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Safety Hazards to Workers in Modular Home Construction

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Abbreviations

BLS	U.S. Bureau of Labor Statistics
HUD	U.S. Department of Housing and Urban Development
NAICS	North American Industry Classification System
SIC	Standard Industrial Classification
WVU	Safety and Health Extension, West Virginia University

Video/CD ROM

A short video provides some of the information in this report – in VHS or CD-ROM format. Contact Mark Fullen, 1-800-626-4748, m.fullen@mail.wvu.edu The report and video will be posted at www.elcosh.org.

Contents

While conducting fall protection training, staff of the Safety and Health Extension, West Virginia University, learned of hazards that are unique to modular home construction and investigated them as part of a pilot study. The literature shows that not much research has been done on the modular home industry and that what has been done focuses on manufacturing, rather than installation. This report, based on observation, interviews, and a questionnaire, lists the hazards faced by workers that appear to be specific to modular home installation, recommends ways to improve worker safety, and suggests areas for future research.

Background

A modular home is best defined as:

> Finished three-dimensional sections of a complete dwelling, built in a factory, [and] transported to [a] site to be joined together on a permanent foundation. The modular home meets conventional building codes and zoning requirements.[1]

Modular homes are distinct from HUD Code manufactured homes, which are known as mobile homes. Unlike mobile homes, modular homes do not have integrated frames and axles. On a mobile home, the metal frame that the house is hauled on is also the structural floor support of the home and stays as part of the home after installation. A modular home, after it is transported to a site, is hoisted off of a metal-frame trailer. The structural portion of the house is timber and similar to typical "stick-built" construction. (Modular manufacturing is used for everything from outbuildings to large resorts and hotels.)

Modular homes are not new. Factory-built houses have been produced for a century. Sears, Roebuck and Co. sold 100,000 factory-built mail-order homes from 1908 to 1940.[2] Over time, the technology and quality has improved to the point where, after installation, it is sometimes hard to tell the difference between a stick-built and a modular home.

Of the industrialized housing-market segments – panelized, production builder, HUD code (mobile), and modular – modular home production is the smallest. Still, modular homes have seen the greatest growth in terms of percentages, averaging 12% per year in the number of homes in 1991-2001.[3]

Production data for the modular home industry are not readily available. However, in 1996, about 37,000 modular homes were produced and industry forecasters see the modular housing industry continuing to increase in its market share.[4] All American Homes, the nation's largest manufacturer of modular homes, illustrates this growth. This company has five manufacturing plants throughout the United States. In 1998, the company shipped 2,511 homes for $150 million. In 1999 they shipped 2,949 houses for $155 million and their 2000 numbers, as of April, were already 25% ahead of 1999.

With growth comes new technology. Some of the biggest changes in the industry have been the ability to design modular homes that match older neighborhoods, meet new housing development requirements, and resemble new stick-built house styles. The typical modular home no longer resembles a doublewide mobile home. The use of a tilt-up roof is a key technology development that has made

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[1]Don O. Carlson, *Automated Builder Encyclopedia, Third Edition*. Carpenteria, CA 1995.

[2]Why buy a modular home. http://www.the-homestore.com

[3]Terry Traynor, Total Housing Even in 2001 at 2.219 Million, *Automated Builder*, January 2001, pages 19-21.

[4]Fast Facts on Building Systems. http://www.nahb.org

this architectural flexibility possible. Before the tilt-up roof was used, the builder was limited to the height limitations that a tractor-trailer could haul, governed by the transportation regulations. Now, houses can be designed with very steep roofs that can be left folded down for transport. When a house arrives on site, the roof panels are tilted up and secured into place.[5]

Within the residential modular market, the cost and size of the houses vary greatly. A large segment of the market consists of two-section ranch-style houses, but many of the houses manufactured today are much larger and more complex. These houses commonly consist of four to six sections, known as modules.

