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NAILING DOWN THE PATTERN IN HISTORICAL ARCHAEOLOGY

A Thesis

Presented for the

Master of Arts

Degree

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Amy L. Young

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ABSTRACT

This study suggests that middle-range research has an important role to play in historical archaeology. Three models are developed for interpreting nail assemblages from 19th and 20th century contexts. All models are based upon ethnoarchaeology, experimental archaeology, and direct observations of nails operating in their systemic contexts. The first model allows for discriminating between a nail assemblage from an ephemeral structure site and an assemblage from a dump site. The second model enables the archaeologist to identify whether a building was log, timber frame, or balloon frame construction. The third model is designed to discriminate between nail assemblages where structures were torn down to recycle the lumber and structures dismantled and materials discarded. These models are used to interpret nails from two East Tennessee archaeological sites. It is concluded that such middle-range research is an effective aid for interpreting historic site formation processes.

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CHAPTER I

MIDDLE-RANGE THEORY IN HISTORICAL ARCHAEOLOGY

Introduction

Binford described the archaeological record as a static document of events of the past existing in the present (Binford 1981, 1983, 1989). The goal of middle-range research is to link the static archaeological record with the dynamic processes that formed it. In this thesis, dynamics which produce archaeological nail assemblages are investigated and described, and relevant attributes uncovered in these investigations are used to make inferences about the past. Three methods have been developed to do this. First, using nails recovered from ethnoarchaeological sites, differences between assemblages from peripheral dump sites and from ephemeral structure sites are ascertained, so that these two types of sites, both characterized by high frequencies of nails, can be identified. Second, nail length frequencies in standing structures are employed to develop models to identify archaeological nail assemblages from log, timber frame, or balloon frame buildings. Third, data from experiments and archaeological sites are used to identify patterning in nail assemblages characteristic of structures torn down to recycle wood or structures dismantled and materials discarded. Finally using these techniques, nails recovered from two archaeological sites in Knox County, Tennessee, the Gibbs House site and the Oliver site, are analyzed and interpreted.

Middle-range research is generally poorly developed in historical archaeology, and as a result, it is difficult to relate "Questions that Count" (Honerkamp 1988; Deagan 1988; Cleland 1988; South 1988a; Leone 1988) (e.g. slavery, imperialism, class formation, cultural syncretism, consumer choice behavior, acculturation, environmental degradation, and others) to the static archaeological record. Historical archaeologists lack the coherent general and middle-range theory to do it. As described by Honerkamp (1988:5), historical archaeology seems prematurely "to have entered a 'normal science' phase", meaning that research has become highly routinized. Cleland (1988:14) agrees that historical archaeologists need to develop "organized and coherent theory" so that we can move beyond "stacking fact upon fact" and begin to synthesize by fitting fact to fact. If middle-range research is to enable archaeologists to link the static archaeological record to the dynamics that formed it, then middle-range theory must be developed to synthesize the dynamics under an overarching theoretical perspective. This perspective, in keeping with the goals of archaeology (Thomas 1989:142-150), must be to define and interpret culture process, to reconstruct lifeways, and to place these in chronological context. South (1988a, 1988b), working under an evolutionary paradigm, states that interpreting culture process requires a series of linking steps in which historical archaeologists make arguments of relevance. If historical archaeology is ever to enter mainstream anthropology (rather than acting as a "handmaiden to history" or a "handmaiden to preservation") and address questions of

culture process, archaeologists need to build arguments of relevance by devoting time to middle-range research. Then we can begin to adequately answer those "Questions that Count".

There have been substantial advances in theory building in historical archaeology, most notably in the late 1970s by South (1977), Ferguson (1977), Schiffer (1976, 1977), and Otto (1977), aimed at gaining a better understanding of how cultural systems work. These studies attempted to step beyond site or artifact specific level analyses to assign meaning to patterning in the archaeological record. Except for Schiffer (1976, 1977, 1987), whose writings and research have not been specifically directed at historical archaeology, none of these works can be characterized as middle-range research. Lately, however, Deetz (1988) and Leone (1988), with others (Leone and Potter 1988; Leone and Crosby 1987) have been calling for a special form of middle-range research which uses historical (written and oral) records much like the ethnographic record to assign meaning to the archaeological record. This type of research treats documentary and archaeological records as two independent data sets (see for example Leone 1987). According to Leone (1988), this is different from using the documentary record to refute or reinforce the archaeological record because meaning is assigned through analysis and interpretation of the ambiguities (i.e. conflicting evidence) between the written/oral and archaeological records, and not just explained away as idiosyncratic behavior (a particularistic approach). While this approach appears promising (see for example Leone 1987), better still

would be actual observations of some of the dynamics which form the archaeological record with ethnoarchaeological and experimental studies in historical archaeology, something this research attempts to do.

In order to better interpret the archaeological record, archaeologists need to observe material culture operating in systemic contexts and envision it as a potential archaeological assemblage. Houses and outbuildings, with nails, stones, bricks, mortar, and window glass, potential archaeological assemblages, are still standing and functioning as they were in the past. Active dumps with architectural artifacts are still becoming part of the archaeological record. People are constructing and tearing down buildings like their fathers and grandfathers before them. These dynamics are observable and measurable.

Nails, sometimes the most common artifacts recovered from historic sites, have been largely overlooked as a source of information about site formation processes. Nails can be especially well suited to answering questions concerning construction, repair and remodeling, abandonment, and destruction of buildings, if patterns in nail assemblages can be detected and correctly interpreted.

In this research, standing outbuildings, active dumps, ethnoarchaeological data, and controlled experiments are used to record dynamics which create and pattern nail assemblages. Outbuildings, rather than houses, are employed to observe the systemic context of nails. The reasons are as follows: 1) outbuildings are

basically of simpler construction, usually single pens (or rooms), making variables easier to control; and 2) remodeling and additions occur less frequently on outbuildings than on dwellings.

A building can be conceptualized as having a life history (following Schliffer 1976) which may be manifested stratigraphically in the archaeological record. The stages of this life history, in simplified form are: 1) construction and use; 2) repair; 3) remodeling (and modernizing) and/or redefined use; 4) abandonment and deterioration; and 5) destruction. Of course, there may be more than one repair or remodeling stage for a particular building, and stages may be skipped. At each stage, however, nails can enter the archaeological record, leaving archaeologists with a residue of events which occurred at a site.

Most research on nails used by historical archaeologists has been carried out primarily outside the discipline, directed towards developing a nail chronology (Nelson 1968; Mercer 1970; Priess 1973; Smith 1975; and Loveday 1983). Typically, historical archaeologists sort nails into their gross manufacturing types (hand wrought, cut, and wire) and count them.

Previous research indicates that it is possible to identify agents responsible for creating patterns in an archaeological nail assemblage (Walker 1971; Faulkner 1984; Young and Carr 1989). Walker (1971) used the frequencies of different nail pennyweights for reconstructing the appearance and structural features of the Arkansas Post Branch Bank. Similarly, Young and Carr (1989) were able to

establish correlations between pennyweight types and their function with nails recovered from standing historic structures in East Tennessee. Faulkner (1984) used clinched (nails driven through wood and the shanks bent over in roughly ninety degree angles to increase holding power) wrought nail distributions to reconstruct the appearance of the James White house in Knox County, Tennessee. Young and Carr (1989) proposed a technique for discriminating nail assemblages from an ephemeral structure from those in secondary peripheral dumps. Identifying and correctly interpreting patterns in nail assemblages is necessary before historical archaeologists can assign meaning to the archaeological record with respect to wood construction, and could prove extremely useful in reconstructing household use in 19th and early 20th century sites.

The research in this thesis builds on the work of Walker (1971), Faulkner (1984), and others, to identify the forces which alter nails and create patterns in nail assemblages. Experimental and ethnoarchaeological methods are employed in addressing three basic problems:

- 1) Determining the differences between archaeological nail assemblages from building sites and secondary peripheral dumps;
- 2) Reconstructing the structural features of buildings (e.g. what kind of siding or roofing a building had, how major structural supports were joined); and,
- 3) Reconstructing how buildings were dismantled (i.e. whether they were allowed to rot, were razed and materials recycled or discarded).

Since construction techniques are closely associated with technology and availability of nails, and assuming that recycling behavior may be highly correlated with cost of nails, a brief history of nail manufacturing technology in America is presented. This serves to place this research in temporal and economic perspective.

History of Nail Manufacturing Technology

Nail making began before the third century A.D. in western Europe. In fact, hand wrought nail technology was well developed and had remained unchanged for centuries. For example, tools for making nails recovered from British Roman archaeological sites are essentially the same as colonial American nail making tools (Mercer 1970). Innovations did occur, such as size standardization and better methods of making nail rod from which nails are cut.

An early innovation introduced in 15th century England was the slitting mill. This device cut wrought iron plates into nail rods which in turn were cut into nails. It was also at about this time that the "penny" pricing system began to be used. Under this pricing system, eight penny (or eight pence) nails referred to the price per 1000 nails and corresponded roughly to the length of the nails (Mercer 1970). This was essentially the first step towards standardization of nail sizes.

Hand wrought nail manufacturing was a two step process (Loveday 1983). First, wrought iron plates were produced by rolling mills (earlier they had been trip-hammered) and cut by the slitting mill

Into thin rods corresponding to the thickness of the nail shank. The second step could be performed at the slitting mill. Since it was common and less expensive, however, to ship the nail rod, consumers usually completed the nail-making process. The second step, converting nail rod into nails, developed into a cottage industry in colonial America. It did not require a large capital investment or highly skilled craftsmen, usually slaves and even children made nails (Loveday 1983). Nail rod could be heated in any fireplace. It was pointed and then cut from the rod using a hammer, chisel and common anvil. The most common form of point was produced by working the four surfaces of the nail rod to a point. Other points were made by flattening the end of the rod to produce a "bill", and still others received chisel points which required that only two surfaces be brought to a point. Each type of point required the nailer to heat the rod and strike several blows with the hammer. Once pointed, a section of the rod corresponding to the length of the nail was cut. Finally the nailer headed the nail. Heading required an additional simple tool for securely holding the nail blank while flattening the proximal end into a head. Although the process varied somewhat, it was usual for a nail blank to be placed in a wrought iron tube with a tapered hole large enough to hold the nail but narrow enough to prevent the nail from falling through. A rosehead was produced by flaring the metal around the shank, producing several facets. A t-head was fashioned by splitting the upper portion of the shank and

flattening it (Loveday 1983:7-8), or by flattening the sides of a rosehead nail.

Manufacturing hand wrought nails was labor-intensive; hence, nails were expensive and scarce, from the colonial period until well into the 18th century. Documentary evidence suggests that nails were so scarce that old buildings were burned to retrieve the nails (Loveday 1983:4-5). By the mid-18th century, rolling and slitting mills were in operation in the American colonies even though British Parliament had outlawed the colonial manufacture of nail rod. Although a sizable industry had developed, nails continued to be expensive. For instance, nails sold for ten to fourteen cents a pound in 1800 along the eastern seaboard, and even more inland, as opposed to 2 cents per pound in 1890 (Loveday 1983). Because the manufacturing process was so labor-intensive, cost related directly to the volume of production which could only be increased with additional nail makers. A skilled nailer could make only a few thousand nails per day (Loveday 1983:8).

A device for turning out "pre-cut" wrought nails was developed at the end of the 18th century. This device simply cut a series of nail rods into blanks that would later be pointed and headed. There were some disadvantages of this machine over the contemporaneous cut nail machine. One was that the die which produced a certain nail length had to be changed as different nail lengths were produced. While this wrought nail cutter could have helped to standardize nail lengths, it was not widely used. However, this machine, along with methods for

producing cast nails (rare in archaeological sites) attests to the fact that nails were considered an important commodity for an expanding young nation.

The technology for manufacturing hand wrought nails remained basically unchanged during the period of colonial settlement in North America by Europeans. Differences in shape and size are largely attributable to differing functions and perhaps idiosyncratic behavior of the individual nailers. There are no definable ways in which to differentiate hand wrought nails made between 1620 and 1780. Attributes used in this study to distinguish hand wrought nails from other nail types include the square shank shape and the configuration of the point.

Exactly when machine cut nails entered the scene in the United States is undetermined. It is known that machine cut tacks, used primarily for textile cards, were used in Europe in the mid-18th century (Loveday 1983). It is probable that American inventors borrowed this technique and applied it to nail making. The process of manufacturing cut nails used in buildings is considered an American invention. Numerous machines for cutting nails were patented in the United States in the 1780s and 1790s.

While the beginning of the machine cut nail industry was not a serious threat to the hand wrought industry, the idea of cutting nails from plates rather than rods was revolutionary and the machine cut nail largely replaced hand wrought nails by around 1830. Improvements in machinery and locating naileries close to domestic iron sources

made it possible for cut nail manufacturers not only to meet the needs of the expanding domestic market, but also export large quantities of nails (Loveday 1983).

