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Rub Some Dirt In It: Reconstructing Authentic Nineteenth-Century Great Plains' Sod Structures

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RUB SOME DIRT IN IT: RECONSTRUCTING AUTHENTIC
NINETEENTH-CENTURY
GREAT PLAINS' SOD STRUCTURES

A Thesis
Presented to
the Graduate Schools of
Clemson University and the College of Charleston

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Historic Preservation

by
Jessica Pearl Fortney
May 2016

Accepted by:
Amalia Leifeste, Committee Chair
Dr. R. Grant Gilmore, III.
Dr. Carter Hudgins

ABSTRACT

This thesis addresses the question: What is the best practices for reconstructing sod houses from the nineteenth century that balances authenticity and practicality. After the Homestead Act of 1862, land west of the Mississippi became easier to acquire for farm land. Since there are few trees on the Great Plains, which makes the region ideal for farming, the new settlers employed an alternative building material, sod. The prairie sod was cut into bricks and stacked to form a structure. Structures that were dug out of a hill or ravine were called dugouts and others were structures with four walls built completely out of sod bricks, a sod house. Since the main construction material is organic and disintegrates, few sod structures survive to the twentieth-first century. This fact brings sod structures into the category of impermanent architecture, which challenges the field of Historic Preservation used to working on more durable building types. Museums and individuals have tried to reconstruct sod structures for interpretation and educational reasons. Three different sites in Minnesota demonstrate the range of reproductions in terms of building materials and construction methods. This thesis analyses three replicas and the maintenance plan from a surviving sod structure and posit a reproduction technique that is both practical for building and authentic in interpreting nineteenth-century sod structures.

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TABLE OF CONTENTS

	Page
TITLE PAGE	i
ABSTRACT	ii
ACKNOWLEDGMENTS	iii
LIST OF TABLES	vi
LIST OF FIGURES	vii
CHAPTER	
I. INTRODUCTION	1
Railroads	5
Pre-European Structures	8
Precedent European Earthen Structures	13
Modern Earthen Structures	18
Sod Composition	22
Site Selection	25
Construction Methods	26
Sod Structures Enduring Today	35
II. METHODOLOGY	39
III. LITERATURE REVIEW	45
IV. HISTORIC IMAGE ANALYSIS	56
Geographic and Chronological Patterns	66
Parameters of Authenticity	70
V. CASE STUDY ANALYSIS	73
Authenticity Ranking Scales	75
Site Descriptions	84
Analysis-Site Ratings	112
Averages and Summary of the Four Case Studies	133

Table of Contents (Continued)

	Page
VI. CONCLUSION.....	139
Significance.....	140
Balance.....	144
Ideal Replica	145
APPENDIX	146
REFERENCES	212

LIST OF TABLES

Table		Page
4.1	Summary of Sod Structure Architectural Features	58-59
4.2	Sod Structure Sizes Bar Graph	60
4.3	Roof Materials Bar Graph.....	61
4.4	Roof Type Bar Graph.....	63
4.5	Roof Penetrations.....	64
4.6	Window Glazing Materials Bar Graph	65
4.7	Roof Types by State/ Territory Bar Graph	68
4.8	Roof Materials by Era Bar Graph	69

LIST OF FIGURES

Figure	Page
1.1 Dugout in Hill	3
1.2 Half Dugout, Half Sod House.....	3
1.3 1869 Railroad Map	6
1.4 Mandan Earthlodge floor plan	10
1.5 Painting of Mandan Village by George Catlin 1886	11
1.6 Icelandic Turf House.....	15
1.7 Rick Joy’s NK’Mip Desert Culture Centre.....	18
1.8 Grassland Ecoregions of the Great Plains.....	22
1.9 Proper Plow.....	26
1.10 Grasshopper or Sod Plow.....	27
1.11 Sod Cutter	28
1.12 Sod Cutter Side View.....	28
1.13 Sod Bricks Stacking Pattern.....	29
1.14 Window Profile.....	31
4.1 Sod Bricks and Lumber Roof Example	61
4.2 Sod Bricks and Logs Roof Example.....	61
4.3 Sod Bricks, Logs, and Lumber Roof Example	62
4.4 Roof Types with Corresponding Graph.....	63
5.1 McCully in Front of His Sod House, 1950s.....	88
5.2 McCully Sod House Kitchen	88
5.3 Sod House in Museum	89
5.4 Interior Wooden Partition and Support Ridge Poles.....	89
5.5 Construction Detail of McCully Sod House	90
5.6 Sod House on the Prairie.....	95
5.7 Sod House, upclose.....	95
5.8 Sod House side view of roof.....	96

List of Figures (Continued)

Figure	Page
5.9 Sod House interior	96
5.10 <i>Sod House on the Prairie</i> Dugout view from Sod House	97
5.11 <i>Sod House on the Prairie</i> Dugout.....	97
5.12 Dugout interior.....	98
5.13 Laura Ingalls Wilder Museum Dugout Replica building form	103
5.14 Newly constructed replica.....	103
5.15 Laura Ingalls Wilder Museum Dugout replica, front view.....	104
5.16 Dugout replica, front view	104
5.17 Dugout replica interior	105
5.18 View of prairie at Laura Ingalls Wilder Museum.....	105
5.19 Dugout at Gordon Farm	106
5.20 Dugout at Gordon Farm, closeup.....	106
5.21 Exterior sod house replica in the TNW Exhibit.....	109
5.22 Interior newspaper finish	109
5.23 Interior roof finish.....	110
5.24 Frontier exhibit.....	110
5.25 Example sod brick.....	111
5.26 Exterior of sod house replica	111