Data on Injuries and Deaths from Injuries

Published data that are precise and recent are difficult to locate. Government data on workplace illnesses, injuries, and deaths generally do not separate manufactured and modular home installation from other types of residential construction. Bureau of Labor Statistics (BLS) data on nonfatal and fatal injuries are available only for broad categories, such as for all residential contractors.

A related problem for analysis of data on modular home installation is that some modular home installation companies may be classified apart from residential construction, at least under the standard industrial classification (SIC) system in effect through 2002 (*see* Industry Relationships, page 8). Many modular home manufacturers and modular home wholesalers – listed separately, in "Wholesale Trade" and "Manufacturing" under the SIC – perform modular home installations. A new data reporting system, the North American Industry Classification System, or NAICS, which was being implemented in 2002, was expected to be more rational than the SIC in the placement of sub-industries within larger categories, but the basic data-reporting category was still expected to be residential construction.

Similarly, a computer-based search of the OSHA Integrated Management Information System (IMIS) can't distinguish modular home and stick-built contractors. The data are incomplete, in any case; OSHA inspections of modular home installation sites are relatively rare, most likely partly because contractors are on a jobsite for a short time, which usually ranges from 3 hours to 2 days.

In 2000, modular and mobile home manufacturing industries experienced 13 deaths from injuries, and residential building contractors, which include modular home installation companies, experienced 97 such deaths, according to the Bureau of Labor Statistics.[6] (In 2000, there were just under 1,200 deaths from injuries in construction.)

In the most recent published report covering modular and mobile homes – manufacturing and installation, combined – the two were among the top 10 high-risk industries, as measured by BLS annual surveys of occupational injuries and illnesses.[7]

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[5] Tilt-Up Roofs for Manufactured and Modular homes. http://www.nahb.org

[6] http://data.bls.gov/labjava/outside.jsp?survey=cf.

[7] Martin E. Personick and Judy R. Daley, Profiles in safety and health: Work hazards of mobile homes, *Monthly Labor Review*. July 1989, Vol. 112, No. 7.

Legislation

Recently, Congress has moved to reform and modernize the 25-year-old federal regulatory program that governs construction standards for manufactured (mobile) homes.[8] On December 27, 2000, President Clinton signed the Manufactured Housing Improvement Act into law (P.L. No. 106-569). It requires each state to institute an installation standard by December 27, 2005.

Under the new federal law, installation standards are "reasonable specifications for the installation of a manufactured home, at the place of occupancy, to ensure proper setting, the joining of all sections of the home, and the installation of stabilization, support, or anchoring systems."

An attempt to set minimal safety requirements at the state level, The Manufactured Housing Installation Standards Act, was introduced by Sen. Keith Goodenough in the Wyoming senate in 2001, but failed by a vote of 12 to 18. The proposed law, while not specifying penalties, would have required that installers register with the state and comply with manufacturers' requirements, among other things.

Research Methods

Participants

Four organizations participated in this research project (The companies installing the homes agreed to cooperate with the research on condition that they not be identified in the report.):

1. A new land and real estate development company, which had plans to buy land and produce housing developments made up mainly of high-end modular homes. The house that was installed during the study was to be the company's model home to show potential buyers. So, they purchased the house from the manufacturer and then hired a contractor that specialized in "modular home sets." This specialty contractor spoke of other projects where his company acted as the purchaser and installing contractor, as well.

2. A local manufacturer of modular homes that installs its own homes. In an additional, small share of its business, the company acts as a wholesaler to other retail modular home lots. The company has one set crew that schedules and conducts all modular home installations.

3. A local company that deals mainly in single and double-wide mobile homes and has recently ventured into the modular home business. The company buys homes from the manufacturer, resells them to the consumer, and has a set crew on staff to install the homes.

4. A nonprofit group that provides no-interest loans to people who meet certain financial requirements. This organization received funding to buy and develop property in a rural county. They decided to use modular homes because of the time and cost savings.