Machines for producing cut nails were simply cutters which sheared nails from wrought iron plates. The machines could be powered by hand, water, and later by steam. The plates were cut into widths which correspond to nail lengths. Nails were produced in two steps. Plates were inserted into the cutter by workers and the blade would strike a small sliver of metal from the plate (the nail). The blade would strike at a slight angle, thus cutting and pointing in one step. The plate was either flipped or wiggled after each strike. Heading was the second step.

Early machine cut nails were hand headed in much the same way as hand wrought nails. However, from the beginning of the cut nail industry, inventors sought to improve machines which could head nails. These automatic heading devices were not perfected and used widely until the 1830s (Nelson 1968; Mercer 1970; Loveday 1983). Early machine headed nails show evidence of compression on the shank which resulted from gripping the nail along the narrow sides. Better automatic headers were developed which turned the nail ninety degrees for gripping on the wider surface. This prevented the upper portion of the shank from being crushed during heading. Exactly when this innovation in heading occurred is uncertain. Nelson (1968) and Loveday (1983) agree that by the late 1830s nails were headed after turning the nail ninety degrees. Smith (1975) suggests that the

technique was introduced in the 1820s. A determination of exactly when all nails were turned and headed requires additional samples from known contexts.

Another innovation occurring in 1836 for machine cut nails was the rotary squeezer. The rotary squeezer was used to make the wrought iron plate in such a way as to make it possible to make nails with the grain of the metal running lengthwise rather than across the shank. Nails produced in this way were more easily clinched than earlier nails which tended to break when clinched.

By the mid-19th century, nail technology had outgrown its cottage industry roots and had become industrialized. Nails were mass-produced and the industry had reached a technological plateau. Nail makers that located their factories near rolling mills and ore sources could produce nails cheaply. A rather large industry developed in the Upper Ohio Valley (Loveday 1983). Between 1805 and 1825 nail prices remained constant at around 9.5 cents per pound. By 1835 prices reached an average of 5 cents per pound. Between 1850 and 1870, production more than doubled, most of this due to more manufacturers rather than to increased levels of production. By the time the industry was fully mature, nails were relatively inexpensive and available to a large portion of the populace. Because of this, nails were probably not often conserved by consumers. This is an important fact to consider in the analysis of nails recovered archaeologically. Recycling of older nails may introduce a temporal bias into the sample.

Wire nails are characterized by a round shank and a regular round stamped head. Nelson (1968) assigns an inception date of 1850s to wire nails in his publication "Nail Chronology as an Aid to Dating Old Buildings" which is the most widely cited reference for nail chronology used by historic archaeologists. Unfortunately, the date is inaccurate. The early wire nails were made of iron. These nails were not strong enough for building purposes, but were used for crates. The United States Patent Office granted the first patent for wire nails strong enough for heavy construction in 1877 (Loveday 1983). After 1880 steel nails became common. By about 1890, wire nail production had overtaken cut nail production (Smith 1975). Cut nails were selling for around 2 cents per pound in 1890 (Loveday 1983). By 1913 cut nail production accounted for less than ten percent of the total nails produced in the United States (Loveday 1983). It was during this critical transition from cut to wire nails that the cut nail industry badly overextended itself by investing in cut nail technology. As a result of this, and in order to compete with cheaper wire nails, cut nails manufacturers were forced to sell below cost (Loveday 1983:139). Manufacturers could not convert to wire nail making, a process so radically different that it required new machinery. This was an expensive gamble for an already suffering industry. Instead, in the 1890s cut nail manufacturers began to diversify into wrought iron and Bessemer steel products. By 1892, there were already forty-nine wire nail manufacturers in the United States.

Wire nails had several advantages over machine cut nails. The wire nail was cheaper to manufacture because less metal was used and the technology more automated. A spool of wire replaced the nail plate and the attendant who fed the cutter was no longer needed. Wire was fed into the machine continuously which eliminated the necessity of flipping the plate and increased the rate of production. The wire nail was also easier to use. It did less damage to the wood and could be pulled easily. Wire nails were advertised as easier to straighten if bent (Anonymous 1888:73; Loveday 1983:138).

Before the last two decades of the 19th century, wire nails were used primarily for construction of packing cases. It took improvement in technology (use of steel rather than iron) and a few years before the wire nail was accepted as a cheap, effective replacement for the cut nail (Priess 1973:87; Swank 1892:450-451). Priess (1973:90) suggests that an effective beginning date for wire nails used in building is 1880.

Building technology in America was closely tied to nail manufacturing technology, the exhaustion of large size hardwood timber supplies in eastern North America, and the availability of milled lumber (Noble 1984:136). For instance, the balloon frame construction technique was developed in the 1840s for inexpensive, easy to construct housing (McMurry 1988:12). Balloon framing required affordable nails (available after the 1830s when cut nails were fully machine made), and a supply of cheap, standard size milled lumber. The 19th century timber frame also required nails for attaching

shakes, siding, and flooring. A combination of hewn timbers and milled lumber was used in the early decades of the 19th century for timber frame structures. These same economic and technological factors affected vernacular carpenters' choices of construction techniques, and whether or not architectural materials were conserved and recycled. This, in turn, affected how nails moved through their systemic contexts and entered the archaeological record, the subject of this thesis.

Conclusions

Binford (1983:20) states that middle-range research in archaeology is "a means of developing secure and intellectually independent interpretive principles and of expanding our knowledge of relevance to our interpretive task". One of our jobs as archaeologists is to study linkages between materials observed in the archaeological record and the behavior which results in the procurement, modification, and disposal of these materials. A large component in historical archaeology are architectural artifacts. In South's artifact patterns, even the Carolina pattern, a substantial ratio of artifacts are classified as architectural. Yet historical archaeologists pay very little attention to this class of artifacts beyond interest in them as chronological markers. Clearly, though, for understanding something as important and basic as shelter and the use of space, archaeologists must train themselves to pay attention to ways behavior creates patterns in architectural artifacts.

CHAPTER II

DUMP SITES AND BUILDING SITES

Introduction

The household, which has been variously defined and redefined emically in American society (see for example Fox-Genovese 1988; McMurry 1988), is a basic analytic unit for understanding lifeways and culture process, important issues in American anthropology. The houselot was the arena for much day-to-day living in the past, as it is today. The houselot was sometimes the center of household production, sometimes the center of household consumption, but usually some combination of both (McMurry 1988). Therefore, reconstructing houselot use, how it changed through time, how people divided and used space based on factors such as class, ethnicity, technology, topography, climate, distance to markets, and others, is a necessary and important component of historical archaeology. In fact, historical archaeology, with its foundation in material culture of the past, stands in a unique position to build upon and contribute substantively to work of other social sciences interested in household-level analyses; and with household-level analyses it can be articulated into mainstream anthropological pursuits. But before such substantive contributions can be made, historical archaeologists need to devote time to basic identification of houselot activity areas. This chapter is a small step in this direction, building on the work of South (1979) and others on historic site content and function, but

differing by taking an ethnoarchaeological approach in identifying signature patterns of nail assemblages from houselots.

The archaeological remains of houselot use-areas are sometimes a palimpsest of postholes, clusters of Kitchen group and Architectural group artifacts, and oftentimes ambiguous deposits and associations. Locating outbuildings and identifying their functions can be problematic since often buildings such as sheds and smokehouses were ephemeral structures built on pier supports. Additionally, houselots, especially 19th and 20th century houselots, are characterized by very high frequencies of nails, described by Journey (1987:83) as "nail rain". Extremely dense concentrations of nails can indicate the presence of a structure. Caution must be taken in equating nail concentrations with buildings, however. Architectural dumps, where lumber from one or more razed/remodeled structures is piled up in an area, are also characterized by extremely dense concentrations of nails. This chapter presents a method by which assemblages of nails from dump areas can be distinguished from assemblages of nails from construction sites, based upon the frequencies of unaltered, bent (pulled), and clinched nails.

Methods

Five carpenters were interviewed to determine whether it might be possible to correctly identify past activities such as construction and razing of buildings, by examining nails. The carpenters described pulled and clinched nails, then examined some nails recovered

archaeologically and suggested that it may be feasible to distinguish nails of building sites from nails of dump sites based on the frequencies of unaltered, pulled, and clinched nails. Unaltered nails are straight, often unused nails. Pulled nails are characterized as bent in gentle arcs. Clinched nails are bent at an approximate 90 degree angle.

Nails, like other artifacts, are moved through a cycle of acquisition, use, and discard or loss, and some finally enter the archaeological record. Determination of when nails were deposited in this cycle is possible through the identification of the physical forces which alter or damage nails. On domestic sites, nails are most likely deposited during construction or razing of a structure, or through the decaying of a structure or a wood pile in a domestic dumping area.

During the process of construction, some nails are likely lost at the site. For example, 40 unaltered (unused) nails and two pulled nails were collected immediately adjacent to a structure just after it was built in west Knox County, Tennessee. The structure contains 5472 nails. Just after construction, some lost nails may be cleared from the area, others enter the archaeological record as unaltered nails as in the modern construction site. Also during construction, some nails are discarded at the construction site as damaged nails (pulled). The remainder of the nails would enter their systemic context, that is as wood fasteners in a building. Some of these nails would be clinched to increase their holding power. If a structure was allowed to

deteriorate at its original site, nails would drop to the ground as the wood rotted and the structure collapsed.

When a building is destroyed, nails are either pulled with a crowbar or claw hammer, or entire boards are pulled from the building. Some pulled nails enter the archaeological record at the building site. Often, large portions of walls or roofs are removed from a building and are carried to a dump site. At the dump site, nails or boards could be removed from the sections to better stack the lumber. At this point, pulled nails enter the archaeological record at the dump site. As the wood rots, nails left in the wood, both pulled and clinched, also enter archaeological context.

At a dump site, a large number of pulled and clinched nails are expected. At a building site where the structure was razed, the nail assemblage should be characterized by a significant proportion of pulled and unaltered nails, with relatively few clinched nails. At a site where the structure was allowed to rot, the assemblage should be characterized by significant numbers of clinched and unaltered nails with relatively fewer pulled nails. Because nails were generally affordable during most of the 19th century (Loveday 1983), little recycling of nails would be expected. Carpenters that were interviewed suggested that it was more common to recycle lumber than nails because the damage incurred on nails during pulling left them relatively useless.

Alteration of Nails from Dump Sites

As stated, an assemblage of nails from a dump site is expected to contain few unaltered nails as compared to building sites. Samples of nails from three modern dump sites were analyzed and compared to nails from two late 19th century building sites. The modern dump sites are a dump on the Truan farm in Knox County Tennessee, and two dumps on the Klippel farm in Blount County, Tennessee. These three dumps were made up mainly of boards from razed structures or boards replaced during repair of structures, fence posts, and other materials such as brush, gas cans, and unidentified metal. The archaeological building sites are Cavett's Station (40KN67), and the Matt Russell site (40KN127). The Cavett's Station structure is shown on a 1895 Knox County, Tennessee map. The Matt Russell nails were recovered from units immediately adjacent to a standing brick I-house which showed architectural evidence of a porch (Faulkner 1991a).

Observed and expected frequencies of unaltered, pulled, and clinched nails from the three ethnoarchaeological dumps are presented in Table 2.1. While the samples are small, it is possible to discern patterns. It is interesting to note, as expected, the frequency of unaltered nails compared to pulled and clinched nails, is relatively low. Averages suggest for every unaltered nail, there are approximately three pulled nails and one clinched nail.

Variability between dump sites may be reflected in percentages of pulled and clinched nails because of how nails enter the

Table 2.1: Observed and Expected Frequencies of Unaltered (u), Pulled (p), and Clinched (c) Nails from Modern (Ethnoarchaeological) Dumps

	u	p	c	TOT
	(38.1)	(196.2)	(60.7)	
Blount Co. 1	37	206	52	295
	(24.8)	(127.7)	(39.5)	
Blount Co. 2	25	125	42	192
	(20.1)	(103.1)	(31.8)	
Truan dump	21	96	38	155
TOTALS	83	427	132	642

chi square = 4.0859 df = 4 p = .3945

archaeological record. Nails in pulled boards (containing both pulled and clinched nails) stacked and left to rot away may enter the archaeological record, or handfulls of waste nails (pulled, unusable nails) may be tossed into a refuse area. Additionally, the brittle nature of cut nails may have reduced the practice of clinching where cut nails were the only available type. Therefore, while clinched and pulled nail proportions may vary between dumps, the low frequency of unaltered nails should remain constant.

Alteration of Nails from Building Sites

An assemblage of nails from a structure site would be expected to contain a relatively high (compared to a dump) proportion of unaltered nails (lost during construction). Pulled nails should also be numerous, pulled as mistakes during construction, or pulled by a claw

hammer or crowbar during remodeling or razing. Clinched nails, difficult (if not impossible) to remove from wood without first straightening the nail, would be rare, unless the structure itself was allowed to rot. A sample of archaeologically derived nails taken from known building areas is presented in Table 2.2. Unaltered and pulled nails are frequent and clinched nails are rare. A (3 - 3 - 1) relationship is indicated between unaltered, pulled, and clinched nails. A chi square test indicates no significant difference at the 0.05 level between the two assemblages.