CHAPTER ONE: INTRODUCTION

Nineteenth-century settlers of the American Great Plains built sod houses out of necessity. The building tradition that pioneers were leaving back East was timber-framed construction. The Eastern United States had a prevalence of trees, which provided a substantial base of raw materials. When settlers migrated out west, specifically to the Great Plains, trees were sparse. Settlers had to find another construction material and the most readily available material was the prairie sod. Sod is the prairie grasses, dirt, and root system combined to form a cohesive material. The strength of the material is in its intricate structure of the root system with the soil which intertwine to serve as a cohesive binding structure. The settlers cut bricks out of the prairie sod and stacked the bricks, like masonry but without mortar, as temporary structures. These structures were temporary on the landscape both because of the ephemeral quality, the sod disintegrated easily, and temporary in terms of other building technologies, which displaced the sod construction type of dwelling. Towards the end of the century, wood frame construction quickly replaced this building practice. As settlements became more established, housing construction became more durable and replicated methods from forested areas of the country.

It is estimated that there were over one million sod houses and dugouts built during the nineteenth century.¹ It took between half an acre to a full acre of sod to construct sod structure (depending if the structure was a dugout or a house).² The

¹ Bill James, *Sod House Pioneers* (Monticello, AR: James Quick Print, 1980), 5.

² Further information in Literature Review

railroad reached the Plains by 1900 and brought with it access to lumber for construction. Settlers saw sod structures as temporary houses until lumber and the railroad reached the rural areas of the Great Plains.

There are a few names for sod structure constructions on the Great Plains. A sod house is an above ground building made of sod bricks stacked in a similar manner to laying masonry bricks.³ Other terms used to describe a sod house are ‘soddie’ or ‘sod shanty.’ A dugout is an excavated hill or a rise in the ground with either sod bricks built up to the sod roof or timber and logs built up to the sod roof (Figure 1.1).⁴ The majority of the interior space is located in the hill or underground. Another type of dugout is a half sod house, half dugout. This sod house, dugout combination has a floor that is three feet below ground level so one has to go down stairs to enter (Figure 1.2).⁵ Other terms to describe dugouts are ‘sod cellar,’ ‘gopher hole,’ ‘root house,’ ‘cave,’ and ‘dirt nest.’ Another term used to describe the sod brick themselves is “Nebraska Marble.” In this thesis, the term sod structure will be an overall term referring to sod houses or dugouts. If a description directly relates to one of the structures, the nomenclature of a sod house or dugout will be specific.

³ Jean Caspers, *Compendium History of the Dugout and Sod House in Minnesota* (Minnesota: Fort Ridgely State Park and Historical Association, 1980), 8.

⁴ Ibid.

⁵ Barbara Oringderff, *True Sod: Sod Houses of Kansas* (North Newton, Kansas: Mennonite Press, Inc., 1976).



Figure 1.1: Dugout in Hill (Naomi Doddington)

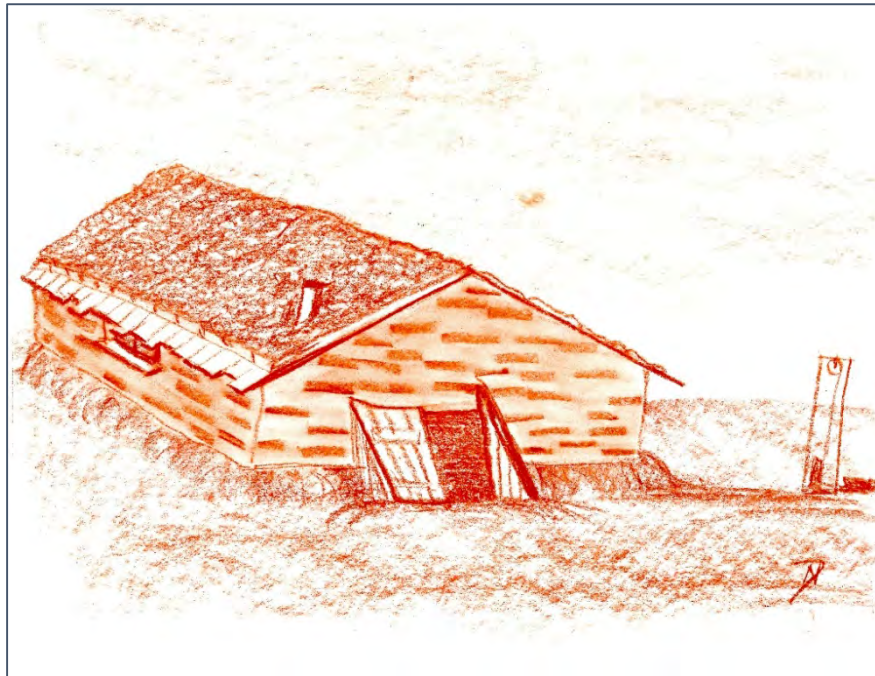


Figure 1.2: Half Dugout, Half Sod House (Naomi Doddington)

