Article Title: How Did They Do That?

Full Citation: David Murphy, "How Did They Do That?" *Nebraska History* 87 (2006): 16-17.

URL of article: http://www.nebraskahistory.org/publish/publicat/history/full-text/NH2006HowThat.pdf

Date: 2/7/2012

Article Summary: This article contains an explanation of the straw bale structural system of the Lone Oak Building, built in 1944 six miles west of Lincoln, Nebraska.

Cataloging Information:

Keywords: Portland Cement Company; mortar; concrete sludge; concrete mortar joints; brick rowlock; joist

Photographs / Images: Construction view of Lone Oak Building showing that the members hold stakes set in the concrete mortar between the bales; Construction view showing a smooth plastered wall, indicating that the interior was at least partially plastered before the exterior was stuccoed or a roof was in place.

How Did They Do That?

Architects, historians, and straw bale enthusiasts are curious about the structural system of the Lone Oak building, not only to understand its place in the history of baled biomass construction, but also to satisfy curiosity about its long-term structural outlook. But structural research—to learn how the walls, floor, and roof are integrated—is difficult because of a structure's technical aspects, and because in a functioning building the telling details are concealed from view.

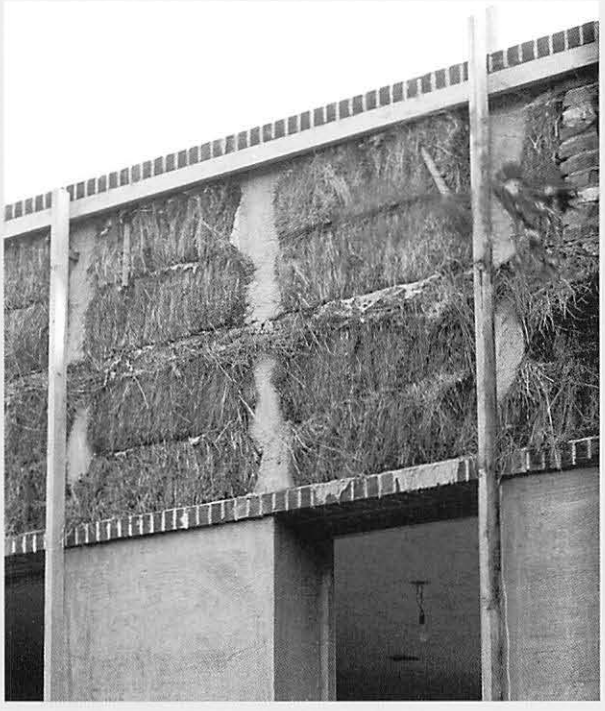

Figure 1. NSHS RG2183-1945-0730-3

Structural research would be easier if blueprints or other construction documents were available, or, paradoxically, if the building were torn down, so hidden structural details could be inspected. The only information we have about construction of the Lone Oak comes from two construction photographs commissioned by the Portland Cement Company and two eyewitness accounts from in the 1990s.

A construction view (Fig. 1) includes what appear to be temporary light vertical frame members along the walls. The detail here shows that the members hold stakes set in the concrete mortar between the bales. It appears the verticals are keeping the wall plumb while the mortar and surface stucco set. They also carry a horizontal member supporting the lip of a continuous brick rowlock course while its mortar sets. The vertical members suggest that the bales are load bearing. Had they been a "veneer" on some other structure, such as a stud wall, the verticals would not have been needed; the bales could have been anchored to the studs. There are similar members on the face of interior wall. They appear to be held by wires passing through the bale and tied to stakes.

The second construction view, taken on the same day (Fig. 2) shows a smooth plastered wall, indicating that the interior was at least partially plastered before the exterior was stuccoed or a roof was in place— an unconventional sequence by ordinary standards.

The wall appears to be one bale thick, and could not conceal a second structure behind the bales (although a structure within the bales is a possibility). The interior plaster and the exterior stucco are applied directly to the hay.

The bales appear to be placed with the constituent materials—the plant stems—oriented vertically (the most common of the historical load-bearing methods), and they are set in a thin bed of mortar or concrete sludge. The bales have wide concrete mortar joints between them, and are laid in stack bond, not the running bond commonly seen in earlier buildings. No evidence of bale strings or wires is visible, and one wonders what is holding the bales together.

Between the second and third courses of bales and below the brick rowlock at the top of the wall are two narrow courses. The lower one seems to be made of loose hay, here and there impregnated with sludge (possibly mud). A thin

Figure 2. NSHS RG2183-1945-0730-4

bed of concrete sludge tops the course. This course, like the brick rowlock, appears to be an idiosyncratic feature of Lone Oak construction. Possibly it is a leveling course and a hardened base for the rowlock bricks. Measurements made from the photographs suggest there must be thin leveling courses elsewhere, probably between every two courses of bales throughout the wall.

The wide vertical mortar joints also are idiosyncratic. Possibly they space the bales for design dimensions not specific to bale construction, but their consistent appearance at the jamb line of every window might suggest some other purpose. Typically wooden jambs are anchored to the bales to provide substructure for windows and doors. Could the wide mortar joints point to some kind of frame embedded in the walls at the jamb lines?

How do the walls support the floors? An intuitive notion that the leveling course might also be the bearing surface for floor joists is negated when the inside and outside views are compared; the joist bearing is about at the top of the first bale above the windows, not at the leveling course. We can see nothing of the actual connection between the joists and the wall—whether, for example, they bear on a plate atop the bales, or on a stringer attached to substructural jambs. Neither option seems particularly viable. In the former case, we question how the bales above the joists would be set in order to maintain the integrity of the wall assembly above. In the latter case, we would expect the jambs to be actual posts, as the wide spacing of these potential framing members would require something heavier than two-inch members. Also, the integrity required of a structural framing system would lead us to expect such posts to be in place already for the entire second storey, as the assembly between the second storey joists and window sills is already completed.

As revealing as the two construction views are, we still lack critical information about the Lone Oak's structure. We need to see the connection of floor to wall to confidently place the building within a structural history. We know the Lone Oak was built at the end of the period of historic bale constructions, but we cannot confidently place its actual construction practice. Is it an extension of the older Nebraska Style, or a newer form of structural framing?

Taking a wider view, we see a high, long wall punctuated by regularly spaced windows and required to support large live loads. From this view it is difficult to believe the wall is load bearing. If it is—and it certainly appears to be—the Lone Oak is a remarkable structural feat indeed! The lack of visible framing leads us inevitably back to that conclusion, though we have to allow for the possibility of an unknown practice, such as some kind of hybrid system, to be hidden within the walls. Perhaps it suffices to let the visible idiosyncrasies place the Lone Oak within an ongoing process of innovation and experimentation. From that perspective, it is a pivotal building through which a distinguished vernacular past connects to a promising sustainable future.

David Murphy