Table 2.2: Observed and Expected Frequencies of Unaltered (u), Pulled (p), and Clinched (c) Nails from Archaeological Building Sites

	u	p	c	TOT
	(53.9)	(63.9)	(18.2)	
Russell construction	59	58	19	136
	(44.1)	(52.1)	(14.8)	
Cavett's construction	39	58	14	111
TOTALS	98	116	33	247

chi square = 2.3626 df = 2 p = .3069

Results

The chi square tests have shown no significant differences between the dump sites, and no significant differences between the

construction sites used in this study. A chi square test of the frequencies of unaltered, pulled, and clinched nails from building and dump sites shows a significant difference at $\alpha = .05$. Table 2.3 shows the observed and expected frequencies of unaltered, pulled, and clinched nails for the total construction sites and total dump sites.

Table 2.3: Observed and Expected Frequencies of Unaltered (u), Pulled (p), and Clinched (c) Nails for the Construction Sites and Ethnoarchaeological Dump Sites

	u	p	c	TOT
	(50.3)	(150.9)	(45.8)	
Total construction	98	116	33	247
	(130.7)	(392.1)	(119.2)	
Total dump	83	427	132	642
TOT	181	543	165	889

chi square = 78.7727 df = 2 p < .0001

As can be seen, particularly in Table 2.3, signature patterns emerge, which are characteristic of dump areas and building sites. As expected, construction areas are characterized by high frequencies of unaltered nails and low frequencies of clinched nails, when compared to dump areas. Use of the method of analysis developed here can allow the archaeologist to identify sites of short-term architectural dumps where old lumber was piled after a building was razed, and sites of ephemeral structures. Both of these areas are characterized by dense

concentrations of nails, and often, nothing else (e.g., foundation or pier support) exists in the archaeological record to identify an area as the site of a building.

Conclusions

Comparisons of data from archaeological and ethnoarchaeological dump sites and archaeological building sites show that frequencies of unaltered, pulled, and clinched nails exhibit patterns which can be used by archaeologists to identify a site as an ephemeral structure or a peripheral dump. Both of these site types are characterized by high frequencies of nails. Building sites exhibit a pattern of higher numbers of unaltered nails and low frequencies of clinched nails. Dump sites are characterized by low frequencies of unaltered nails, with higher frequencies of clinched nails.

While artifact patterning (South 1978; Ball 1984) is a useful first step in reconstructing behavior, the method needs expanding. This study has shown that the search for signature patterns beyond those proposed by South and Ball is productive. Focusing on a particular artifact class within the Architectural group (i.e. nails) enhances abilities to reconstruct systemic context. In-depth analysis of other architectural classes (such as window glass) would bring in other lines of evidence, thereby strengthening interpretations.

Although the archaeological remains of houselots are sometimes confusing associations of artifact concentrations and features, middle-range theory can place the archaeologist in a position of

assigning meaning to the archaeological record of the houselot, or in Binford's words (1980:5) "accurately diagnosing patterned variability". By ethnoarchaeological investigations of building sites and active dump areas, it has been possible to identify signature patterns of nail assemblages associated with each of these two site types. Correctly identifying houselot functional areas is a necessary first step in understanding how houselots were adapted to particular environments or to technological change.

CHAPTER III

LOG, TIMBER FRAME, AND BALLOON FRAME STRUCTURES

Introduction

This chapter introduces a way in which data gleaned from historic standing structures can be used to make reliable inferences about archaeological nail assemblages and the structures they represent. Eight extant structures, mostly outbuildings, were carefully measured, and nails of different functions were counted. From these data, models were generated whereby structure type is predicted from archaeological nail assemblages. In other words, the models allow for identification of the kind of building (log, timber frame, or balloon frame) that stood at a site. With the models, reconstructions based on informant and documentary data can be tested. The types of structures represented by the nails from two archaeological sites, the Garner site located in Blount County, Tennessee, and the Locust Grove site in Jefferson County, Kentucky, are identified based on models developed here.

Architecture and Archaeology

From the works of such scholars as Glassie (1963, 1975), Kniffen (1965), Vlach (1976), Deetz (1977), and others, historical archaeologists can examine how architecture has changed over time, how buildings differ between ethnic groups and between social and economic classes of people. By studying extant structures and the documents

that describe them, scholars can develop ideas concerning past building construction, how people divided their living and working space, and how ethnicity and class affected their concepts of the built environment. But can the information from these studies be used to interpret the archaeological record? At present, only a broad picture can be presented of how and why people constructed their buildings the way they did, and of how such things as technological advances and the distribution of resources and capital affected peoples' decisions of how and where to build, and what they needed to survive and thrive.

What data are available provide interesting and provocative, if fuzzy, pictures of buildings of the past. For instance, from reading Southern antebellum-period agricultural journals (e.g. Breeden 1980), it is apparent that some planters, at least, were aware of the need to provide adequate shelter for their slaves. Ideally, according to these planters, housing was supposed to be well ventilated, well heated, and sufficiently large ("commodious") for slave families. But remembrances of former slaves offer a contrasting picture. Here is a fairly typical description:

The cabins we lived in was built of logs split open and pegged together. The fire places was big that held logs....These chimneys was made of sticks, dirt, and straw. The cabins didn't have but about one window and two doors (Rawick 1977:309).

Based on descriptions by former slaves, Orser (1988:93) states that slave houses usually consisted of a single pen and that windows were not

glazed but rather wood shuttered. Some had dirt floors, some had wooden floors.

These memories of former slaves, and the ideal housing published by planters, paint provocative and contrasting pictures of slave houses. But they do not provide us with the physical detail to interpret archaeological remains of slave and tenant houses, and do not allow for reliable inferences about the past built environment.

Here is another interesting picture of the past. Mr. C. Butler Rider designed and built a new farm house in western New York. He sent his design, and his comments to Moore's Rural New Yorker in January 1860, stating that:

a well-made balloon frame is much cheaper and better for all houses of moderate height than a timber frame. It adapts itself better to circumstances. It is more plastic, so to speak (in McMurry 1988:12).

McMurry (1988:12) describes the balloon frame:

The balloon frame, first developed in Chicago in the 1830s and 1840s, replaced the cumbersome timber-framing system of massive beams held together with wooden pins. Instead, the balloon frame consisted of many light, uniformly sized and spaced studs nailed together. A few people could erect the frame using such simple tools as a hammer, saw, and nails. This innovation, which the agricultural press publicized extensively...allowed for spatial variety and did not require sophisticated building skill.

If the balloon frame was so cheap and easy to build, plastic, and widely publicized, why did some builders choose timber-framing? How frequently and where did the preference of timber-framing over

balloon-framing occur after the latter was introduced as a construction technique? If historical archaeologists depend upon examining surviving 19th century structures to answer these questions, the results may be unreliable because of the biased nature of the sample of surviving buildings. Similarly, using data only from standing slave "cabins" cannot answer the question of adequacy of slave housing. Data are needed from the archaeological record to address these problems. But before this can be accomplished, historical archaeologists must accurately interpret all types of architectural remains: foundations and other features; window glass; masonry; and nails.

Developing Reliable Inferences About the Archaeological Record

In order to develop a methodology that can allow for reliable inferences about architecture from the archaeological record, standing outbuildings and houses in East Tennessee were surveyed. This was accomplished in order to detect and interpret patterning in nail assemblages. Based on what is known about the manner buildings are constructed, it seems logical that the frequencies of nail lengths would vary between buildings of log, timber frame and balloon frame. Each of these building types should have a nail signature pattern that might be recognizable in the archaeological record. The goal here is to analyze an archaeological nail assemblage, and based on the nail length frequencies, reliably determine if the structure was log, timber frame, or balloon frame.

Field Methods

Eight outbuildings were surveyed; three log, two timber frame, and three balloon frame buildings. None of these structures was extensively modified. Each structure was measured and photographed, and the number of nails in each of the following functional categories was recorded: 1) flooring; 2) roofing; 3) siding; 4) heavy framing (rafters, purlins, collars, ridge boards, wall studs and braces, plates, sills, floor joists, door frames and window frames); 5) light framing (spaced sheathing); and 6) other (trim, shutters, other). Additionally, for most of these functional categories, one or two nails were removed and nail length (to the nearest 1/4 inch) was measured. For the heavy framing category, recording the exact nail length was often impossible so an estimate was made based on the observed head and shank size. These nails were recorded as less than 3.0 inches, greater than 3.0 inches, or equal to 3.0 inches (3.0 inches = modern 10d).

The Eight Extant Structures

Log Buildings

Building a log structure requires little specialized skill, a minimum number of tools, and few materials not available at or near the site of construction. A log structure can be built without using nails, but most builders managed to purchase or produce enough nails to make doors, window frames, and shutters (Loveday 1983:27). For residential buildings, nails were also used for interior woodwork.

Ramsey log shed. The Ramsey shed is a log outbuilding of undetermined original function, currently used as a storage shed at the historic Ramsey House in East Knox County. It measures 15 by 17 feet, is a single story, and contains a door at a gable end. The roof is covered with wood shakes nailed to spaced sheathing. There are no windows. The door is board and batten, and the eaves are clapboarded. Most of the nails associated with this structure are used in roofing, the rest in the roof superstructure, door and door frame, and clapboards. Table 3.1 presents the structure's nails by size and function.

McCorkle "slave" house. The McCorkle "slave" structure is a 1 1/2 story single pen V-notched log building measuring 17 feet 7 inches by 15 feet 9 inches. It is located in Greene County in East Tennessee. Based on the limestone fireplace base at one gable end, it was most likely a dwelling. An informant suggested that it was originally a slave house. Opposite the chimney is a window. There are two doors. The floor is wood, and the roof is tin. The structure was built on a continuous limestone foundation. Table 3.1 presents the frequencies and sizes of nails by function.

McCullom smokehouse. The McCullom smokehouse is a single story V-notched log structure measuring 12 feet by 14 feet 7 inches, standing within a cluster of outbuildings at the McCullom farm in Blount County, Tennessee. An informant who lived and worked on the McCullom farm remembers the structure used in the 1930s to smoke pork. It is currently used for general storage. The structure is set on limestone piers. The

roof is cantilevered and covered with tin, and a door is set into a gable end. There are no windows and the floor is earth. The interstices between the logs are not chinked, but rather boards have been nailed on to cover the spaces. The door of the structure is board and batten. Originally the boards had been fastened to the battens by pegs, but later battens were nailed. The gables are sided with clapboarding. The structure contains a total of 1059 nails in sizes ranging from 1.75 to 3.0 inches (5d - 10d) (Table 3.1).

Table 3.1: Nails from the Log Buildings

Function	Ramsey N	McCorkle N	McCullom N	Nail Length in inches
flooring	0	360	0	3.0 (10d)
sliding *	118	264	479	2.5 (8d)
roofing	3840	225	118	1.5 (4d)
light framing	208	128	216	2.0 (6d)
heavy framing	323	218	210	3.0+ (10d+)
trim	0	0	36	2.5 (8d)
TOTALS	4489	1195	1059	

*Includes nails used to attach boards covering spaces between logs on the McCullom log house

Timber Frame Structures

In timber frame structures, large timbers are interlocked by mortise and tenon joinery to form a framework that supports the roof and is covered by wood siding. Such construction requires a supply of nails for

wood siding, roofing, windows, doors, interior woodwork, and floors. Even with this type of construction, nails can be replaced with wooden pegs. Braced frame technology is a form of timber framing common in the 19th century. In a braced frame structure, heavy framing is done with mortise and tenon joinery, and some light framing is attached with nails (Noble 1984:136-137; McAlester and McAlester 1984:36-37).

McCorkle "wash house". The McCorkle "wash house" in Greene County, Tennessee, is a timber frame structure measuring 10 feet 4 inches by 12 feet 2 inches. The siding is board and batten. It has a cantilevered roof covered with tin. A door is in the gable end, and there are three louvered windows. Table 3.2 shows the distribution of nails by function and size.

McCorkle "grain house". The McCorkle grain house is an 18 by 20 foot timber frame building with board and batten siding, located next to the wash house on the McCorkle farm in Greene County, Tennessee. The roof is a tin-covered cantilevered structure. A door is set in a gable end, and there are three louvered windows, one in each of the other three sides. The floor is wood and the interior walls are partially panelled with tongue-in-groove boards about half-way up the walls from the floor. Table 3.2 presents a breakdown of nail lengths by function.