The nonprofit bought a home and hired a local contractor to install it, who subcontracted with a local carpenter contractor to assist. The main contractor had little or no experience installing modular homes, having previously done civil and excavation work.

[8] Manufactured Housing Institute. Summary of the manufactured housing improvement. Act P.L. 106-569. www.manufacturedhousing.org/government_affairs

Pilot study participants: Industry roles

Company or organization	Manufacturer	Buyer	Reseller	Installer	Subcontracts out installation
1		x	x		x
2	x		x	x	
3		x	x	x	
4		x	x		x

Job Safety Analyses

This study was based on job safety analyses of four modular home installations between June 2001 and April 2002. Staff of the Safety and Health Extension, West Virginia University (WVU) videotaped the installation processes with two cameras, while documenting the job tasks. Each sequence was videotaped for more-detailed analysis at a later time and also to compile a short informational video showing safety hazards in the modular home industry. (The video is to be posted at www.elcosh.org or contact m.fullen@mail.wvu.edu.)

The detailed analysis consisted of two members of the research team independently viewing the footage. After each completed a preliminary analysis, the two would meet and compile the data for a final analysis.

The videotaping was used also to help develop conceptual engineering controls for the hazards that were found to be specific to the modular home industry.

Questionnaires

While on site, WVU asked employees and employers to complete questionnaires about the experience and knowledge of the workers and companies involved; completion of the questionnaires was voluntary.

Interviews

At the same time, WVU interviewed the companies' on-site personnel to better determine the industry relationships and how the companies interact.

Findings

Job Safety Analyses

Hazards Typical of Residential Construction

Many of the job tasks and hazards that were documented in the job safety analyses are typical of residential construction. These include:

- Using a chain saw (fig. 1)
- Setting and climbing an extension ladder (figs. 2 and 5)
- Hammering
- Using an air nailer
- Using a circular saw (fig. 3)
- Setting and using a step ladder (fig. 4)
- Overhead hazards (fig. 6)
- Misuse of tools (fig. 6)
- Walking and working at heights above 6 feet (fig. 7)
- Safe access to roof (fig. 8).
- Carrying bundles of shingles (fig. 9)
- Using a cordless drill.

For the above-listed tasks, in many instances, basic safety rules and procedures were not followed. This was due in part to the lack of formal safety training of many of the employees and shortcuts taken. Unlike a typical stick-built house that is constructed in phases, a modular home is 95% complete when it leaves the factory, so the material on the interior needs to be protected from the elements as soon as possible (*see* footnote 1).

These are some of the precautions not taken or hazards that were not controlled:

- No personal protective equipment when using a chain saw
- Improper use of step- and extension ladders, including use of damaged ladders
- Walking/working under loads, some of them not properly secured
- No safety glasses when using a hammer, sledgehammer, air nailer, and circular saw
- Lack of hard hats when exposed to falling-object hazards
- High noise exposures (measurements were not taken)
- Fall hazards while working on foundation walls, around an open excavation. and while working on low-sloped and steep-sloped roofs.

Procedures and Hazards Unique to Modular Home Construction

Installing (setting) a modular home is entirely different from building a traditional stick-built house, so some job tasks create hazards that are not usually encountered in residential construction. Procedures also differ among installation companies, such as the four companies in this pilot study. Even with variations, however, there was a common thread of steps – and hazards – that could be identified.

Unlike most other residential sites, a modular-home installation requires a large hydraulic crane to lift modules (boxes) onto the foundation. Having the crane, along with a tractor-trailer that delivers the modules – and possibly a bulldozer – creates a high-hazard site (*see* fig. 10).

Once a modular house has been driven to a site, the work crew prepares the house for the rigging assembly and rigs the home for lifting. The house is then hoisted onto the prepared foundation. The employees use a tagline to guide the house to the foundation. They then use crowbars and other similar tools to align the house to the foundation.