The Homestead Act of 1862 gave land to individuals who wanted to go west and farm. The government owned the land after the Louisiana Purchase and wanted to cultivate and settle the west. The Act passed on May 20, 1862 and continued allocating land into the mid-twentieth century. The first requirement to acquire the land was one had to be the head of a family, over the age of twenty-one (this included both men and women) or one had to have served in the United States Army. Also, no one who had “borne arms against the United States Government” after January 1, 1963 was eligible for the land.⁶ The purpose of selling the land to settlers was for “actual settlement and cultivation.”⁷ A settler had five years to cultivate the land and set a homestead. After five years, the government gave the title to the land to the settler. The claims were in quarter sections or 160 acres. The United States Government asked for some compensation for the section of land, so the settlers had to pay ten dollars while filing the claim at the local claim office. This act was the start of the westward rush.

Many settlers rushed out to claims and when they arrived were in need of shelter. The next four decades following the passing of the Homestead Act of 1862 was the height of sod construction. By 1900, the Homestead Act gave about 600,000 claims with 80 million acres to eager settlers.⁸ The region where sod structures were most common was the Great Plains region. The Great Plains spans from the Mississippi River to the Rocky Mountains. Composition of thick sod, grazing animals, and flat rolling prairie

⁶ 37th U.S.A Congress, “Act of May 20, 1862 (Homestead Act), Public Law 37-64 (12 STAT 392),” 1962.

⁷ Ibid.

⁸ Claudia Glenn Dowling, “This Land Was Their Land: Homesteaders Grabbed Free Acres and Used the Earth Itself to Build the American Dream,” *American History* 45, no. 3 (August 2010): 42–50.

with few trees characterized the Plains. The prairie had a rich soil that was advantageous for farming. An initial obstacle to accessing this rich farmland was the labor-intensive job of turning the sod over to uncover the soil to plant. Cutting sod for houses turned over about an acre of the sod helping both start a house and start a field. There were other uses for sod structures besides living dwellings such as schools, churches, post offices, and barns.

Railroads

Railroads were very important to the settlers and the small towns of the Great Plains, because they brought new building materials and spread agricultural wealth. New railroads made the Great Plains and West accessible to more settlers, which allowed great distance travel, and brought eastern agricultural markets to the farmers of the Great Plains and West.⁹ Also, the railroad companies sold land to settlers in large quantities to spur even more land development.¹⁰ During the Civil War, railroad companies started to compete with each other to reach the west coast with rail lines, which would allow the Union to claim more land and resources, giving them advantage.¹¹ The Union Pacific Railroad Company started at the Missouri River and moved west, while the Central Pacific built east from Sacramento, California connecting the East and the West completely on May 10, 1869, at Promontory Point, Utah.¹² The railroad would ultimately spur the movement of millions of people out to the Great Plains and further

⁹ John F Stover, *American Railroads* (Chicago: University of Chicago Press, 2008), 63.

¹⁰ Walter Prescott Webb, *The Great Plains* (Boston: Ginn and Company, 1931), 279.

¹¹ Everett Dick, *Vanguards of the Frontier* (New York: D. Appleton-Century Company, Inc., 1941), 368.

¹² Stover, *American Railroads*, 64; Dick, *Vanguards of the Frontier*, 378.

west over the course of history. Most Territories had rail lines a decade before they became States.¹³ In 1865, there were about 3,000 miles of railway through the Great Plains, and by 1900, there were about 87,000 miles.¹⁴ Figure 1.3 shows how the rail lines covered the Plains and West in 1869. The Great Plains now had the assets to move people and resources from the East to the West.