Table 3.2: Nails from the Timber Frame Structures

Function	McCorkle wash N	McCorkle grain N	Nail Length in inches
flooring *	-	924	3.0 (10d)
siding	740	1266	2.5 (8d)
roofing	240	408	1.7 (5d)
light framing	210	416	2.5 (8d)
heavy framing	158	163	3.0+ (10d+)
trim *	126	392	2.5 (8d)
TOTALS	1474	3569	

* undetermined number of flooring nails for the McCorkle wash house and inside panelling in the grain house

Balloon Frame Structures

In the balloon frame, mortise and tenon joinery is replaced with the use of nails at the joints. Instead of heavy posts and beams, corner posts and sometimes plates and sills are built-up 2x4s (Noble 1984:136-137; McAlester and McAlester 1984:36-37). It was estimated in 1869 that a balloon frame could be constructed for "forty percent less money than mortise and tenon frame" (Field 1942).

Truan smokehouse. The Truan smokehouse is a 12 feet 3 inches by 14 feet 2 inches balloon frame structure with vertical siding and a concrete floor. It is located in northeast Knox County, Tennessee. The structure is a story-and-a-half, with the main floor and loft currently being used for general storage. An informant who grew up and still lives on the farm remembers its use as a smokehouse. A wash house was built onto the back, and a woodshed was built onto one side. The door to the smokehouse

is in a gable end, and the entrance to the loft is above the door, requiring a ladder to gain entrance. The roof is tin, but was originally covered with wood shakes. Table 3.3 shows the nail pennyweights by function.

Truan wash house. The Truan wash house is a single story frame structure measuring 13 feet by 12 feet 3 inches. It has a wood floor, two doors, and two windows. The roof is tin. The building is sided with vertical boards. A furnace for heating water occupies a corner of the building. It was built about 20 years after the Truan smokehouse and shares a wall with the smokehouse. Table 3.3 shows the number of nails for each function for the Truan wash house.

Brabson smokehouse. The Brabson smokehouse, located in Sevier County, Tennessee, is a 1 1/2 story frame building measuring 16 feet 4 inches by 20 feet 2 inches. It has a cantilevered tin roof and a dirt floor. There are no windows and a door is in the gable end. The building is clapboarded. Table 3.3 shows the frequencies of nails by their functions for the Brabson smokehouse. Table 3.4 presents a summary of the percentages of nail lengths for each of the structures surveyed.

Table 3.3: Nails from the Balloon Frame Structures

Function	Truan smokehouse N	Truan wash N	Brabson smokehouse N	Nail Length in inches
flooring	0	252	0	-
siding	811	434	1392	3.0 (10d)
roofing	162	130	684	1.7 (5d)
light framing	144	112	374	2.5 (8d)
heavy framing	483	401	673	3.0+ (10d+)
trim	0	0	60	2.5 (8d)
TOTALS	1600	1329	3183	

As seen in Table 3.4, the frequencies of nail sizes for the buildings show a great deal of variability. No signature patterns are immediately apparent. The reasons are that the structures are various sizes and have different features. Some had floors, some did not. One has a shake roof, the rest have tin roofs. Some siding nails are 2.5 inches, some 3.0 inches. Some floors have 10 inch floor boards, some 4 inch floor boards. While each of the buildings is unique, some share common features like siding, roofing, and flooring.

Models

One major factor contributing to the variability of pennyweight frequencies is building size. Resolution of this problem comes through generating simulation models so that size can be controlled. To do this, frequencies of nail lengths were converted to number of nails of each functional category per square foot (Table 3.5). In this way, reliable

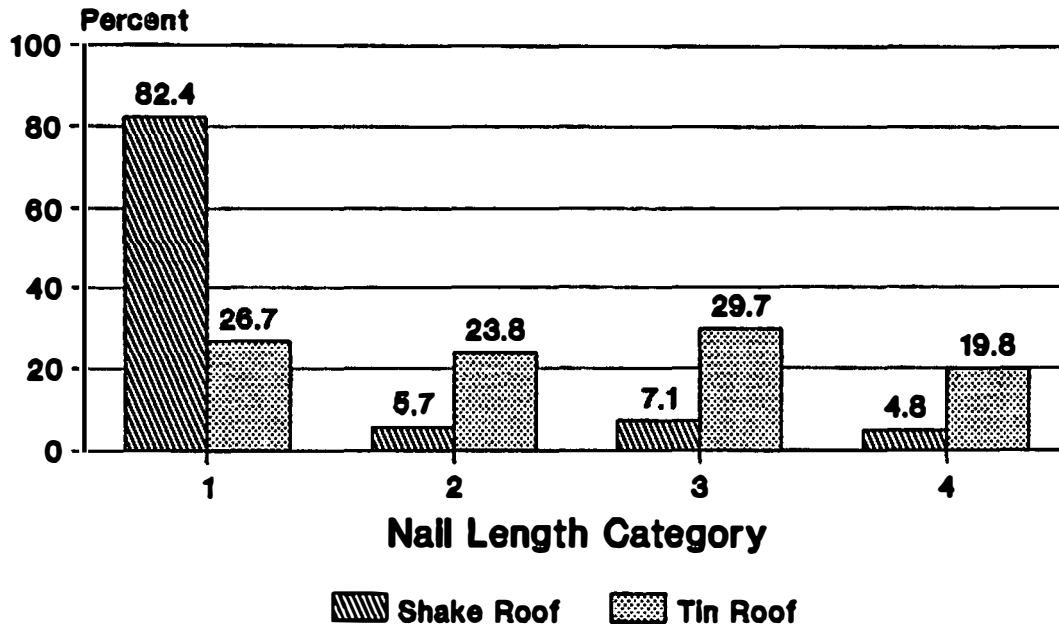
estimates can be made of the number of nail functions and lengths for any size building, and log, timber frame, and balloon frame structures can be compared.

Table 3.4: Summary of Percentages of Nail Lengths
From All Buildings Surveyed

Structure	Nail lengths in inches				
	1.5-1.7	2.0	2.5	3.0	3.0+
Ramsey (log)	85.5	4.6	2.6	-	7.2
McCorkle (log)	18.8	10.7	22.1	30.1	18.2
McCullom (log)	11.1	20.4	3.4	65.1	-
McCorkle (timber)	16.3	-	73.0	-	10.7
McCorkle (timber)	11.4	-	58.1	25.8	4.6
Truan (frame)	10.1	-	9.0	50.7	30.2
Truan (frame)	9.8	-	8.4	51.6	30.1
Brabson (frame)	21.5	-	57.4	-	21.1

With these data, models have been constructed to simulate structures of different construction types measuring 16X16 feet, with varying roof type. Sixteen by sixteen feet is a common pen size and is used for comparison of archaeological data from two sites which had structures of this size. Figures 3.1 through 3.3 present a series of charts, or models, for log, timber frame, and balloon frame structures with tin and shake roofing. Floor board widths were held constant at 10 inches.

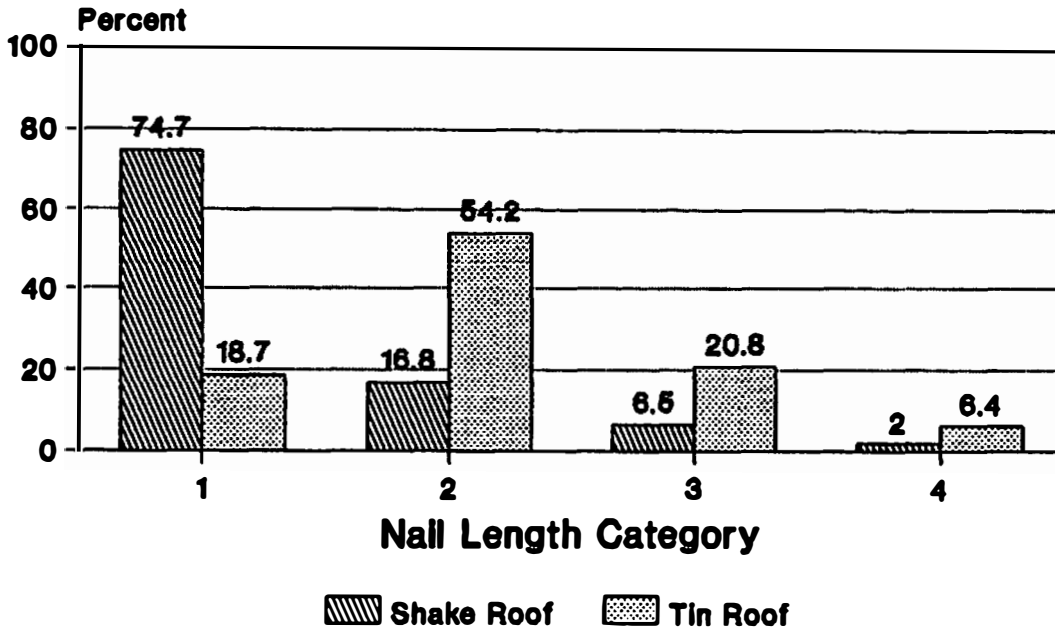
16x16 Log Wood Floor



Key: Nail length category 1 = roofing
Nail length category 2 = siding and light framing
Nail length category 3 = flooring
Nail length category 4 = heavy framing

Figure 3.1: Model for a 16x16 Foot Log Structure with Shake or Tin Roof

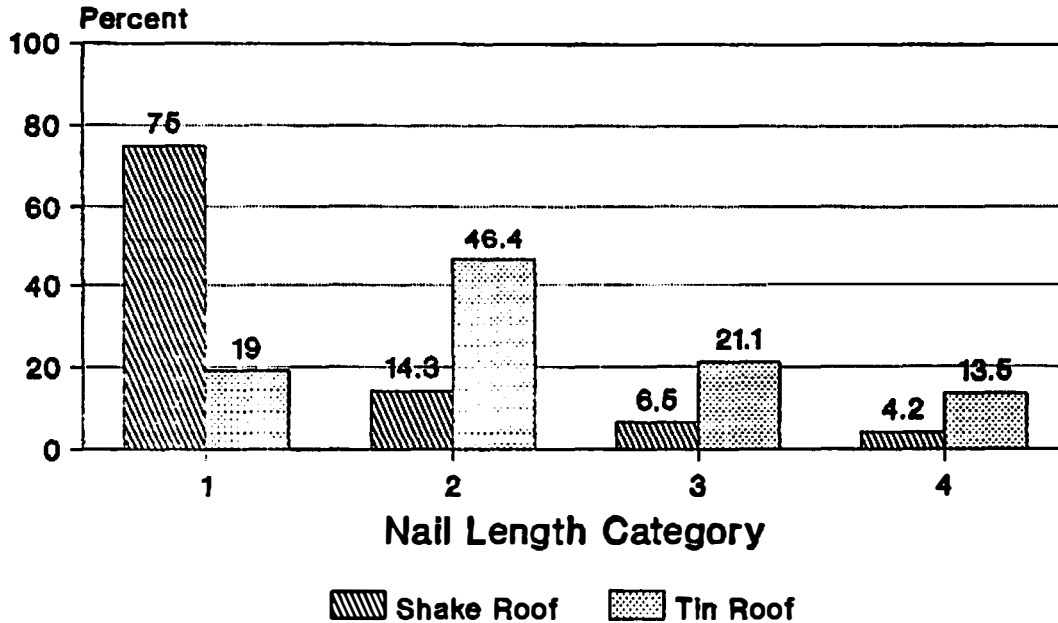
16x16 Timber Frame Wood Floor



Key: Nail length category 1 = roofing
Nail length category 2 = siding and light framing
Nail length category 3 = flooring
Nail length category 4 = heavy framing

Figure 3.2: Model for a 16x16 Foot Timber Frame Structure with Shake or Tin Roof

16x16 Balloon Frame Wood Floor



Key: Nail length category 1 = roofing
Nail length category 2 = siding and light framing
Nail length category 3 = flooring
Nail length category 4 = heavy framing

Figure 3.3: Model for a 16x16 Foot Balloon Frame Structure with Shake or Tin Roof

Table 3.5: Conversions to Nails Per Square Foot For Each Functional Category For Eight Buildings Surveyed

category	Extant Structures							
	1	2	3	4	5	6	7	8
flooring	0	1.3	0	-	2.6	0	1.6	0
sliding	2.6	-	-	1.6	1.5	1.5	1.3	1.3
roofing	-	.8	.8	1.1	.9	.8	.8	1.7
lt frame	.8	.5	.9	1.0	.9	.7	.7	.9
hvy frame	.4	.2	.3	.2	.1	.7	.6	.5

Extant structure 1 = Ramsey log
 2 = McCorkle log
 3 = McCullom log
 4 = McCorkle timber frame wash house
 5 = McCorkle timber frame grain house
 6 = Truan frame smokehouse
 7 = Truan frame wash house
 8 = Brabson frame

These models predict how an archaeological nail assemblage should look, given certain parameters, and can be used to interpret archaeological nail assemblages. The accuracy of the models depends upon the assumption that all nails from a structure have an equal chance of entering the archaeological record. At this point in the research, because of the small sample size (eight extant buildings), tests of statistically significant differences or similarities are inappropriate. Instead, the closest fit between a model and the archaeological assemblage is used to predict the type of building that stood at a site. When a larger sample of outbuildings is examined and a larger data base with which to construct models is available, then statistical testing would be warranted.

