condition survey can significantly shorten the time it takes to become proficient. New facilities engineers are urged to consider accompanying an experienced engineer on several condition surveys before attempting a solo inspection, or to have the experienced inspector accompany the new inspector on the first few inspections. Experienced facilities engineers at other USDA Forest Service units usually are willing to assist less experienced engineers. Above all, a facilities engineer must know when to involve specialists or those with more experience. It's okay to say, "I don't know, but I'll find out."

Familiarity with Codes

Since October 2001, the USDA Forest Service has recognized the international family of building codes for the design of buildings and related facilities. *Forest Service Handbook* 7309.11 Zero Code, part 06 (*http://fsweb.wo.fs.fed.us/directives/fsh/7309.11/7309.11_zero_code.doc*) details the technical standards and codes that must be followed for new construction, leased buildings, and existing Forest Service buildings. They include accessibility guidelines, safety codes, the Built Environment Image Guide, and energy standards. This section of the handbook also explains what to do if codes and standards conflict. Facilities engineers conducting condition surveys need at least a cursory knowledge of these codes and how to use them.

Code training by International Code Council (ICC) chapters and private companies is readily available. USDA Forest Service engineers and architects have found the code training put on by the Colorado Chapter of the ICC, the University of Texas Construction Research Center, and the Southern Nevada Chapter of the ICC (see Code Training in appendix A) to be high quality.

The Taunton Press (*http://www.taunton.com*) has published a set of handy code reference guides for field use, called *Code Check* (*http://www.codecheck.com*). These guides summarize the information found in the international codes in an easy-to-use, laminated, spiral-bound format suitable for field use. The guides even provide code references for each item to be checked. Appendix A provides information on these guides.

Tools

Facilities inspectors generally need a number of tools for a thorough condition survey. The "Tools of the Trade" chapter of the book *Inspecting a House* has a complete summary of useful inspection tools. Some of these tools, such as ladders, are available at most USDA Forest Service administrative sites. However, when inspecting remote facilities, inspectors must bring all the tools they will need. Screwdrivers, ladder, flashlight, pliers, tape measure, and an extendable mirror to look into hard-to-access areas should be part of the inspector's toolkit (figures 8 and 9). Specialty tools like moisture meters and electrical testing tools may be helpful when their capabilities and limits are understood.

An inspection form is a key tool for conducting a successful condition survey. Although few people enjoy completing forms, a detailed inspection form can serve as a reminder of all the building components that should be inspected. Forms also help standardize the data gathered and facilitate cost estimates. Many forms are available, but those generated within the USDA Forest Service seem to meet agency requirements the best. Chapter 40, section 44.7 of the *Forest Service Handbook* 7309.11 (*http://*

Figure 8—A compact facilities inspector's toolkit.

Figure 9—A more extensive facilities inspector's toolkit.

fsweb.wo.fs.fed.us/directives/fsh/7309.11/7309.11,40.rtf) requires use of the Maintenance Condition Survey Checklist (Form FS-7300-1) or a similar form that contains the elements of FS-7300-1 for conducting and documenting inspections.

The Northern Region has developed an Excel spreadsheet for *Building Maintenance Data Entry*. Information about maintenance needs can be entered as the inspection is conducted using a laptop computer or can be handwritten and transferred to digital format later. The building description is based on information from the INFRA database. Estimates of the cost of repairs can be generated automatically within the spreadsheet. Cost adjustment factors can be applied to account for remote locations and the historic status of structures. Unit cost data in the spreadsheet is based on RSMeans cost data publications and must be updated annually and adjusted to customary local costs to remain accurate. The inspection items in the Excel spreadsheet, which is organized in Construction Specification Institute format, serve as a good checklist for a building condition survey. This spreadsheet automatically compiles cost data and sorts cost estimates to match the appropriate INFRA reporting categories: health and safety, mission, and resource protection.

