

BOXED HOUSES: A SIMPLE METHOD FOR HOUSING

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The 19th century saw many innovations in housing, most notably the balloon and platform framing methods that dominate low-rise housing construction in the U.S. to this day. But there was an alternative; from 1815 through the 1950's whenever Americans needed semi-permanent shelter they built structures with simple thin boards acting simultaneously as structure and enclosure. These "shanties," "box-houses," "single-walls," were built in New England canal towns, midwestern railroad camps, and as disaster relief camps following the great 1906 earthquake in San Francisco. Thousands were likely built as housing, utility, and mercantile structures, perhaps hundreds remain in service today. But few design and construction professionals know of this construction method. This paper will present the principles of structure and a case study in construction. This little known mode of constructing shelter has great potential as second stage disaster recovery housing. It is durable, some lasting over 100 years, can be built with unskilled/semi-skilled labor with few tools and fasteners, and is easily flat-packed for shipping to disaster regions.

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1 INTRODUCTION

The single-wall, or "box" type house became the successor to the early timber plank houses that lost its heavy timber frame along the way. The box house popped up in the housing camps for canal-builders, in the boomtowns erected by gold, silver, and lead miners, in railroad workers camps, on homesteads, was the post-tent housing solution of choice for earthquake survivors, and newly freed (and homeless) slaves, and oilfield workers all across the United States.

A common misconception among professionals in the design, construction, and design education community is that American pioneers moved directly from the log cabin to either the timber frame or the light wood frame. What seems to have been a very common type of construction, the single-wall, or box-type as it was known in the southeastern U.S. was a favorite form of shelter for those who needed to quickly erect a shelter, and having few resources in the way of tools, skills, and manpower.

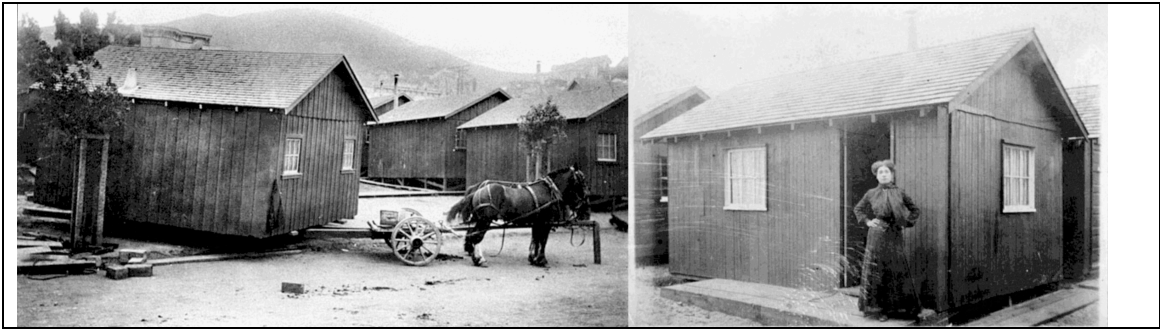


Figure 1: “Earthquake Shacks” Following the San Francisco Earthquake of 1906, these single wall shacks served as post-earthquake housing.¹

2 DESCRIPTION OF THE BOX HOUSE

The boxed house or single-wall form of construction is well described by Charles Martin in “Hollybush: Folk Building and Social Change in an Appalachian Community” (Martin 1984). Martin explains the core concept of the single-wall method, “Whereas a frame house is supported by a skeletal structure independent of the wall coverings, a ‘box’ house (the regional name for a board and batten structure) is not. If the wall coverings of a frame house, both interior and exterior, are torn down, the house will continue to stand. In box structures, the walls are the critical components; if they are removed, the structure will collapse.”

The walls of these single-wall or box-type constructions are simply one-inch thick boards that are six to eight inches or more in width, and extending from sill to the eave continuously. Joints are covered with one by three-inch batten strips on the exterior and interior of the wall. These very thin board and batten walls are the primary load-carrying structural components of the building. (Fig. 2)

¹ The shacks were available for sale to their occupants. One recently resold for \$347,000.00! San Francisco Public Library photos used by permission Creative Commons
http://foundsf.org/index.php?title=Bernal_Heights_1906_Quake_Shack_survivors



Figure 2: Interior and exterior batten strips over joints in one by wall boards, Joseph V. Frnka house, Front and Water streets, Columbus, TX.

Many of these single-wall buildings are still in service today, primarily as houses, although churches, commercial buildings, and agricultural buildings are also found to use this method. One significant cluster of these buildings is found in Bodie, California. Bodie is currently managed as a National and State Historic Landmark District. Approximately one-fifth of the original structures still remain at this high mountain mining town where at one time there was a population of over 10,000. Today, there are no inhabitants. Over 200,000 people visit Bodie each year to take in the authentic landscape of the 1890's era gold-rush town. In a Master's Thesis titled "Structural Failures of Single-wall Construction in a Western Mining Town: Bodie California," (Morrison 1999) Andrea Sue Morrison notes that of the one hundred twenty-two standing, unmodified original buildings in Bodie, eighty are single-wall constructions. When Charles Martin conducted his fifty interviews on the Appalachian town of Hollybush and the construction methods found there, he noted the vast majority of the interviewees cited growing up in a "box" house, and that when asked to recount how many framed houses they remembered in their community, they frequently could recount them on one hand, a clear indication of the favoring of these single-wall or box-type constructions over both cabins and balloon framed houses.