Judith McKellar, cited in Schliffer (1976), South (1979), and Rathje and Schliffer (1980), proposed that small objects, under three or four inches in overall dimension, are most likely to remain behind as primary refuse (trash discarded at the location of use). Schliffer (1976) refers to this phenomenon as the McKellar hypothesis. This cultural sorting may be at work on a nail assemblage at the site of a razed structure. Large nails, greater than 3 inches (10d) may be transported from the site of a structure in two ways: first, since very large nails are extremely difficult to remove from wood, they could be transported from the site in wood discarded elsewhere (as secondary refuse); and second, because large nails not in wood are more visible, and may be removed during clean-up activities at the site of a razed structure. The frequencies of large nails used for heavy framing are most important when trying to distinguish balloon frame from timber frame structures. For the purposes of these models, it is assumed that the "McKellar principle" works equally on an assemblage from timber frame and balloon frame structure sites so that their frequencies relative to each other remain constant. However, no adjustment can be made to the models until more data are available concerning the relative frequency in which large nails (greater than 10d) are transported from a structure site as compared to small nails.

Archaeological Sites

Garner Site

The Garner site is located in Blount County, Tennessee. The site consists of a standing farm house, various standing outbuildings, cisterns, and the archaeological remains of at least one outbuilding. Early in 1990, the area of an outbuilding located behind the house was tested by opening 70 1x1 foot test units spaced every three feet. Six pier supports, and the base of a brick fireplace were located in the testing. An early 20th century photograph shows that the structure was a double-pen building with two doors and a wood shake roof. The building was sided with board and batten. A tin roof later replaced the wood shake roof. From the spacing of the pier supports, each pen measured approximately 16X16 feet. A total of 175 complete nails was recovered in the testing (Table 3.6).

Many of the nails measuring 1.75 inches (5d) still had lead seals on the heads, indicating their use as tin roofing nails. With this in mind, the assemblage was divided into roofing, siding and light framing, flooring, and heavy framing nails, as seen in Figure 3.4.

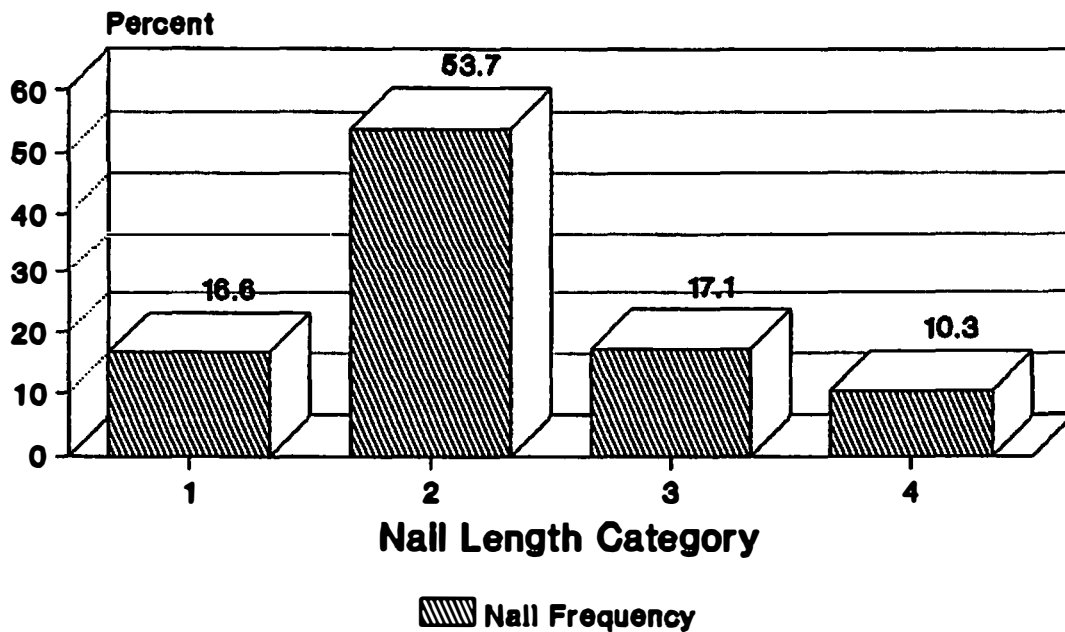
The closest fit between a model and the archaeological assemblage is computed by summing the differences of each category (roofing, siding and light framing, flooring, heavy framing) as seen in Table 3.7. The model with the lowest score (least difference) is chosen. The closest fit model appears to be a timber frame structure with a tin roof. Figure 3.5 superimposes this model with the Garner site nail assemblage.

Table 3.6: Nails from the Garner Site Outbuilding

Nail Length	N	%
1.25 (3d)	4	2.3
1.50 (4d)	4	2.3
1.75 (5d)	25	14.3
2.00 (6d)	40	22.9
2.25 (7d)	2	1.1
2.50 (8d)	52	29.7
2.75 (9d)	2	1.1
3.00 (10d)	28	16.0
3.25 (12d)	11	6.3
3.50 (16d)	3	1.7
>3.50 (16d+)	4	2.3
TOTAL	175	

The largest difference between the model and the Garner assemblage is in the nail length category of heavy frame. This leaves some doubt as to whether the structure was timber or balloon frame. The sample size (N=175) and the fact that the structure had two roofs (first wood shake, then tin), as well as how the structure was dismantled, may account for the differences between the models and the Garner assemblage. But preliminarily, it appears that the Garner structure was timber frame.

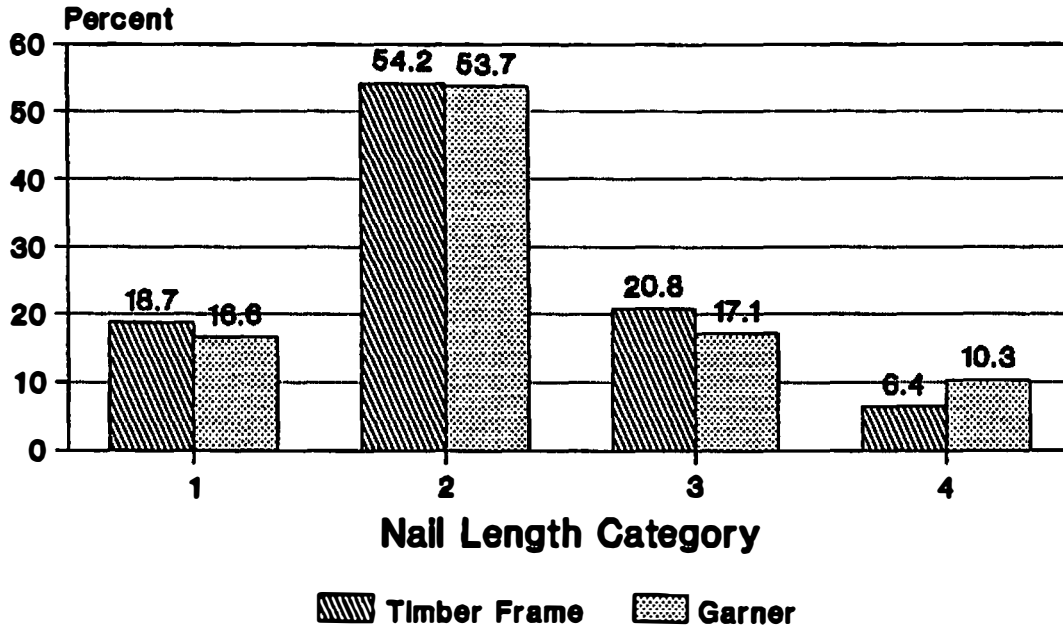
Garner Wood Floor



Key: Nail length category 1 = roofing
Nail length category 2 = siding and light framing
Nail length category 3 = flooring
Nail length category 4 = heavy framing

Figure 3.4: Distribution of Nails in Length Categories for the Garner Assemblage

Timber Frame vs. Garner Wood Floor



Tin Roof

Key: Nail length category 1 = roofing
 Nail length category 2 = siding and light framing
 Nail length category 3 = flooring
 Nail length category 4 = heavy framing

Figure 3.5: Distribution of Nails in Length Categories for the Garner Assemblage Compared with Distribution for a Timber Frame Model

Table 3.7: Frequencies of Garner Nails in Functional Categories Compared to Log, Timber, and Balloon Frame Models

Category	Garner		Log		Timber		Balloon	
	N	%	%	D	%	D	%	D
1	29	16.6	26.7	10.1	18.7	2.1	19.0	2.4
2	94	53.7	23.8	29.9	54.2	0.5	46.4	7.3
3	30	17.1	29.7	12.6	20.8	3.7	21.1	4.0
4	18	10.3	19.8	9.5	6.4	3.9	13.5	3.2
Totals				62.1		10.2		16.9

Category 1 = roofing

Category 2 = siding and light framing

Category 3 = flooring

Category 4 = heavy framing

Locust Grove

Locust Grove is a late 18th century plantation/farm site located near Louisville, Kentucky. In 1987, the site of a structure was excavated, revealing a continuous limestone foundation measuring about 16 by 16 feet, and a hearth and fireplace base. A late 18th or early 19th century construction date has been proposed (Young 1988). A total of 645 complete nails was recovered in the excavations. Table 3.8 shows the frequencies of the different nail lengths and Table 3.9 shows the frequencies of roofing, light framing and siding, flooring, and heavy framing nails. This does not seem to compare well with any of the models

Table 3.8: Nails from Locust Grove Cabin

Nail Length	N	%
1.00 (2d)	13	2.0
1.25 (3d)	71	11.0
1.50 (4d)	206	31.9
1.75 (5d)	105	16.3
2.00 (6d)	42	6.5
2.25 (7d)	33	5.1
2.50 (8d)	31	4.8
2.75 (9d)	58	9.0
3.00 (10d)	32	5.0
3.25 (12d)	38	6.0
3.50 (16d)	7	1.1
>3.50 (16d+)	9	1.4
TOTAL	645	

Table 3.9: Frequencies of Locust Grove Nails in Functional Categories

Category	Length range	N	%
roofing	1.50-1.75	382	59.0
sliding & light framing	2.00-2.50	106	16.4
flooring	2.75-3.00	90	13.9
heavy framing	3.25+	54	8.3

developed, possibly because of the overwhelming number of roofing nails.

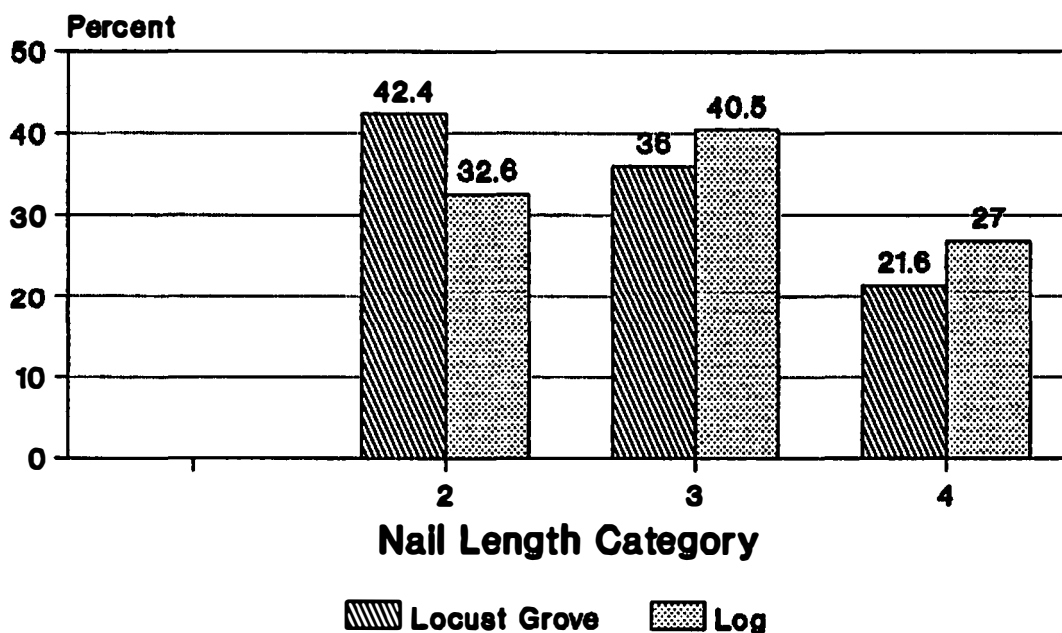
If roofing nails are removed, the Locust Grove sample shows the least difference with the log model. It appears, then, that a log structure with a shake roof is the closest fit for the Locust Grove nail assemblage (Figure 3.6).