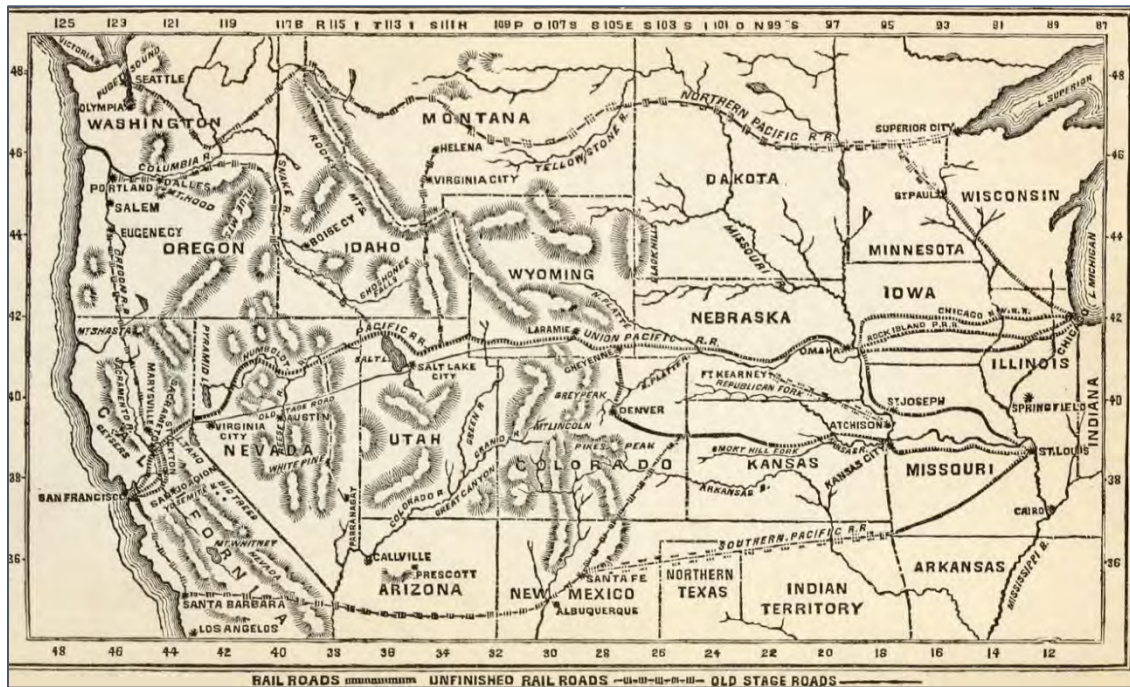


Figure 1.3: 1869 Railroad Map (Samuel Bowles, Public Domain)

¹³ Stover, *American Railroads*, 62.

¹⁴ *Ibid.*, 77.

The railroad needed many workers and this further spurred development and settlement across the Great Plains. There was no surveyed path when the companies started, so they needed to send out engineers and scouts to survey. These men would go about fifteen to twenty miles ahead of the construction crew and would sometimes build sod houses and barns along the way to stay in as they surveyed and waited for other crews.¹⁵ The railroad progressed about a mile or more a day while there was no rush, and later the rate of construction increased to more than four miles a day due to the demand.¹⁶ Building a railroad takes many resources such as labor, iron, grading materials, and timber. As the rail lines went along, construction used most of the wood that was near the rivers or lakes leaving little timber available to the settlers to use for their own buildings.¹⁷ Along the construction path, terminals or boomtowns were set up for the construction teams.¹⁸ These boomtowns and terminals along the railways brought another form of income to the settlers to supplement their farming income because the workers needed food, supplies, and services such as laundry.¹⁹

The railway was an exciting new technology that brought many people out to the Great Plains and West. The passenger railcars moved at nineteen miles per hour and freight cars at a slower rate of nine miles per hour.²⁰ To move through Kansas' 190

¹⁵ Dick, *Vanguards of the Frontier*, 372.

¹⁶ *Ibid.*, 374.

¹⁷ *Ibid.*, 372.

¹⁸ *Ibid.*, 384.

¹⁹ Everett Dick, *The Sod-House Frontier, 1854-1890; Kansas & Nebraska to the Admission of the Dakotas* (Lincoln, NE: Johnsen Pub. Co., 1954), 355.

²⁰ Dick, *Vanguards of the Frontier*, 389.

miles, it took sixteen hours and ten minutes.²¹ Fares in 1866 were about ten to nineteen cents a mile per passenger.²² At first, the railroads were slow and expensive but as the Great Plains and the popularity of the railroad grew, towns started and spurred continued growth of the railroad.

Farming benefited greatly from the railroad, which was one of the main reasons for settling the Great Plains. The Homestead Act of 1862 specifically gave land to those who wanted to farm. Railroads could distribute goods faster and more easily to different parts of the country making farming more profitable. Farmers needed crops transported to the larger eastern market because the market was initially not large enough in the West to support the farms. Between 1860 and 1900, the number of farms west of the Mississippi River increased from 2,044,000 to 5,737,000.²³ If farms were successful, families could afford to buy wood to build new houses on the prairie and abandon their sod structures, which were typically the first generation of homestead structures.

Pre-European Earth Structures

Though the period of investigation for this thesis is on sod structures from settlers of European descent during the mid to late nineteenth century, the landscape already had earthen structures that predated European influence. The Great Plains was home to several American Indian tribes before European settlement. Some of the tribes were nomadic, so their housing was easily moveable, and others were sedentary agricultural

²¹ Ibid.

²² Ibid.; Dick, *The Sod-House Frontier, 1854-1890; Kansas & Nebraska to the Admission of the Dakotas*, 356.

²³ Stover, *American Railroads*, 90.

based communities with permanent structures. Some of the sedentary American Indian tribes who built Earth Lodges were the Pawnee, Omaha, Oto, Ponca, Hidatsa, Mandan, and Arikara. Explorers found many of these tribes on their journey west, sometimes spending a considerable amount of time with the communities.