Another frequently used inspection form is an expanded and reorganized *Maintenance Condition Survey Checklist* based on Form FS-7300-1. This form has space for more detail than the spreadsheet, but does not include cost data. It is a good form for an initial inspection of a structure and provides much of the data needed for the building's official records. These documents and others developed by experienced USDA Forest Service facilities engineers are available at *http://fsweb.wo.fs.fed.us/eng/programs/facilities/surforms.htm*. In the future, INFRA may have the capability to function as a field information-gathering tool, but until then, spreadsheets or other forms are being used by most facilities engineers.

Safety

Safety must be the first consideration during a condition assessment survey. Facilities engineers routinely inspect areas such as crawl spaces under buildings, attics inhabited by bats, and septic tanks. The potential for accidents is relatively high if inspectors aren't aware of the hazards and appropriate mitigation measures. Facilities engineers should complete a job hazard analysis (JHA) covering all aspects of their work and taking into consideration the specific tools they use and the situations they encounter. Example JHAs for most aspects of facilities inspection work and guidelines for creating other JHAs are available at *http://fsweb.wo.fs.fed.us/OSOH/jha.html*.

Facilities engineers also have a responsibility to help protect the people who use USDA Forest Service structures. Any situation discovered during a facilities condition survey that presents a risk to the safety or health of employees or the public should be brought to the attention of management immediately and scheduled for corrective work (figure 10).

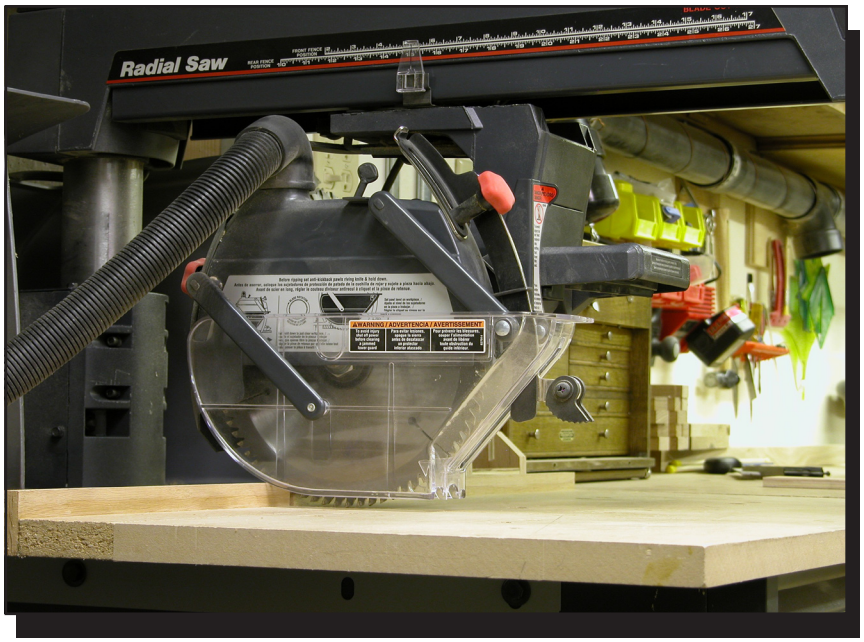

Figure 10—Proper guards and shields on equipment and machinery are important safety devices that may be noticed during facilities condition assessment surveys. Although this sort of safety hazard is not technically part of a condition survey, missing guards and shields should be brought to management's attention so the problem can be corrected immediately.

What To Do With the Data

A facilities condition assessment survey produces a mountain of information on each structure surveyed. The following sections explain how to use the data.

INFRA and Record Keeping

The information that is gathered during facility condition surveys should be added to the official records for each structure. Chapter 60 of the *Forest Service Handbook* 7309.11 (*http://fsweb.wo.fs.fed.us/directives/fsh/7309.11/7309.11,60.rtf*) identifies the required facility records. This information also is used to complete INFRA facilities maintenance data inputs, to identify and set priorities for needed maintenance work, to develop work plans, and to allocate sparse facility maintenance funds to the highest priority problems.