Conclusions

While preliminary, this research has shown that it is possible for researchers to identify log, timber frame, and balloon frame structures from archaeological nail assemblages. The models are extremely simple, and have been built from a data base of the most simple structures that could be located, outbuildings and single pen dwellings. All possible permutations, such as a clapboarded log structure, have not been considered here. More data are necessary before more complex (and realistic) models can be constructed.

Binford (1983) has stated that archaeologists need to train themselves to pay attention to the ways in which behavior modifies material surroundings. In historical archaeology, there are numerous opportunities to do this, so that it should be possible to accurately interpret the historical archaeological record. Thus far, historical archaeologists have relied too heavily upon using documents as analogue models for interpreting past behavior. It is necessary to study more direct linkages between the objects found in the archaeological record and the various behaviors and circumstances that resulted in the manufacture, modification, and eventual disposal of those objects.

Log vs Locust Grove Wood Floor



No Roof

Key: Nail length category 1 = roofing
Nail length category 2 = siding and light framing
Nail length category 3 = flooring
Nail length category 4 = heavy framing

Figure 3.6: Distribution of Nails in Length Categories for the Locust Grove Assemblage Compared with Distribution for a Log Structure Model

CHAPTER IV

RECYCLING AND DISCARDING BEHAVIOR

Introduction

This chapter introduces a way middle-range research, specifically experiments and ethnoarchaeology, can be used in historical archaeology to identify how a nail assemblage is transformed and patterned as nails are bent when a structure is dismantled to recycle wood and when a structure is torn down and materials discarded. The experiments and ethnoarchaeological nail assemblages described here focus on identifying the pattern produced when a structure is torn down to recycle the wood. The purpose of the experiment is simple: to determine what effect nail length (pennyweight), the method used to remove the nails, and board thickness have on how nails are altered during the razing of a structure. Ethnoarchaeological assemblages are then used to identify recycling and discard patterns in archaeological nail assemblages.

Methods

Vernacular carpenters were employed to build and tear down a simulated section of a simple outbuilding in order to adequately represent construction and razing activities. A four by four foot structural frame was built of 2x4 inch pine, with 2x4s placed on 16 inch centers to represent wall studs or floor joists.

For the first part of the experiment, 1x8 inch pine boards were placed on the frame perpendicular to the studs. Six penny common wire nails were used to fasten the boards to the frame. Then using a crowbar, boards were loosened and finally removed from the frame. Some nails were straightened and driven back through the wood and removed, while others were pulled directly from the frame and board structure with a claw hammer. The experiment was then repeated, first using eight and then ten penny nails.

The second experiment fastened one-half by six inch beveled pine siding and beveled cedar siding of the same size, first with six penny, then with eight penny nails. As in the first experiment, a crowbar and claw hammer were used to remove the siding and/or nails. Ten penny nails were not used on the siding since the eight penny nails tended to split the wood.

Generally the pulled nails were bent in single gentle arcs, although a few s-shaped (or re-curved) bends resulted. Only three examples were visibly twisted as well as bent in gentle arcs so this characteristic was not used in the analysis, especially since this twisting may not be detectable in archaeologically derived nails. Other nails were left visibly unaltered. A method was devised to measure how much each nail was bent, so that the effects of nail length, board thickness, and pulling method on altering a nail could be determined (pulling method being either the board was removed from the frame and nails hammered out the back or a claw hammer was used to pull the nails directly from the structure). It was decided that

measuring the maximum height of the curve of bent nails adequately represents the degree of alteration. In cases of s-shaped curves, both curve heights were added together.

The experiments were designed to test two hypotheses. First, it was hypothesized that the shorter six penny nails would be less altered than longer eight and ten penny nails and that this effect would be exaggerated with thicker wood. It was also hypothesized that the method of pulling would have a significant effect on nail alteration, with pulling boards from the structure then removing nails from boards simulating recycling behavior, and pulling nails directly from the structure closely approximating discard behavior. Comparisons of raw means and a two-factorial analysis of variance were employed to determine if the amount of alteration of the nails (curve height) is a function of nail length, board thickness, and method of pulling. So for each nail, maximum curve height, pennyweight, board thickness, and pulling technique were recorded, with a total sample size of 143 nails.

Analysis and Results

Table 4.1 presents the means, minimum, and maximum heights of curves, and standard deviations for six, eight, and ten penny nails. It is obvious that the longer nails were bent more severely than the shorter six penny nails. All pairwise comparisons further support that there are significant differences in curve height at the .05 level between the three nail sizes. Table 4.2 shows the mean height

of the curves for one inch and half inch thick wood, along with the ranges and standard deviations. A T-test also shows these to be significantly different at $\alpha = .05$. These tests are taken as support for the first hypothesis that pennyweight and board thickness have an effect on nail alteration. Finally, Table 4.3 displays the means, ranges, and standard deviations for the two pulling techniques. This appears to suggest that how the nails were pulled does affect the amount of nail alteration.

A two-way analysis of variance was used to test the effect of nail length and board thickness. Table 4.4 shows that pennyweight, and the combination of pennyweight and board thickness significantly affect how nails are bent. This is shown by the F statistic and low probability values ($p = .0143$, $p = .0293$) (Table 4.4). A look at the means, ranges, and standard deviations for each of these treatments on nails further illustrates this point. Note the small

Table 4.1: Mean Heights for Six, Eight, and Ten Penny Nails

Pennyweight	N	Mean Height	Min	Max	Standard Deviation
6d	48	0.8	0	6.1	1.497
8d	64	1.7	0	6.3	1.438
10d	31	2.4	0	8.2	1.672

Table 4.2: Mean Curve Heights for 1/2 and 1 Inch Board Thickness

Thickness	N	Mean Height	Min	Max	Standard Deviation
1/2	64	1.1	0	6.2	1.407
1	79	1.9	0	8.2	1.677

Table 4.3: Mean Curve Heights for Pulling Method

Method	N	Mean Height	Min	Max	Standard Deviation
board	48	0.9	0	6.1	1.592
nail	95	1.9	0	8.2	1.536

standard deviation and range for six penny nails (Table 4.5) with board thickness of one-half inch. Most of these nails, 21 out of 32, exhibited no bending at all, as contrasted with the ten penny nails where only three out of 31 nails were left unaltered during razing of the simulated structure.

Table 4.4: General Linear Models Procedures

Dependent Variable: HT

Source	df	Sum of Squares	Mean Squares
Model	4	63.2379	15.8095
Error	138	304.7729	2.2085
Total	142	368.0109	

Model F = 7.14

PR > F = .0001

R-Square	C.V.	Root MSE	HT Mean
.1718	95.0414	1.4861	1.5636

Source	df	Type III SS	F value	P > F
LEN	2	19.3603	4.38	.0143
THK	1	7.0560	3.19	.0771
LEN*THK	1	10.7123	4.85	.0293

Ethnoarchaeological Samples

During the experiments, nails pulled by removing boards from the structure frame were hammered from the back of the wood. If nails were bent after boards removed, then the nails were straightened

Table 4.5: Mean Heights for Pennyweight by Board Thickness

LEN	THK	N	Mean Height	Min	Max	Standard Deviation
6d	1/2	32	0.4	0	3.1	0.836
6d	1	16	1.6	0	6.1	2.146
8d	1/2	32	1.8	0	6.2	1.545
8d	1	32	1.7	0	6.3	1.346
10d	1	31	2.4	0	8.2	1.673

before being hammered out the back. When the experimental structure was torn down to recycle the wood, more care was taken in removing boards from the structural frame. The vernacular carpenter pulled nails directly from the structure during razing to discard the materials. With adequate samples with comparable ranges of nail sizes, each of these two methods of removing nails should result in distinct, identifiable patterns.

Two ethnoarchaeological assemblages from known contexts are used to illustrate how nails from sites where wood was recycled differ from nails from sites where a structure was torn down and materials discarded. The first assemblage is from the Garner site in Blount County, Tennessee. The area of an outbuilding constructed around 1905 and torn down in the 1960s was tested. When the structure was dismantled, the wood was recycled to build a chicken house. From this outbuilding site, a total of 195 complete nails was collected. Of these, 186 were in adequate shape to measure alteration. For each of these nails, length and curve height were recorded.

The second archaeological assemblage is from the Gibbs House site located in Knox County, Tennessee. The area beneath the front porch was systematically surface collected. The porch has been rebuilt twice, and both times the wood was discarded. A total of 283 complete analyzable nails was recovered from beneath the porch. For each, nail length and curve height were recorded.

Since the experiments show that nail length affects curve height, adjusted alteration was computed by dividing curve height by nail length for both ethnoarchaeological assemblages. Table 4.6 shows the distribution of nails in the adjusted curve height categories from the two sites. A Kolmogorov-Smirnov test shows that the two assemblages are significantly different (Table 4.6) at $\alpha = .05$ (i.e. the two samples come from different populations).

Nails from structures torn down to recycle wood exhibit a pattern which is different than nails from structures that were destroyed and the materials discarded. Both ethnoarchaeological sites yielded a relatively large sample of nails, residues which exhibit patterns which resulted from radically different activities.

Table 4.6: Distribution of Nails in Adjusted Curve Height Categories for the Recycled and Discard Sites

Adjusted Curve Height	Recycled		Discarded		D
	f	cum	f	cum	
0	81	.435	45	.159	.276
.01-.05	56	.736	76	.428	.308
.06-.10	28	.887	74	.689	.198
.11-.15	13	.957	62	.908	.049
.16-.20	6	.989	26	1.0	-.011
.21-.25	2	1.0	0	-	-
	186		283		

alpha = .05

D = .1284

Conclusions

The experiments and the examination of archaeological and ethnoarchaeological assemblages were designed to answer questions concerning the formation of the archaeological record with respect to nails. Additionally, it has been documented that such middle-range studies in historical archaeology are both possible and productive.

Careful analyses of nail assemblages can yield important information concerning activities which took place on a site. This study has shown that a particular pattern in nail assemblages will result from situations where structures were torn down in order to reuse the wood and/or nails to build other structures, and that one must carefully consider the factor of nail length when analyzing nail alteration. This study is a step in understanding the formation

processes affecting a nail assemblage, and identifying the activities that produce particular nail patterns.

All factors affecting nail assemblages have not been considered here. Further experimental and ethnoarchaeological work is necessary before we can nail down the pattern, and bring historical archaeology to the forefront of theory building.

CHAPTER V

TWO ARCHAEOLOGICAL EXAMPLES: THE GIBBS HOUSE SITE AND THE OLIVER SITE

Introduction

Using the methods developed in this research, two archaeological nail assemblages are analyzed and interpreted. The first assemblage is from the Gibbs House site, and the second is from the Oliver site. Both sites are located in Knox County, Tennessee and both date to the early 20th century (Faulkner 1991b; Reigel 1990). Three questions are addressed through the nail analysis. First, the sites are identified as either the remains of structures or dumps. Second, if the remains are from structures, the type of structure (log, timber frame, or frame) is identified. Finally, what happened to the structure, whether the wood was recycled when the building was razed, is investigated.

The Gibbs House Site

The Gibbs House site (40KN124) is located in northeast Knox County, Tennessee. Currently, the Nicholas Gibbs Historical Society owns and maintains the property. The tract was first settled by Nicholas Gibbs (b. ca. 1733- d. ca. 1817) in the early 1790s. According to family tradition, he built a log house on the site about 1792. This date is supported by the archaeology and the architectural study. This log house still stands on the property. A frame pen was added on the east side of the log house at a fairly early date and a

kitchen ell was added around the middle of the 19th century. The kitchen ell and frame pen were torn down in 1959 and new rooms added. Only one outbuilding is extant; however, this building has been moved from its original location (Faulkner 1991b). This is a log building that is currently used as a storage shed. The Gibbs descendants believe that this structure is the original log smokehouse built by Nicholas Gibbs.

The Gibbs farm remained in the family until 1971. Mrs. Ethel Gibbs Brown, a descendant of Nicholas Gibbs, was born on the property and lived there until she was nine years old. She drew a map of the property as she remembered it from her childhood (Faulkner 1988). It is this map, and information from other 20th century residents of the property that has helped to direct the testing strategy of the Gibbs site house lot.

The University of Tennessee has conducted four seasons of test excavations at the Gibbs House site in 1987, 1988, 1989 and 1990. This research has been carried out under the direction of Dr. Charles H. Faulkner. A major focus in the research was to locate and identify the outbuildings and house lot activity areas associated with the early log dwelling (Faulkner 1988, 1989, 1991b).