The Hidatsa, Mandan, and Arikara have circular earth lodges with comparable construction methods and materials to nineteenth-century Great Plains sod structures. Their American Indian Nations are primarily located in the Dakotas. The Arikara's earth lodges were round with an opening in the center of the roof to release smoke from fires.²⁴ The dimensions of the lodges were about fifteen feet high and thirty feet in diameter.²⁵ The earth lodges described by explorers are circular, but archaeology shows that initially these lodges were rectangular.²⁶ The center of the lodge has a square form built out of wooden poles that extend the height of the lodge, and the fire pit is located within the poles. Around the sides, shorter vertical wooden poles outline the circumference and cross beams lean on the small poles and reach diagonally to the center square of poles forming a steeply pitched roof.²⁷ The roofing may have had up to 100 poles connecting the bottom outer frame to the central middle frame.²⁸ Mud and willow branches spread over the wooden poles formed an exterior cladding. The Mandan villages had a similar

²⁴ James P Ronda, *Lewis and Clark among the Indians* (Lincoln NE: University of Nebraska Press, 1984), 45.

²⁵ Ibid.

²⁶ Peter Nabokov and Robert Easton, *Native American Architecture* (New York: Oxford University Press, 1989), 134.

²⁷ Ronda, *Lewis and Clark among the Indians*, 45–46.

²⁸ Nabokov and Easton, *Native American Architecture*, 130.

description of their earth lodges, which is shown in Figure 1.4. The lodges fit the earth's landscape, were successful in keeping out the winter weather, and were big enough for the tribes to use them as gathering spaces. Through Lewis and Clark's expedition, they noted that the Hidatsa community has about 130 earth lodges at one time.²⁹ A painting by George Catlin in 1833 (Figure 1.5) depicts a Mandan Village that has many earth lodges in close proximity forming a community. The communities of earth lodges were large, and the lodges were close together in one central location.

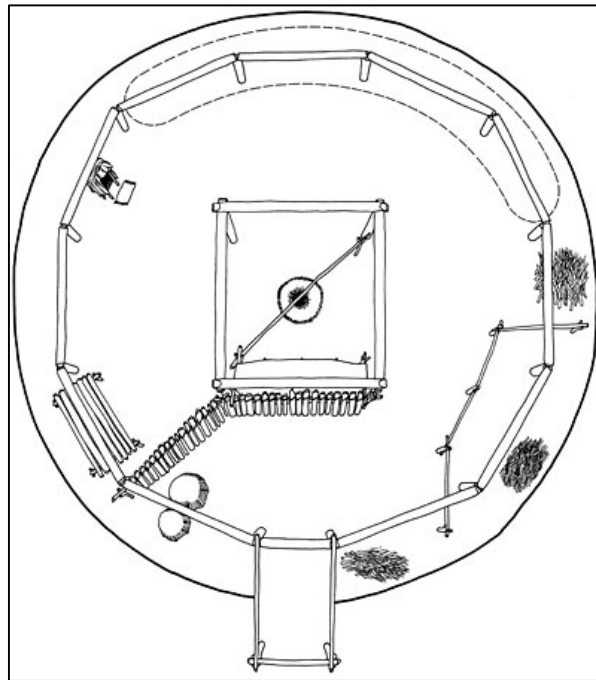


Figure 1.4: Mandan Earthlodge floor plan (State Historical Society of North Dakota)

²⁹ Ronda, *Lewis and Clark among the Indians*, 70.



Figure 1.5: *Painting of Mandan Village* by George Catlin 1833 (*National Register of Historic Places*, ref. no. 86002800, Public Domain)

In Kansas and Nebraska, there were the Pawnee and the Omaha American Indians. The earth lodges of these communities were very similar to the ones of the Hidatsa, Mandan, and Arikara but the floor was not flush with the ground but below ground level about three feet.³⁰ The Pawnee lodges also had eight to ten central frame posts instead of the four central posts as in the structure of the Hidatsa, Mandan, and Arikara.³¹ The Omaha lodges had bundles of grass or thatch on top of the roof frame to shed water, with sod layered on like shingles and a final coating of mud to form a

³⁰ Nabokov and Easton, *Native American Architecture*, 136.

³¹ *Ibid.*

cohesive system to keep the layers together.³² Through archaeology, there are documentation and preservation efforts of many floor plans of these lodges.

Another group of American Indian tribes, the Kitchai, Wichitas, Hasinai, and Caddos, built grass lodges on the Great Plains. The grass lodges were circular that began with forked posts in the ground, which were connected by laying poles across the forks.³³ Saplings or branches that bend easily started at the base of the circle outside of the frame and were bent upward connecting at the top giving the grass lodge a cone shape.³⁴ Rows of wooden poles were wrapped horizontally around the exterior frame to lay thatch bundles over.³⁵

The earth and grass lodges native to the American Great Plains have few similarities to the sod houses as well as notable differences. One similar idea is using earth to insulate against the weather is present in both American Indian earth lodges and sod structures. One difference is the American Indian earth and grass lodges utilized more wood than settlers' sod structures. These structures did not use cut sod or bricks but instead used a wooden frame and in earth lodges, mud, to form to the shape. Sod houses were out on claims of 160 acres, which means that sod structures were not usually close together like the American Indian lodges that formed communities of several structures. Another difference is the heating source in American Indian structures and sod houses;

³² Roger L. Welsch, *Sod Walls: The Story of the Nebraska Sod House* (Broken Bow, Nebraska: Purcells, Inc., 1968), 4–6. This source includes a more detailed account of every step to make an Omaha Earth Lodge.