In one installation that was observed, the crane was overloaded and the operator was hoisting the module barely above the foundation, in case it had to be set down quickly. Eventually, the operator hoisted the house back toward the crane so the employees could enter the house, while suspended in air, and remove bundles of shingles to bring the total weight down so the module could reach its set point.

On the same installation, the set crew consisted of two employees (fewer than other companies in the study whose crews ranged from 5 to 10 employees). At various times during the day, both workers would work under and pass under the house as it was suspended above them (fig. 11).

When the house is set, the employees climb up on the roof. The reason: Most new modular homes have tilt-up roofs to accommodate U.S. Department of Transportation height restrictions. The roofs are tilted up on site (*see* figs. 12-18). Once the employees have accessed the roof, they use a special hook to rig the rafters to lift – tilt up – the roof. The employees then ride the roof up into position or stand on a second box while the roof is being tilted.

The procedure varies, depending on the house style. For instance, on a ranch-style house with a 5:12 (low) roof slope, one box must be set first and tilted up before the second box is put into place, because one side of the roof hangs past the center line of the house. Or, if a house has a steeper-slope roof (such as, Cape Cod-style), the roof is not completed to the centerline, so both modules are set on the foundation first. The tilt-up roof of one module can be rigged and lifted while the employees stand on the other rooftop that has not yet been tilted. These are just two examples of many styles of modular homes being installed (and methods of roof installation).

After the roof is tilted up, while the crane holds the roof, the employees typically go into the attic area to install roof supports, without fall-protection equipment. The roof supports observed varied by house style and manufacturer type, but they all caused a similar hazard: a rigging, crane, or structural failure would cause the tilt-up roof to crush the employees. In two installations, the employees reached the attic area by crawling over the top edge of the roof into the attic. This activity put the employees at high risk for a fall to the ground below or even further, if the house was set on a completed basement. After installing roof supports, the employees exited the attic area by climbing back onto the roof, exposing them again to a fall risk.

Compared to traditional residential housing, modular home installation has these major job tasks (and potential hazards):

- Flagging traffic while positioning the home for hoisting (struck by)
- Hoisting of large, heavy modules, or "boxes," by an inexperienced workforce on a site having uneven terrain and other less-than-desirable conditions. (struck by, caught between)
- Working under a heavy load that is being hoisted into place (struck by, caught between), which happens less often in other residential work
- Aligning the house to the foundation (caught between)
- Accessing the foundation wall with a ladder that does not exceed the top edge of the wall, as required by OSHA, to allow clearance for the house to set (fall)
- Accessing the roof with an extension ladder (fall)(also a problem in traditional residential construction)
- Riding the tilt-up roof into place/riding the load (fall)
- Accessing the attic area from the roof top (fall)
- Working under the roof while it is suspended by the crane (caught between, crushed by, fall).

In the pilot study, the amount of time to install each house ranged from less than 3 hours for one contractor to two full days for another; a third contractor completed the process in about 4 hours. A

fourth contractor had a rigging assembly pull up through the house because the rigging holes were not set up to account for an uneven load. That mistake delayed the completion of that job by two months.

Differing procedures among the four companies could be explained by these factors:

- Manufacturer of the house
- Style of house
- Company experience
- Supervisor experience
- Worker experience
- Crane operator experience
- Site conditions
- Weather.

Questionnaire Responses

Two of the 4 employers and 17 of 25 employees (68%) chose to complete the questionnaire. The numbers of contractors and workers reported here are so small that they are not necessarily typical for the industry. Nonetheless, the following patterns were observed.

Experience and training. The questionnaire was used to determine employers' and employees' modular home installation experience, as well as their training related to modular home installations and safety. Questions were used also to ascertain what employers and employees believed to be the major hazards in the work and to identify their safety concerns.

Most of the employees reported receiving some type of on-the-job training; the survey did not ask about the duration or frequency of this training. One employee referred to the training as "common sense." Other employees and one employer indicated that the only training performed was in the manufacturing facility and not at the installation site.