In 1989, 15 3 by 3 foot test units were excavated in the area (Area D) reported to have been the location of the original log smokehouse built by Nicholas Gibbs, and a later frame smokehouse built by John Gibbs around 1900 (Faulkner 1991b). Stratigraphically, the area shows deposits dating from about 1820 into the 20th century (Faulkner 1991b:4-7). Beneath a dark loam humus were strata and

lenses with heavy concentrations of clinders and ashes, indicating that dumping took place in the area. Additionally, two large limestone blocks (Features 13 and 14) were found in situ and were likely footers for the frame smokehouse. Very heavy concentrations of coal and clinders were found in the units west of the footers in a gully cut by an early path, and in a depression (Feature 16) north of the footer stones (in Unit 26). Evidence is fairly strong supporting the area tested as the location of a structure, but evidence also suggests that the area was used as a dump.

Nail Analysis and Results

From the 15 test units, a total of 680 nails identifiable as to length and alteration state (unaltered, pulled, or clinched) was recovered. Additionally, five wire tacks, one handwrought spike, 106 cut nail fragments, 178 wire nail fragments, and 26 unidentified nail fragments were recovered. Of the complete nails, 619 are wire, 57 are cut, two are hand wrought, and two are unidentified. Most of the complete nails were recovered in the upper two levels. Level 1 contained 379 nails and level 2 contained 234 nails. Figure 5.1 shows the distribution of the complete nails in the 15 units along with the locations of the path, Feature 16 (an early 19th century cellar pit) and the two limestone pier stones.

AREA D GIBBS HOUSE SITE

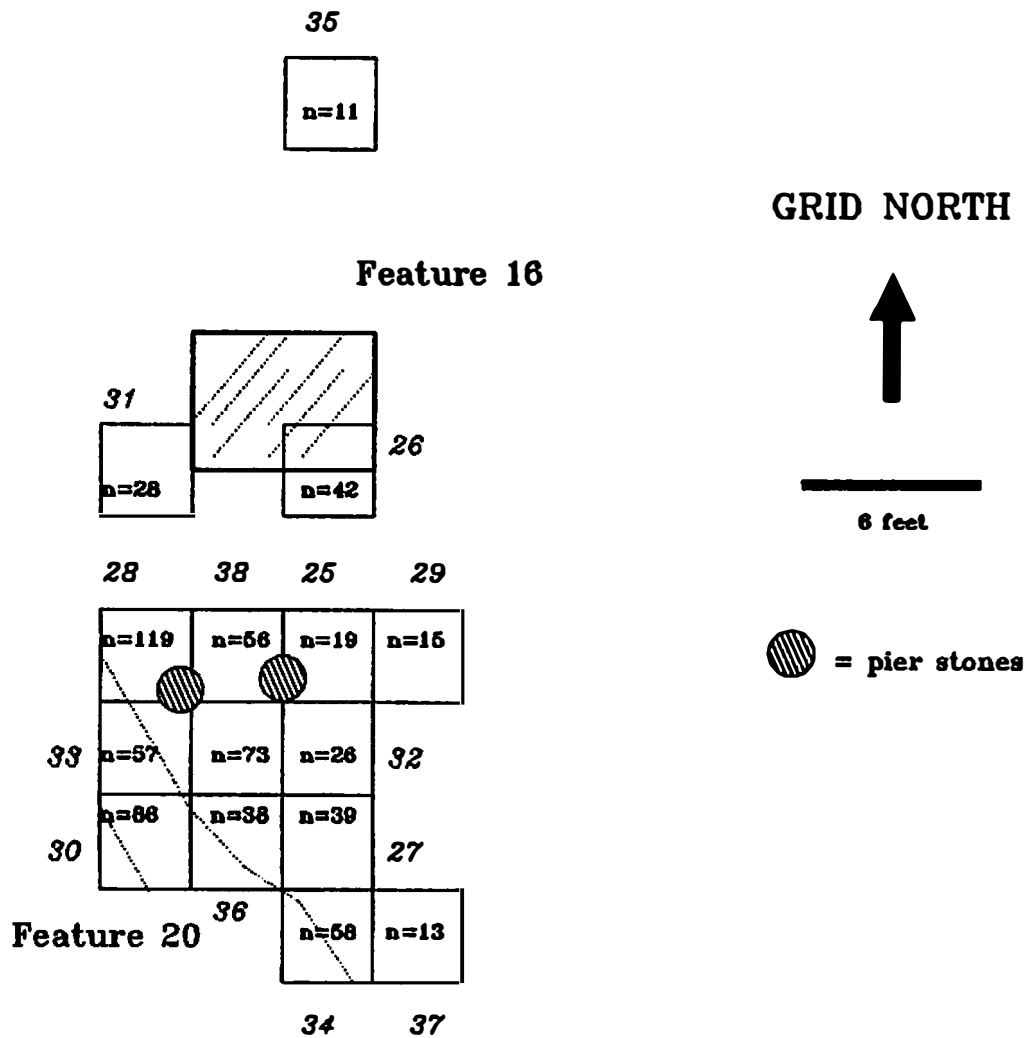


Figure 5.1: Distribution of Nails in Units in Area D at the Gibbs House Site

Of the complete nails identified as to alteration state, 330 are pulled, 222 are unaltered, and 128 are clinched. Tables 5.1 and 5.2 compare the Gibbs nails to nails from building and dump sites. As the tables show, nails from the 1989 field season test units at the Gibbs House site were most likely deposited during the construction and razing of a building, as well as during some dumping with coal and cinders around the structure.

The area around the early path became a receptacle for refuse, especially coal and cinders (see Figure 5.1). Another area that was obviously used to dispose of refuse was a depression to the north of the excavation block in the areas of units 26 and 31. Nails from the units with the path and the feature (units 26, 28, 30, 31, 33, and 38), as well as nails from unit 35, to the north of the block of units, were removed from the sample, as these nails were most likely deposited both during construction and razing of the structure and during dumping around the structure. The remainder of the nails, inside the area of the pier supports, was analyzed to identify what kind of structure occupied the area. Informant data suggest that both smokehouses (log and frame) were situated in the same location (Faulkner 1991b). The later frame smokehouse was supposed to have been built over the site of the earlier log smokehouse after the log structure was moved circa 1900. The paucity of cut and handwrought nails ($N = 59$, $\% = 8.7$) suggests that the original log smokehouse must have been located elsewhere.

Models showing the frequencies of nail lengths were generated for 9 by 9 foot structures approximately 7 feet high. The dimensions are

Table 5.1: Gibbs Nails versus Construction Sites

	u	p	c	
Construction sites	(85.3) 98	(118.8) 116	(49.2) 33	247
Gibbs assemblage	(234.7) 222	(327.2) 330	(118.1) 128	680
totals	320	446	161	927

chi square = 5.7826 df = 2 p = .0555

Table 5.2: Gibbs Nails versus Dump Sites

	u	p	c	
Dump sites	(148.1) 83	(367.6) 127	(126.3) 132	642
Gibbs assemblage	(156.9) 222	(389.4) 330	(133.7) 128	680
totals	305	757	260	1322

chi square = 74.7864 df = 2 p < .0001

based on information from a former resident of the Gibbs house. These models are then compared to the nails from the excavation units.

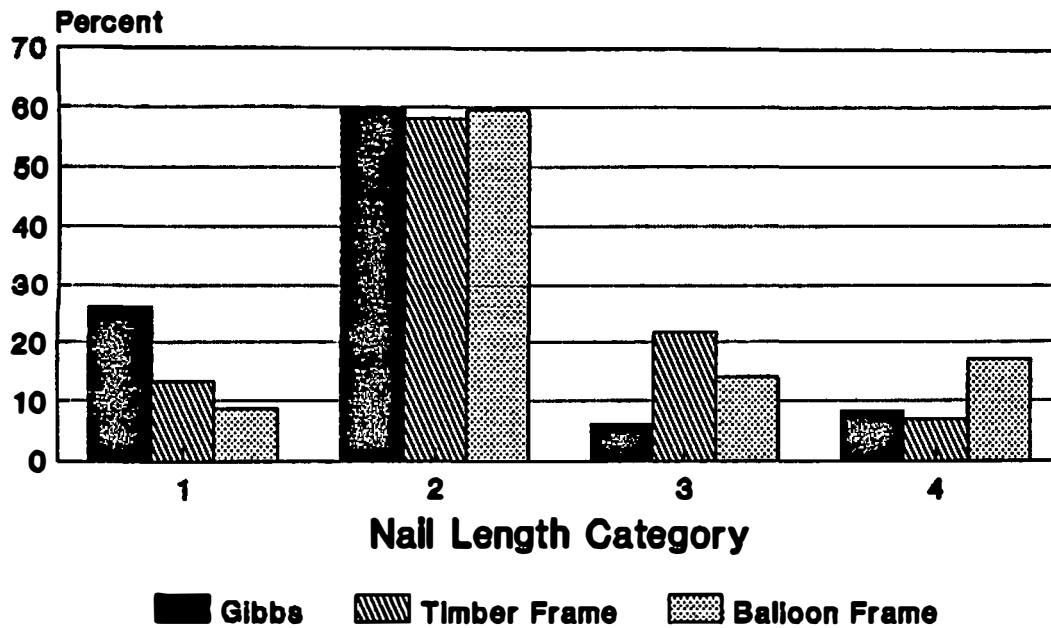
Figure 5.2 displays the frequencies in the four nail-length groups for the Gibbs nails and for 9 by 9 foot timber frame and balloon frame models with tin roofs (of the models generated, these two show the closest fit). The differences between the Gibbs structure and the timber frame or balloon frame models are close, making it difficult to determine whether the Gibbs structure was timber or balloon frame. However, it appears that the Gibbs structure was timber frame.

The final question concerning the Gibbs structure is if the wood from the building was intended to be recycled after the building was dismantled. To do this, the complete nails (recovered from the area of the structure) were analyzed as to amount of bending. A total of 233 complete unaltered and pulled nails was recovered from units 25, 27, 29, 32, 34, 36, 37, and 39. The maximum height of the curve of these nails was recorded. Because nail length affects alteration, alteration was converted to curve height divided by nail length.

Table 5.3 shows the percentages of nails in the different adjusted curve height categories for the Gibbs assemblage and for the recycled ethnoarchaeological assemblage. A Kolmogorov-Smirnov test shows that the two assemblages are not from different populations ($\alpha = .01$), but marginally different at $\alpha = .05$, indicating that the wood from the frame building at the Gibbs House site was probably recycled when the structure was razed.

Gibbs Structure vs Models

Wood Floor



Tin Roof

Key: Nail length category 1 = roofing
 Nail length category 2 = siding and light framing
 Nail length category 3 = flooring
 Nail length category 4 = heavy framing

Figure 5.2: Frequencies of Nail Lengths from the Gibbs House Nails Compared with All Models

Table 5.3: Frequencies of Nails in Adjusted Curve Height Categories for the Gibbs Assemblage and for a Recycled Assemblage

Adjusted Curve Height	Recycled		Gibbs		D
	f	cum	f	cum	
0	81	.435	104	.446	-.001
.01-.05	56	.735	34	.592	.144
.06-.10	28	.887	37	.751	.136
.11-.15	13	.957	22	.845	.112
.16-.20	6	.989	25	.952	.037
.21-.25	2	1.0	10	.995	.005
.26+	0	1.0	1	1.0	
	-----		-----		
	186		233		

D = .1337

not significant at alpha = .01

marginally significant at alpha = .05

The Oliver Site

The Oliver site (40KN103) is located in southern Knox County, Tennessee. A house mound containing rubble from a chimney fall was excavated in 1989 and 1990 as part of the Tennessee Department of Transportation Mississippi Parkway project. According to historical documents and interviews with informants, the Oliver site represents the remains of a tenant house built around the turn of the century. It was described as being a hall-and-parlor type house with board and batten weatherboarding and a central chimney. The structure was probably razed in the 1930s.

Nail Analysis and Results

A total of 25 one by one meter and one 1/2 by 1 meter test units excavated in the house mound in 5 centimeter levels yielded 611 nails and nail fragments. No in situ pier supports were found. The exact size of the structure is undetermined. A nearby extant tenant house, measuring approximately 30x9 feet (two rooms with a central chimney) is used as a model for the dimensions of the Oliver structure because of the apparent similarity of this structure and the descriptions of the Oliver house.

A total of 372 (95.6%) of the complete nails are wire, 16 (4.1%) are cut, and one is unidentified. Of the nail fragments, 131 (59%) are wire, 21 (9.5%) are cut, and 70 (31.5%) are unidentified fragments. None of the cut nails exhibited squeezing of the shank below the head indicative of early machine-headed nails. All of these nails fit well within the date range of circa 1900 to 1940.

The site is clearly identified as the remains of a structure, and the frequencies of unaltered, pulled, and clinched nails exhibit the pattern associated with construction activities. Table 5.4 compares the frequencies of unaltered, pulled, and clinched nails from Oliver with nails from construction sites. A chi square test shows no significant difference at $\alpha = .05$ between the Oliver nails and construction sample nails (chi square = 0.6971).