³³ Nabokov and Easton, *Native American Architecture*, 146.

³⁴ *Ibid.*

³⁵ *Ibid.*, 145.

the earth lodges used fires and needed the opening in the roof for smoke removal and the settlers in the sod structures mostly used metal stoves with stovepipes penetrating the roof. Most of the earth lodges were circular and sod houses were rectangular or square.

Precedent European Earthen Structures

Though not part of the American geographic region targeted in this thesis, there are several types of related earthen architecture precedents worth noting. Icelandic mineral turf houses have been around since the ninth century.³⁶ The Icelandic climate, environmental resources, and society are the main reasons the turf house thrived and the knowledge of construction passed through generations. Turf houses' structure consists mainly of timber, but turf is the enclosure material, which is distinct from a nineteenth-century Great Plains' sod houses where the structure and enclosure are sod bricks and some timber supports in the roof. Iceland used the sod as a cladding over the timber frame because of its insulating property.³⁷ The National Museum of Iceland describes turf houses as "longitudinal double-pitched roof was supported by freestanding inside posts and covered with turf."³⁸ The turf used in Iceland came from mineral-based marshlands while the Great Plains used prairie and slough grasses. Iceland's weather was a role in the long lasting turf houses. The walls of the turf houses could last up to 50 years because the long duration of winters kept the sod frozen.³⁹ Some turf structures

³⁶ Joost van Hoof and Froukje van Dijken, "The Historical Turf Farm of Iceland: Architecture, Building Technology and the Indoor Environment," *Building and Environment* 43 (2008): 1023–30.

³⁷ Ibid.

³⁸ National Museum of Iceland, "The Turf Tradition," non-profit, *United Nations Educational, Scientific and Cultural Organization*, (2011), <http://whc.unesco.org/en/tentativelists/5589>.

³⁹ Ibid.

still exist today, but they are no longer used as primary residences. The switch to all timber-framed housing was in the late nineteenth century.⁴⁰ Iceland also has a variety of turf dwellings with many forms of sod bricks. Some are cut very thick (fale), very thin (divot), while others are cut at an angle to lock when stacked.⁴¹ Figure 1.6 depicts an Icelandic turf house with angled sod bricks locking together. Several examples of turf structure include Tyrfinsstadir and Klambrg. A Tyfingsstadir consists of turf, stone and wood.⁴² Klambrg is a type of thicker turf blocks and cut into a parallelogram shape. In comparison to the nineteenth-century Great Plains' sod houses, Iceland's turf houses used different turfs, had unique brick configurations, and used more timber in their construction. Other countries that also have a turf tradition include Norway, Scotland, Ireland, Faeroe Islands, Greenland, and parts Northern Europe. The thick blocks of turf made an ideal building material in areas with harsh cold winters.

⁴⁰ Brian Wilkinson, "A Study of Turf: Historic Rural Settlements in Scotland and Iceland" (Royal Commission on the Ancient and Historical Monuments of Scotland, n.d.), 20.

⁴¹ *Ibid.*, 23.

⁴² *Ibid.*, 23.



Figure 1.6: Icelandic Turf Houses (Glaumbaer MDR, Public Domain)

Ireland had similar turf houses in rural communities where sod was the only option for building materials.⁴³ Other than in the rural communities, sod houses were only for temporary housing or places of “little concern” such as barns.⁴⁴ A timber-framed hut with a sod exterior was a popular housing structure for animals in the fifteenth and sixteenth centuries because of the free material and insulation.⁴⁵ The sod houses in rural Ireland were found in poorer farm areas and not seen as a desired building.

Many believe that settlers of German-Russian descent built sod houses on the Great Plains, because they brought over the knowledge from Eastern Europe. German-Russians first settled on the Great Plains in dugouts. Their main areas of settlement were

⁴³ Kevin Danaher, *Ireland's Vernacular Architecture* (Cork, Ireland: Mercier Press, 1975), 64.

⁴⁴ *Ibid.*, 9.

⁴⁵ *Ibid.*, 81.

in Kansas and North Dakota.⁴⁶ One of the main structures built was a semlijanken, which is a house set three feet below ground level.⁴⁷ These structures were also temporary structures and disappeared within a decade as wood or stone framing became the preferred building material.⁴⁸ The transition to wood or stone materials is because of trends growing throughout the Great Plains, not necessarily because the mud bricks did not work well. Many call the German-Russian structures sod structures but actually, mud and dirt with straw as a binder made the structures.⁴⁹ Gulliford in *Earth Architecture of the Prairie Pioneer*, states German-Russians identified their houses as sod because of the language barrier but in reality they were sun-dried bricks.⁵⁰

Dugouts were more common in Sweden, Norway, and Iceland. They were usually located in the poorer rural areas.⁵¹ There were a couple different types of dugouts. One type of a traditional Scandinavian dugout is set into the ground and the other type is where half of the dwelling is underground with a full sod brick façade.⁵² Traditionally, the Swedish thought dugouts were places for the rural poor lived. Since the settlers wanted to show they could afford more than a dugout, this type of housing was usually temporary. Once enough money and resources became available, a new

⁴⁶Albert J. Peterson, "The German-Russian House in Kansas: A Study in Persistence of Form," *Pioneer America* 8, no. 1 (January 1976): 19; John Hudson, "Frontier Housing in North Dakota," *North Dakota History*, 1975.