Maintaining good facility records is key to effective long-term management and also is required by the *Forest Service Handbook*. Good records give ever-changing personnel the information needed to keep Forest Service facilities well maintained and to manage risks.

INFRA (*http://pcs27.f16.r6.fs.fed.us/infra*) is a particularly important information storage tool. Maintaining and updating the INFRA database gives region, station, and headquarters offices ready access to the information they need to make management and budgetary decisions and to provide evidence of work accomplishments. With INFRA's continually improving report functions, it also can be used for forest- and district-level work planning, budgeting, and tracking work accomplishments. Facilities engineers who are not familiar with INFRA and its capabilities should contact their unit's INFRA coordinator to learn about training opportunities.

Planning and Budgeting

The *Forest Service Handbook* requires facilities engineers to prevent major unplanned facilities repairs, reconditioning, or replacement by developing and implementing a preventive maintenance program. Good records are needed for such a program. The facilities engineer needs to know the maintenance that is to be performed annually, when buildings are due to be repainted or reroofed, the expected life of materials, and so on. Commercial computer programs such as *Facilities Tracker* and *Mpulse* (see Maintenance Management Software in appendix A) can help a facilities engineer create a preventive maintenance plan. The Northern Region's *Building Maintenance Data Entry* spreadsheet's annual maintenance section (*http://fsweb.wo.fs.fed.us/eng/programs/facilities/r01forms.htm*) provides some information on expected replacement cycles. Future plans for INFRA include a maintenance management feature.

Facilities budgeting procedures are not uniform. Some forests distribute funds to each district based on a formula accounting for a building's square footage and its age. Each district then uses the findings of the facilities condition survey as a basis for determining how maintenance funds will be spent. Other forests set priorities for projects forestwide and distribute funding to the districts for the highest priority projects. The authors have observed that units that set priorities and fund projects forestwide generally tend to have a lower backlog of deferred maintenance projects. One way to organize and display overall forest maintenance funding priorities is to use a spreadsheet similar to *Facilities Maintenance Projects (http://fsweb.wo.fs.fed.us/eng/programs/ facilities/documents/convey04.xls)*. A drawback of this sort of spreadsheet is that projects have to be copied into it from other sources.

Summary

Forest Service facilities engineers have a challenging job. The Forest Service's diverse and often unique structures, the continual scarcity of maintenance funds, and an aging infrastructure add complexity to the job. Timely condition surveys, good record keeping, and effective use of tools can help facilities engineers meet the challenge. *Inspecting a House,* the "What the Books Don't Tell You" section of this guide, and a good condition survey checklist can help inexperienced facilities engineers perform comprehensive facilities condition assessment surveys. The surveys will help ensure that appropriate maintenance is performed on Forest Service structures (figure 11) so that they meet the needs of visitors and the staffs who occupy them throughout their full service life.

Figure 11—This fire engine garage is the latest addition to the Oak Grove Work Center on the Cleveland National Forest's Palomar Ranger District (Pacific Southwest Region).

References (see appendix A for additional information)

Casey, Michael; O'Malley, Kevin. 2000. Building codes for the home inspector. Oceanside, CA: Inspection Training Associates.

Cauldwell, Rex. 2001. Inspecting a house. Newtown, CT: The Taunton Press. 266 p.

Erickson, J. Craig; McMullen, William H.; Throop, Wes. 2004a. Everyday hazmat designer's training guide. Tech. Rep. 0471–2812–MTDC. Missoula, MT: U.S. Department of Agriculture Forest Service, Missoula Technology and Development Center. 59 p. Available at: *http://fsweb.mtdc.wo.fs.fed.us/everyday_hazmat* and on the Internet at: *http://www.fs.fed.us/t-d/everyday_hazmat* (username: t-d, password: t-d).