Table 5.4: Frequencies of Unaltered (u), Pulled (p), and Clinched (c) Nails of Oliver and Construction Sites

	u	p	c	
Oliver nails	164	169	55	388
Construction sites	98	116	33	247
	262	285	88	635

chi square = .6971 df = 2 p = .7057

The most interesting question concerning the Oliver nail assemblage is the type of structure it might represent. Several informants described the structure in detail, as they remembered it. The informants were able to describe the placement of windows and doors, the type of weatherboarding, and additions. None were able to tell if the structure was timber frame, balloon frame, or log. The models developed in this study are not able to identify specific architectural features such as number of windows and doors, or siding type, but can identify whether the structure was log or frame.

Figure 5.3 shows the distribution of nail lengths for the Oliver nails and for log, timber-frame, and balloon frame models measuring 30 by 9 feet. Table 5.5 presents the Oliver nail and model nail length frequencies for timber frame and balloon frame structures with tin roofs. The closest fit (showing least cumulative difference in the four categories) is with the timber frame model. The Oliver nails clearly fall within a frame-type weatherboarded structure.

Table 5.5: Frequencies in Functional Categories for Oliver Nail Assemblage and Log, Timber Frame, and Balloon Frame Models with Tin Roof

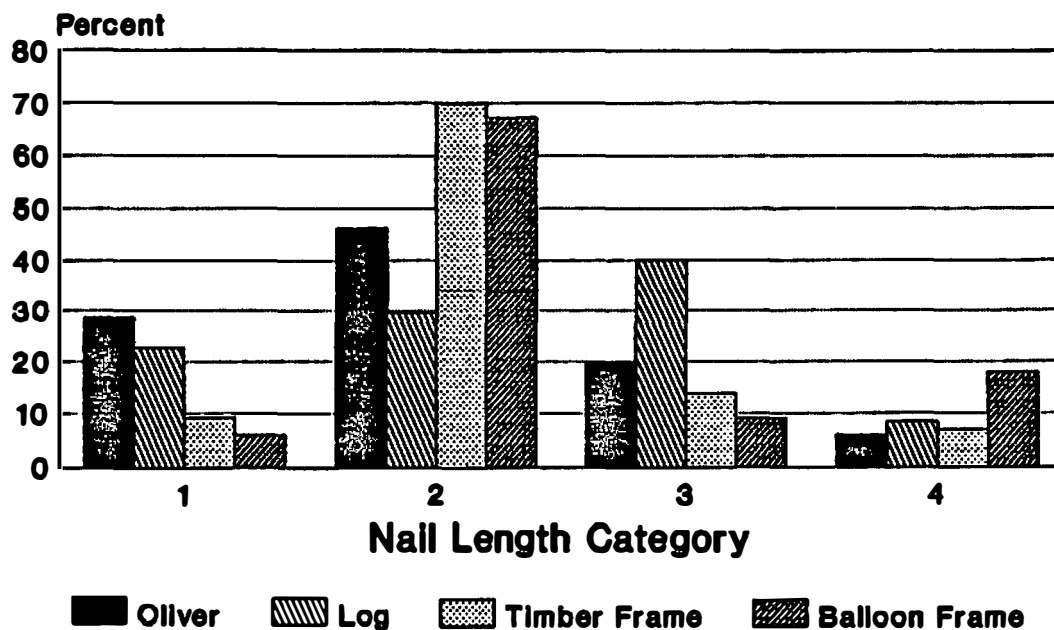
function	Oliver N	Oliver %	log %	timber frame %	balloon frame %
roofing	108	28.4	22.5	9.2	6.0
siding & light frame	175	46.1	29.2	70.0	67.2
flooring	75	19.7	39.9	13.9	9.0
heavy frame	22	5.8	8.4	6.9	17.8

As seen in Table 5.5, a great deal of disparity exists in the category of roofing nails (1.5 - 1.75 inches, 4d and 5d nails). It is likely that the Oliver house had a shake roof which was removed in large sections and carried away from the site either when a new roof was applied, or when the structure was dismantled. If this occurred, relatively few shake roofing nails would enter the archaeological record at the site of the structure. Table 5.6 compares the Oliver nails with models without roofing nails for timber frame and balloon frame structures. Again, the timber frame model is closest to the Oliver assemblage.

From historical documents and interviews, and from the analysis of the nail assemblage, it appears that the Oliver house was constructed around 1900. From historical documents, what happened to the building after 1930 is unclear. Analysis of the degree of alteration exhibited by the Oliver nails indicates what happened to the structure.

Oliver vs Models

Wood Floor



Tin Roof

Key: Nail length category 1 = roofing
 Nail length category 2 = siding & light frame
 Nail length category 3 = flooring
 Nail length category 4 = heavy frame

Figure 5.3: Distribution of Nails in Length Categories of Oliver Nails and Log, Timber Frame, and Balloon Frame Models with Tin Roof

Table 5.6: Frequencies in Functional Categories for Oliver Nail Assemblage and Timber Frame and Balloon Frame Models without Roofing Nails

function	Oliver N	%	timber frame %	balloon frame %
sliding & light frame	175	64.3	77.9	70.8
flooring	75	27.6	15.4	9.5
heavy frame	22	8.1	6.7	18.8

A large portion of the nails recovered from the excavation is visibly unaltered (n = 164), but nearly the same number exhibit characteristics of being pulled (n = 169). Table 5.7 compares the frequencies of alteration categories for the Oliver assemblage and the recycled ethnoarchaeological assemblage. A Kolmogorov-Smirnov test ($\alpha = .05$) shows that these two assemblages are not significantly different. This analysis indicates that the wood from the tenant house was intended for recycling when the building was dismantled.

Conclusions

Three questions concerning nail assemblages from the Gibbs House site and the Oliver site have been addressed through the methods developed in this study. Nails from the 1989 test excavations at the Gibbs House site (40KN124) have been analyzed to ascertain whether the area tested was used as a dump or if a structure stood at the location. The analysis of the nails clearly shows that a frame type (timber or balloon frame) building stood at the site. The nails from

Table 5.7: Frequencies of Nails in Adjusted Curve Height Categories for the Oliver Assemblage and for a Recycled Assemblage

Adjusted Curve Height	Recycled		Oliver		D
	f	cum	f	cum	
0	81	.435	165	.495	-.006
.01-.05	56	.735	41	.618	.118
.06-.10	28	.887	65	.813	.074
.11-.15	13	.957	29	.900	.057
.16-.20	6	.989	23	.969	.020
.21-.25	2	1.0	10	1.0	-
	186		333		

D = .1245

not significant at alpha = .05

the excavation units were deposited when the structure was built and torn down, and during dumping activities that occurred around the structure. Nail analysis also indicates that when the structure was finally dismantled, the wood was intended to be recycled.

Additionally, almost all of the nails were wire nails dating after 1880 (Loveday 1983; Priess 1973). Very few cut and hand wrought nails were recovered from any of the units. The small sample size of these earlier cut and wrought nails precluded statistical testing, but most likely, the original log smokehouse did not sit in the location of the 1989 test area. These findings corroborate most of the informants' information, i.e. that an early 20th century structure occupied the area, and support Faulkner's (1991b) conclusions concerning activities which occurred in this tested area of the Gibbs houselot.

The analysis of the nails recovered from the excavation units at the Oliver tenant house supports data from informants and from the

documentary record about house type and date and construction. In addition, based on the nail analysis, inferences can be made about the razing activities which occurred at the site, and about the occupants/builders of the Oliver tenant house.

The fact that a hall-and-parlor style tenant house appears to have been built with a combination of joinery techniques (nails and mortise and tenon) suggests that even in the Knoxville area where nails were easily available at the turn of the century, and at a time when balloon framing was used for popular style housing (Noble 1984:127), vernacular architecture was still practiced. Most likely, tenants who lived at the Oliver farm either aided in the construction or constructed their own homes.

Timber frame (especially braced frame) construction is an artifact of 19th century technology. Its persistence into the 20th century in outbuildings, such as the turn-of-the-century McCorkle wash house and grain house, is not particularly out of place. The use of what is essentially 19th century wood joinery in dwellings constructed in the 20th century, while not entirely surprising, requires further study.

One possibility not researched here is that the Oliver tenant house was of "box" construction (Morgan 1990). Patrick (1981) and Morgan (1990) suggest that balloon framing did not gain wide acceptance in rural areas in East Tennessee until after the Civil War. Additionally, Morgan (1990) believes that in the 1890s-1900 box construction became common for tenant houses. Box construction is flimsier than balloon or platform framing, and requires fewer heavy

structural nails since few or no wall studs are used. Unfortunately, because of the flimsier construction, few box houses survive for study today. This makes testing whether the Oliver assemblage represents the remains of a box house problematic. At best, it can be inferred that the Oliver house was not balloon frame, but either timber frame or box construction.

CHAPTER VI

CONCLUSIONS

Until very recently, middle-range research has been generally lacking in historical archaeology (Leone and Potter 1988; Holland 1990; Sanford 1991). With middle-range research, progress can be made toward understanding and explaining the past. Binford has stated that he:

was led to the inescapable conclusion that there existed no way to develop archaeological methods of inference, except via the study of contemporary living peoples, or by controlled experiments under laboratory conditions, or by doing archaeology in situations whose dynamic component is historically documented (Binford 1983:104).

Methods developed in this research used ethnoarchaeological and experimental data, along with observations made on standing structures, to identify dynamics which create and pattern archaeological nail assemblages.

Architectural materials such as bricks, mortar, window glass, and nails, often occur in very high frequencies on historical sites. For instance, even in South's (1977) Carolina Artifact Pattern, architectural artifact frequencies range from about 12 to 35 percent of the total assemblage. Most research has been aimed at determining manufacturing dates of artifacts in this group. Unfortunately, very little research has been carried out to reconstruct how these materials move through their systemic context and enter the archaeological record.

Three methods for analyzing archaeological nail assemblages have been developed in this research. Two of the methods are designed to make it possible to identify the three architectural activities: razing structures; recycling wood; and discarding architectural materials. Another method allows for reconstructing the kind of building (log, timber frame, or balloon frame) that existed at an archaeological site. These methods have been successfully employed to analyze and interpret two archaeological nail assemblages, one from the Gibbs House site (40KN124) and the other from the Oliver site (40KN103), both in Knox County, Tennessee.

The first problem addressed in this research was to distinguish dump sites from sites of ephemeral structures, both of which are characterized by high frequencies of nails. To do this, nails from existing dumps were collected and analyzed, and nails from known building sites were examined. The frequencies of unaltered, pulled, and clinched nails were compared between the two types of sites. Dump sites were found to be characterized by relatively low percentages of unaltered nails and relatively high percentages of clinched nails. Conversely, building sites were found to have high frequencies of unaltered nails and low frequencies of clinched nails. The method of analysis is simple and does not require much time to perform. Using the method becomes problematic when a site was used for both types of activities (i.e. when dumping occurs in or immediately adjacent to a structure).

For the second method, nails of different functions (roofing, siding and light framing, flooring, and heavy framing) were counted in

standing log, timber frame, and balloon frame structures. The different nail functions correlate with nail lengths. These data were used to generate models where size of the structure, roof covering, and flooring could be varied. It was found that log, timber frame, and balloon frame structures of the same parameters each exhibit distinctive patterns in proportions of nail lengths. The models, having been developed with a small data base consisting of eight standing structures, are coarse-grained and in need of refinement. Nevertheless, they have proved moderately successful in reconstructing whether an archaeological nail assemblage represents a log, timber frame, or balloon frame structure.

The last method used data from ethnoarchaeological sites to identify patterning in nail assemblages characteristic of structures torn down to recycle wood or structures dismantled and materials discarded. Based on observations made during experiments on a simulated portion of a structure being dismantled, it was thought that the amount of bending, or degree of alteration exhibited by nails might help identify these patterns. First, experiments were conducted to determine what effect nail length has on degree of alteration. It was found that nail length has a positive effect on nail alteration. To compensate for this effect, nail alteration was measured by the height of the curve of a bent nail, divided by its length. Nails from ethnoarchaeological sites were collected and adjusted alteration compared. Nails from sites where buildings were razed and wood recycled were altered differently than nails from building sites where the structure was torn down and materials discarded. Since only

complete nails were analyzed, future work might include experimental and ethnoarchaeological research to determine how frequently nails break when structures are dismantled in different ways.

Most of the research presented here centered on wire nails and late 19th and 20th century structures, but previous research (Loveday 1983) suggests that at least early cut nails are more brittle than later cut and wire nails. Consequently, more research is necessary before the patterns of nail assemblages identified here can be extended to interpret early 19th century archaeological nail assemblages. The methods presented here are effective for interpreting archaeological assemblages that date later than circa 1830.

It has been demonstrated that middle-range research can be an effective aid for interpreting historic site formation processes. Strong inferences can be made when developed and tested through experimental archaeology and ethnoarchaeology. Historic archaeologists must devote greater time to building middle-range theory or answers to "Questions that Count" will remain just-so stories.

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