⁴⁷Peterson, "The German-Russian House in Kansas: A Study in Persistence of Form," 19.

⁴⁸ Ibid.

⁴⁹ Hudson, "Frontier Housing in North Dakota," 9.

⁵⁰Andrew Gulliford, "Earth Architecture of the Prairie Pioneer," *The Midwest Review* 8 (Spring 1886): 19.; Further information can be found in Chapter Three: Literature Review.

⁵¹ Donald W. Linebaugh, "Excavating the Dugout House of Norwegian Immigrant Anna Byberg Christopherson Goulson, Swift County, Minnesota," *Historical Archaeology* 39, no. 2 (2005): 71.

⁵² Ibid.

house of stone or wood was constructed. Swedish immigrants desired to fit into the new country and culture so they wanted the new “American Style” or wooden framed structures.⁵³

Many of the European turf houses and dugouts were influential to the Great Plains sod houses and dugouts. By 1870, the total immigration population from Ireland, Norway, and Sweden totaled a little over twelve percent in Kansas, Minnesota, the Dakota Territory, and Nebraska. The highest ethnic group was from Norway.⁵⁴ In 1890, of the total populations in Kansas, Minnesota, Nebraska, North Dakota, South Dakota, and Oklahoma, about thirteen percent of the population were immigrants from Ireland, Norway, and Sweden. Both European turf houses and Great Plains’ sod structures respond to the same economic and environmental conditions as the places these immigrants were likely familiar. The European turf houses and dugouts took advantage of available wood resources around to construct a timber frame associated with the sod. The sod or turf was employed as an insulating cladding not a structural wall. Immigrants saw dugouts as a lower class dwelling so they did not want to stay in dugouts on the Great Plains. Many European immigrants had timber frame traditions and gladly welcomed wood frame construction when the resources became available.

⁵³ Elizabeth Jaderborg, “Swedish Architecture Influence in the Kansas Smoky Valley Community,” *Swedish-American Historical Quarterly* 32, no. 1 (January 1981): 68.

⁵⁴ Kansas, Minnesota, the Dakota Territory, and Nebraska were the only states and territories listed in the 1870’s census. Also, there were more immigrant population groups noted in the census but Ireland, Sweden and Norway are the ethnic groups who have a tradition in sod structures.

Modern Earthen Structures and Elements

Today there are still variations of sod houses and earth lodges being constructed across the United States. One example is rammed earth construction which is dirt compacted to form a wall (example shown in figure 1.7). A framework is constructed and dirt, usually from the immediate site, is compacted into the framework. In vernacular forms, the dirt was compacted by hand and now current construction uses pneumatic ramming systems.⁵⁵ One of the characteristic aesthetic features of rammed earth is the strata design of the dirt compacted together. Rammed earth, like sod structures, use local earth materials, and has structural and insulating properties. Unlike sod structures, the rammed earth needs formwork during construction and uses a compacting construction technique rather than stacking.



Figure 1.7: Rick Joy's NK'Mip Desert Cultural Centre (www.worldarchitecturenews.com)

⁵⁵ Lynne Elizabeth and Cassandra Adams, eds., *Alternative Construction: Contemporary Natural Building Methods* (New York: John Wiley & Sons, Inc., 2000), 151.

Another type of earthen architecture precedent native to the Southwest United States uses adobe bricks to construct buildings. People have used adobe, which is sun-dried mud, all over the world for thousands of years and it is still used today.⁵⁶ This form of construction is more common in desert landscapes due to of the lack of wood or alternative building materials.⁵⁷ Originally, Native Nations used the resources around them to construct structures like the settlers used sod. Several traditions and peoples built adobe structures in many different shapes and sizes. Builders form the adobe mixture of earth, water, and an organic material, like straw or grasses, into bricks and sun dry them. The dried bricks are stacked together with mortar between blocks to assemble a wall. Originally these bricks were handmade, but now they are mass-produced in the United States' Southwest.⁵⁸ Both adobe and sod use an earthen material to produce modular units, bricks that stack to form walls.

Another construction technique that involves the use of soil and vegetation is a green roof. Vegetated roofs started in Scandinavia and were valued for their insulative characteristic.⁵⁹ In a traditional Scandinavian roof assembly, the turf laid on top of a layer of birch bark, which acted as a water barrier to prevent water from draining through the soil and into the interior of the house. The mass of turf served as insulation and worked to reduce heat loss. On the nineteenth-century Great Plains, settlers also

⁵⁶ Ibid., 88–92.

⁵⁷ Ibid., 89–90.

⁵⁸ Ibid., 94.