Erickson, J. Craig; McMullen, William H.; Throop, Wes. 2004b. Everyday hazmat user's training guide. Tech. Rep. 0471–2810–MTDC. Missoula, MT: U.S. Department of Agriculture Forest Service, Missoula Technology and Development Center. 116 p. Available at: *http://fsweb.mtdc.wo.fs.fed.us/everyday_hazmat* and on the Internet at: *http://www.fs.fed.us/t-d/everyday_hazmat* (username: t-d, password: t-d).

Litchfield, Michael; Robinson, Roger. 2003. House check: finding and fixing common house problems. Newtown, CT: The Taunton Press. 41 p.

Newer buildings like the Rochester Ranger Station in the Green Mountain and Finger Lakes National Forest in the Eastern Region may not be as likely to require significant repairs as older structures, but they should be inspected just as thoroughly. Unpleasant surprises sometimes become evident as a new building "settles in," and it's always best to catch and fix those before they cause serious damage to the structure or problems for the building's occupants.

Appendix A—Additional Information (see References for materials cited in the guide)

Other Building Inspection Books

Bannister, Jay M. 1991. Building construction inspection: a guide for architects. Hoboken, NJ: John Wiley & Sons. 291 p.

Becker, Norman, P.E. 1993. The complete book of home inspection. New York: McGraw-Hill. 289 p.

Hoffman, George. 1993. How to inspect a house: expanded edition. Reading, MA: Addison-Wesley. 224 p.

Irwin, Robert. 1994. The home inspection troubleshooter. Chicago, IL: Dearborn Trade, a Kaplan Professional Company. 224 p.

Kardon, Redwood. 2001. Code check electrical (3rd ed.): a field guide to wiring a house. Newtown, CT: The Taunton Press. 32 p.

Kardon, Redwood; Casey, Michael; Hansen, Douglas. 2004. Code check (4th ed.): a field guide to building a safe house. Newtown, CT: The Taunton Press. 32 p.

Kardon, Redwood; Casey, Michael; Hansen, Douglas. 2003. Code check building: a field guide to the building codes. Newtown, CT: The Taunton Press. 32 p.

Kardon, Redwood; Casey, Michael; Hansen, Douglas. 2001. Code check HVAC: a field guide to heating and cooling. Newtown, CT: The Taunton Press. 32 p.

Kardon, Redwood; Hansen, Douglas; Casey, Michael. 2004. Code check plumbing (2nd ed.): a field guide to the plumbing codes. Newtown, CT: The Taunton Press. 32 p.

Newcomer, Roy. 1996. A practical guide to inspecting structure. New Berlin, WI: American Home Inspectors Training Institute. 116 p.

Scaduto, Mike and Joe. 1993. The home inspector's bible. Lynnfield, MA: Society of Professional Real Estate Inspectors. 304 p.

Spada, Marcia Darvin. 2003. The home inspection book: a guide for professionals. Mason, OH: South-Western Educational Publishing. 384 p.

Traister, John E. 1997. Home inspection handbook. Carlsbac, CA: Craftsman Book Company. 320 p.

Williams, Andrew R. 1993. Domestic building surveys (The Builder's Bookshelf). London, UK: E & F N Spon. 200 p.

Building Inspection Web Sites

These are just some of the available resources. Readers are encouraged to search other Internet sites for additional resources.

Sources of Books and Reference Materials

- **Books and literature:** Electrical and Construction Bookstore. Yaphank, NY. *http://www.electrical-contractor.net/The_Store/Menu/Home_Inspection.htm*
- **Books:** Professional Equipment, Inc. Hauppauge, NY. *http://www.professionalequipment.com/xq/ASP/building codes_books/ID.2/source.google/qx/default.htm*
- **Home inspection software:** Home Inspection Software 2000. Naples, FL. *http://www.homeinspection2000.com*
- **Books:** The Taunton Press. Newtown, CT, code reference guides for field use. *http://www.taunton.com/store/index_fhbv.asp*; *Code Check* series, *http://www.codecheck.com*

Maintenance Management Software

- **Facilities Tracker; Conservation Services**
  305 Concho Drive
  Pueblo West, CO 81007
  719–547–7788
  goodall@rmi.net