The single-wall structures in Bodie, where winter temperatures can drop to twenty below zero, Fahrenheit, were lined on the inside surface of the walls with muslin, paper, cardboard or tin (often the remnants of canned foods consumed by the occupant) to provide some insulation value and draft stopping. In some cases, single-wall buildings have additional layers of siding, either vertical or horizontal, applied to one or both sides of the load bearing one by eight. This additional siding

would have both stiffened the wall, and given additional protection from the elements. Frank Lloyd Wright used this single-core plus siding approach in the Usonian houses.

3 CONJECTURES ON THE CONSTRUCTION PROCESS

As a construction process, the single-wall required few tools, little skill, and due to the lightness of the pieces, not much labor compared to log cabins or traditional timber frames. Two to three men could construct a single-wall house, while fifteen or more would be required for a similar hewn house. Floors would be constructed either directly on the ground, or on stone or wood piers, depending on the topography. Typically, the floor would be framed with shallow joists nailed to two inch thick plates, with one-inch thick floorboards, either square-edged or tongue-and-grooved.

Once the floor was laid, the process of enclosing towards supporting the roof was fairly simple. In "Pride and Prejudice" Michael Ann Williams includes this excerpt from an interview with Jessie Frazier in 1984. (Williams 1990)

"Well, [a boxed house is] when you – when they don't take pains to cut the lumber all to pieces and fix it up fine. They just take the planks and set them up and nail them. You know, and just all around. Just kind of boxed them in...that's the way my dad built them to rent to people, because wasn't building them to stay there forever."

The walls were primarily boards, either milled at a sawmill, or riven, (whip sawn) locally. Martin documents families producing up to twelve of these boards per day using the whipsaw technique. The framing process would begin at the corners, where two milled two-inch thick boards would be nailed together at ninety-degree angles to produce a boxed corner. Once all four corners were in place, eave plates would be nailed to the tops of the boxed corners. Wallboards would be nailed to the face of the floor frame, and to the face of the eave plate.

Single-wall construction observed in Columbus, Texas used three-ten-penny nails in each 8 to twelve inch board to attach it, and transfer roof and attic loads through shear to the face of the floor frame. (Fig. 3) The live and dead loads amount to approximately 186 pounds per nail in shear, very close to the current engineering practice of 154 pounds. Engineering practice reduces the capacity per nail in shear according to lumber species, if we take the capacity reduction assigned to the softest species of lumber used in framing, SPF or Spruce/Pine/Fir, the allowable load per nail is 107.8 pounds, approximately 57% of the assumed load, yet, the house stands, and has been in service as a house since the early twentieth century.



Figure 3: Joseph V. Frnka historic site, photo of vertical load bearing wall-board with 8 penny nails, reference lines at bottom indicate observed nail locations.

A two by four wall ledger would be nailed to the inside of the wall boards at attic ceiling height, and ceiling joists notched so that the underside of each joist would align with the bottom of the wall ledger. This ledger served to further tie together and brace the one-inch thick wallboards against buckling. The attic floor would be nailed down one-inch thick boards, either square edged or tongue and groove. This floor often served as a work platform to raise the roof joists and install the skip sheathing for wood shingles. (Fig. 5).

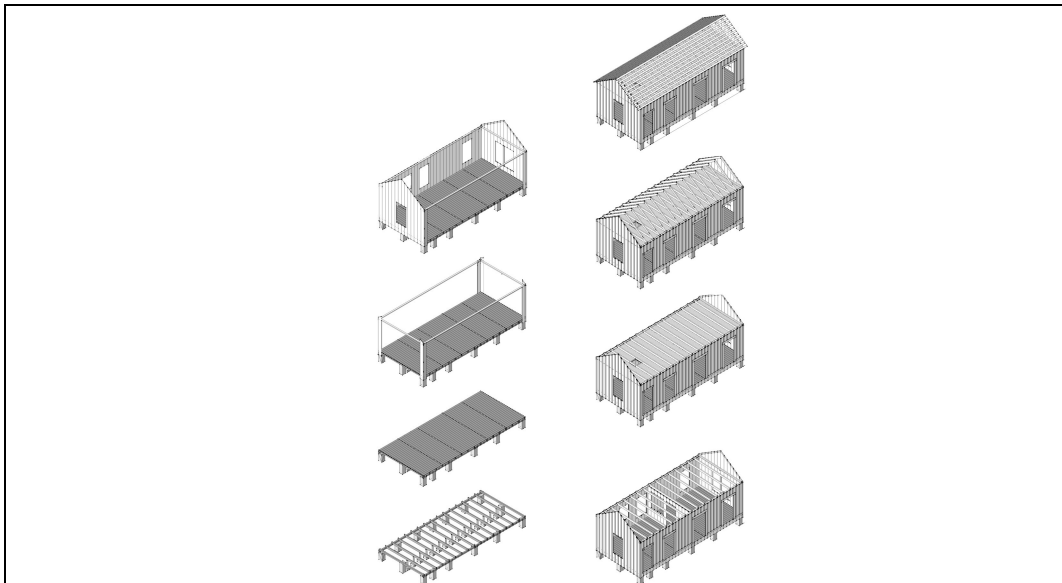


Fig. 5: Joseph V. Frnka historic site, Computer model of conjectured construction process.

3 CONCLUSIONS

With thousands of surviving exemplars, and hundreds that are still being used as habitations prove the enduring value of the single-wall/box/shanty type of construction.

The single wall type of house construction, while limited in it's ability to elegantly integrate mechanical and electrical systems within walls, and limited in it's inherent thermal modest, is a low-skill, low-tech form of construction eminently suited to "flat pack" approaches to transporting shelter to disaster-stricken communities. Simple hand tools (hammer, saw, and square) and simple fasteners (10 and 16 penny nails) and pictographic directions are all that is needed for disaster-survivors to "do-it-yourself" their way towards a recovery following a disaster.

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