Most modular homes now use **tilt-up roofs,** yet only 7 of the employees (40%) stated that they had received some type of training on such roofs. This questionnaire didn't ask participants to indicate duration or frequency of the training. Both employees and employers noted that tilt-up roofs present fall and crushing hazards, some of them fatal.

Likewise, with regard to **rigging,** only 50% of the employees had received training, yet 75% had rigged a modular home. More than 80% of the employees stated that **crushing** and **pinching** hazards, as well as potential damage to the house were pertinent concerns. Employers felt damage to the house was the major concern because of improper rigging.

Injuries. Five (29%) of the 17 employees responding said they'd been injured on a modular home installation jobsite in their careers, with these injuries: broken leg, finger amputation, strained back, sprained ankle, and an electric shock.

Safety equipment. Employees indicated that they thought they were provided with necessary safety equipment but that they would like to see personal protective equipment such as fall, eye, head, and foot protection. The employers did not respond to questions regarding safety equipment provided by the company and the researchers were unable to follow up.

Industry Relationships

The four organizations participating in this pilot study reflect the diversity of companies in the modular home installation industry (*see* page 4). Such diversity makes it difficult to uniformly assign responsibility for safety and health on site. Groups purchasing the homes appear not to be experienced or knowledgeable in dealing with construction safety and health. And because buyers and sellers of the houses often are often separate disconnected from the installers, the installers do not know in advance what type of house, site conditions, and other factors to expect on a given job.

Similarly, the variety of companies involved has hindered efforts to obtain data to define the problems. For instance, under the Standard Industrial Classification system, the real estate development company (#1) would not have been classified in residential construction, but the modular home set crew (*see* #1) that was subcontracted most likely would have been. The small manufacturer of modular homes (#2) had a set crew of about 6 employees, while the rest of the employees manufacture the homes in a plant; so the plant-based employees would not have been classified under the residential construction SIC for installing modular homes. Most likely, the contractor in this pilot study who had experience in civil/excavation work (*see* #4, page 4, above) would not have been classified under the SIC code for installation of modular homes.

Many of the classification problems appear to remain under the system replacing the SIC, the NAICS system. Modular home installation remains part of single-family housing, but companies primarily engaged, for instance, in excavation or land development would not be considered part of residential construction in NAICS 2002.

Conclusions and Recommendations

The process of installing a modular home is complex and dangerous. The site conditions, the location of the foundation, the type and size of the house, and many other factors can affect the potential for injury to employees on site. However, changes in design, training, technology, and regulation could make this industry and process safer. This industry is growing rapidly and likely will continue to do so. Now is the time to implement change and eliminate the risks.

The main hazards that could not be addressed by current standards were:
- Working under a live load, a tilt-up roof, while installing supports
- Working on the peak of the roof or in the attic with no fall protection systems available.

In conducting this pilot study, the intent was to recommend, first, conceptual engineering controls that the manufacturers of these modular homes could incorporate into the manufacturing process and, second, work-practice controls, based on adequate training and including safe procedures and the use of personal protective equipment.

Tilt-Up Roof Hazards

The major hazard appears to be the potential for employees to be crushed by a tilt-up roof while securing the roof in place. All four homes that were analyzed had tilt-up roofs and all four support systems were of different designs. The type of support system depends on the style and type of house.

Systems range from what is called a “knee wall” (a support the length of the house that has to be pulled into place and nailed to supports) to support arms that are secured to the roof and hinge down as the roof is raised. Both of these systems have the potential for failure if the crane, rigging, connections, or roof system fails during the lift and suspension of the roof.

The conceptual design that would reduce or eliminate this hazard is a support system that at any point in the lift of the tilt-up roof would have the ability to be secure and prevent the roof from collapsing. Conceptually, this design would be a telescoping support that at specific points in the extension would lock the previous section into place and, if the roof collapsed, would only slip back to the last locked section. This support could be designed to be an integral part of the home that is permanently secure to the ceiling joists and to the roof joists that once in place becomes the roof support.