- **MPulse; SpecTech, Inc.**
  P.O. Box 22906
  Eugene, OR 97402
  800–944–1796
  http://www.mpulsecmms.com

Online Information

- **Home inspections:** The Old House Web.
  Gardiner, ME
  http://www.oldhouseweb.com/stories/How-To/Home_Inspection/The_Home_Inspector
- **Home maintenance and repair:** Michigan State University Extension Service
  http://www.msue.msu.edu/imp/mod02/master02.html
- **Inspection tips:** National Association of Certified Home Inspectors. *http://www.nachi.org/toc-tips.htm*

Professional Organizations

- American Society of Home Inspectors, Inc., Des Plaines, IL
  http://www.ashi.com
- California Real Estate Inspection Association, Palm Springs, CA
  http://www.creia.org
- National Association of Certified Home Inspectors, Valley Forge, PA
  http://www.nachi.org
- National Association of Home Inspectors, Inc., Minneapolis, MN
  http://www.nahi.org

Building Code Training

- Colorado Chapter of the International Code Council
  http://www.coloradochaptericc.org/
- International Code Council
  http://www.iccsafe.org/training/seminars/complete.html
- Southern Nevada Chapter of the International Code Council
  http://www.educode.us/
- University of Texas Construction Research Center
  http://www.crc.uta.edu/

Inspection Training

- American Society of Home Inspectors
  http://www.ashi.com/inspectors/ashiaschool.asp
- InspectAmerica Engineering, P.C. White Plains, NY
  http://www.inspectamerica.com/Home_Inspector_Training/get_training.html
- National Association of Certified Home Inspectors
  http://www.nachi.org/events.htm
- National Institute of Building Inspectors
  http://www.nibi.com/courses.html
- The Inspection Depot Institute
  http://www.inspectiondepot.com/training/training.html
- Training Services Association, Tucson, AZ
  http://www.trainingservicesassoc.com

About the Authors

Cherie Peacock came to MTDC in 2004. She works part time while pursuing a master's degree in architecture at Washington State University's Interdisciplinary Design Institute in Spokane, WA. Before joining MTDC, Cherie was the forest engineer for the Ottawa National Forest. She has worked for the Bitterroot, Lolo, and Tongass National Forests in facilities, roads, bridges, trails, and environmental engineering. Cherie graduated from Michigan Technological University in 1986 with a bachelor's degree in civil engineering with an emphasis in environmental engineering.

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. Kathleen also spent 10 years working in highway design and construction with the Idaho Division of Highways after graduation from Washington State University in 1974 with a bachelor's degree in architectural studies.

Library Card

Peacock, Cherie; Snodgrass, Kathleen. 2004. So that's why it's always cold in here: a guide for conducting facilities condition assessment surveys. Tech. Rep. 0473–2839–MTDC. Missoula, MT: U.S. Department of Agriculture Forest Service, Missoula Technology and Development Center. 20 p.

Provides information to help Forest Service facilities engineers conduct facilities condition assessment surveys. These surveys, also referred to as maintenance condition surveys or building inspections outside the USDA Forest Service, are an inspection and record of the physical condition of an existing building. The surveys provide most of the information needed for technical support and maintenance of the facilities. The data gathered can be a basis for allocating funds. This guide, which includes references to Web sites, books, forms, computer programs, and other materials, is intended to help engineering and architecture professionals and technicians become familiar with the inspection process.

Keywords: architects, buildings, facility engineers, inspections

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Single copies of this document may be ordered from:
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For additional information about this guide, contact Kathleen Snodgrass at MTDC.
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Electronic copies of MTDC's documents are available on the Internet at:
http://www.fs.fed.us/t-d (username: t-d, password: t-d)

USDA Forest Service and U.S. Department of the Interior Bureau of Land Management employees can search a more complete collection of MTDC's documents, videos, and CDs on their internal computer networks at
http://fsweb.mtdc.wo.fs.fed.us/search