Fall Hazards

The risk of falls from the roof and the attic area during the installation of a modular home is high. The residential construction industry currently follows OSHA's Interim Guidelines on Fall Protection for Residential Construction. The problem is that the roofing, attic and foundation wall work involved in the modular home industry differs greatly from that of stick-built residential construction.

> Example 1: The residential fall protection guidelines require a safety monitor on a roof with a slope of 4:12 or less. The difference is, at the peak of the roof, the fall exposure on a modular home is a straight drop to the ground below or to an open basement compared to the peak of a roof on a stick-built structure where there is no immediate straight fall to the ground below from the peak, just the downward slope of the other side of the roof. As the roof pitch increases, the OSHA requirements get more stringent, but they still do not address the uniqueness of the modular industry.
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> Example 2: A roof slope of 6:12 on a traditional residential site vs. a 6:12 on a modular home. On a traditional site, an interim OSHA directive, 3.1.1 Interim Fall Protection Guidelines for Residential Construction, requires the installation of slide guards continuously along the eaves placed no more than 3 rows of shingles up the roof. The other requirement is that, when working in an attic, no employee works directly below another employee and that each employee has all tools within easy reach. OSHA has set no personal fall-arrest requirements. The requirement for slide guards would prevent modular home workers from sliding off the eave edge, but, without personal fall-arrest, workers are not protected from falling from the peak edge that has a straight drop to the ground or basement below. Also, the interim standard doesn't address how to safely tilt up a roof. Often employees have to be on the roof to assist in the tilting up process and they are not protected from a fall during this. This tilting-up activity, which is different from roofing, has not been addressed by OSHA. A third issue is that fall protection is needed for workers who are in an open-sided attic during modular home installations. when modular home workers are working in attics, where one edge is an open fall hazard, attics are typically accessed from the roof, unlike on a traditional site where the attic is accessed from the interior of the home, the attic is complete, and there are no open-side fall hazards.

The recommendation from WVU would first be for OSHA to develop a set of standards or guidelines that would address the hazards specific to the installation of modular homes. Second would be for the manufacturers of modular homes to design into the home or purchase existing systems that provide adequate anchor points and/or fall protection systems for workers to tie off to while working on the roofs and in the attics of these modular homes. Some fall protection system manufacturers have already developed anchor points and fall-arrest systems specifically for use in residential construction that the installers of modular homes could install on site. Still, these fall protection manufacturers need to look at the processes involved in modular home installation and develop systems that would work with this industry. Having the fall protection systems already in place when the homes arrive from the factory would help ensure that the systems are used.

Hoisting and Rigging Hazards

The hazard of making large lifts on a residential jobsite without adequately trained employees is another concern. Again, this differs greatly from other residential construction. As noted earlier (page 6), two employees worked under the house while it was suspended; one module weighed 22,000 pounds. On another site employees worked under the house while it was suspended to knock loose the wheels and axles before continuing the lift.

The solution to this hazard is to train employees in the safe procedures related to rigging these homes and working around them during the lift. The industry would also benefit from an OSHA guideline similar to that of setting precast concrete that is addressed in the Subpart M – Fall Protection Standard.

Ladders

Although common in all types of construction, ladders are used in numerous spots around the modular house for very short durations. In some cases, a ladder cannot extend above the foundation wall – as required by OSHA – because the house is about to be set on the foundation.

WVU would recommend a thorough review of existing ladder designs and ladder accessories that could benefit the industry. Also, employees need to be trained in the proper use and inspection of ladders.

WVU has developed the design of a ladder that could be used against foundation walls that would have a hinged arm that when not in use would fold down parallel to the ladder. When engaged, it could be hinged up to a vertical position above the top of the ladder and could act as a handhold to access the foundation wall and the ladder. This ladder would need to incorporate some other ladder accessories that are currently available, such as rubber grips on the top ends of the ladder to keep the ladder from slipping down the wall and a balance system at the bottom of the ladder to keep it from slipping out from under the worker (fig. 19).

Statistical Classification (NAICS)

In conducting this research it was apparent that, for a modular home, the construction process is completely different from that of traditional residential construction. Tracking of industry hours, injuries, deaths, and compliance with government safety regulations would be feasible if the modular home classification code was moved up one level in the SIC/NAICS, so modular installation is equal to residential construction, and not a subset.

Future Research

Research is needed into industry relationships, the economics of the industry, and the true injury and death statistics. There is a need also to complete designs of the proposed safety systems described in this report.

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The many different roles that exist and all of the potential combination of "players" that can or cannot be involved with a project makes studying and, more important, changing the safety of the industry difficult. There may be a move for positive change in the industry, however. Elliott Fabri, President of New Era Homes, called for the Modular Industries to "come of age" in an acceptance speech after receiving the Automated Builder/James R. Price Achievement in Housing Award for 2001. Some of his goals for the industry included no longer shipping out boxes and hoping that they are installed properly on site. He sees the industry moving to more "turnkey" projects, where the manufacturer assures not just a quality-built home, but a quality-installed home. Safety wasn't addressed specifically, but quality of products, thinking outside of the "box," and new design methods were, which leaves room for interpretation that if the industry is in the middle of a dramatic change, this would be an appropriate time to reassess the risks to the modular home installers and develop innovative ways to control those risks.

References

Carlson, Don O. 1995. *Automated Builder Encyclopedia, Third Edition.* Carpinteria, CA, Automated Builder Magazine Publications.

Fast Facts on Building Systems. no date. www.nahb.org.

Manufactured Housing Institute. 2003. Summary of the manufactured housing improvement. Act P.L. 106-569. www.manufacturedhousing.org/GA_summary.html

OSHA, Occupational Safety and Health Administration, U.S. Department of Labor. Inspections within SICs. http://155.103.6.10/cgi-bin/sichq/sic1 (as of March 12, 2002)

Personick, Martin E., and Judy R. Daley. 1989. Profiles in safety and health: Work hazards of mobile homes. *Monthly Labor Review*, 112(7): 15-20, July.

Sharon Stangenes. 2000. Home Delivery. *Chicago Tribune Internet Edition,* www.chicagotribune.com/marketplaces/homes, April 8.

Tilt-Up Roofs for Manufactured and Modular Homes. www.nahb.org

Why buy a modular home. www.the-homestore.com

Construction site safety is an aspect of construction-related activities concerned with protecting construction site workers and others from death, injury, disease or other health-related risks. Construction is an often hazardous, predominantly land-based activity where site workers may be exposed to various risks. Site risks can include working at height, moving machinery (vehicles, cranes, etc) and materials, power tools and electrical equipment, hazardous substances, plus the effects of excessive... Construction workers build, repair, maintain, renovate, modify and demolish buildings. Construction as a proportion of gross domestic product varies widely in industrialized countries. A large portion of construction workers are unskilled labourers.Â A large portion of construction workers are unskilled labourers. Original Description. Health and Safety Hazards in the Construction Industry. Original Title. Health and Safety Hazards in the Construction Industry. Copyright. Â© Attribution Non-Commercial (BY-NC). About 64% of construction workers suffer from musculoskeletal disorders, as a result of an accident or through repetitive movement. Workers are also at risk from repeated use of particular machinery and equipment, such as ground working equipment and vibrating power tools, resulting in a condition called Hand Arm Vibration Syndrome or â€œblue fingerâ€. This can cause the loss of many hours of work.Â The Occupational Safety and Health Administration provides a series of standards, covering possible hazards in construction and tips to prevent them. Scaffolding.Â Hazard: Falls are the main cause of fatalities in the construction industry, and they can happen due to several factors. For example, unstable working surfaces, misuse of fall protection equipment and human error can all cause falls.