⁵⁹ Nigel Dunnett and Noel Kingsbury, *Planting Green Roofs and Living Walls* (Portland: Timber Press, 2008), 15.

employed sod roofs for the sod's insulating properties and also out of necessity. Much later, in the 1970s, German researchers rediscovered green roofs. The Germans researched and published literature on green roofs helping urban environments restore lost green spaces.⁶⁰ A variety of vegetation, such as grasses, shrubs, and trees, planted on building roofs introduced green space into urban environments. Other reasons to install green roofs are environmental, economic, and in Norway, they are part of the national heritage and used to show pride. Traditionally, people used green roofs as insulating structures, but now there are many other reasons such as introducing green space in urban settings and environmental reasons. The technology of waterproofing and drainage layers have helped transition green roofs into an option for modern buildings.

A similar building construction technique to sod houses is straw-bale construction. Great Plains' settlers employed straw-bale construction in a time frame that overlaps with sod houses. According to Kelly Lerner, Bob Theis, and Dan Smith from *Alternative Construction: Contemporary National Building Methods*, "between 1896 and 1975 some 70 bale buildings were constructed in this [Great Plains] region, of which 12 were known to exist in 1993."⁶¹ The first known built example in the Great Plains to demonstrate the standard style was in Sand Hills, Nebraska.⁶² Sand Hills, Nebraska had sand dunes with little sod, so settlers discovered a new building material. The roots of the grass are not included in straw bale construction compared to sod, which includes the

⁶⁰ Ibid., 17.

⁶¹ Elizabeth and Adams, *Alternative Construction: Contemporary Natural Building Methods*, 211.

⁶² Ibid., 212.

root system and dirt. The straw is dried and compacted to form bales approximately eighteen by thirty-six inches and tied together with string.⁶³ The mid-nineteenth century society introduced straw-bale construction and it still endures as a building tradition today. To ensure stability and prevent leaking in present-day straw-bale construction, the structures include the addition of composite or synthetic materials. Straw-bale construction is very close to sod because of the grassy organic material, historic geographic region, and time period.

⁶³ Ibid., 222.

Sod Composition

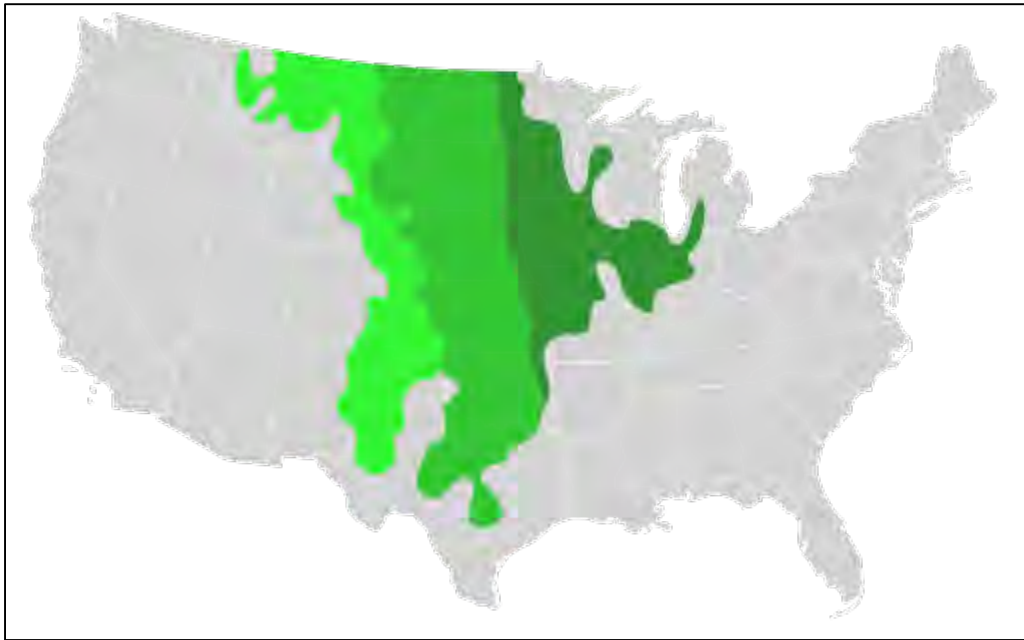
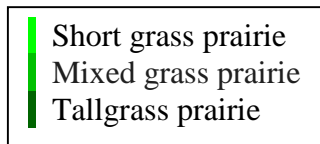


Figure 1.8: Grassland ecoregions of the Great Plains (Blank_US_Map.svg, Public Domain)



An essential first step in sod construction is the identification of viable, ample sod. The prairie was full of many different species of grasses that prevented soil erosion on the Great Plains with its “hardy, winter-tested” roots.⁶⁴ The toughest and thickest sod was the most desirable for construction and included several species of prairie grasses such as Slough Grass, Big Blue Stem, Buffalo Grass, Little Bluestem, Blue Gama and Indian Grass.⁶⁵ These grasses grew in three different types of prairies in the Great Plains:

⁶⁴ Larry Haun, “The Soddy,” in *A Carpenter’s Life as Told by Houses* (Newtown, CT: The Taunton Press, Inc., 2011), 14.

⁶⁵ Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 30; Cass G. Barns, *The Sod House; Reminiscent, Historical and Biographical Sketches Featuring Nebraska Pioneers, 1867-1897* (Madison, Nebraska, 1930), 59; Haun, “The Soddy,” 14.

tallgrass, mixed prairie, and shortgrass as shown in Figure 1.8. The dark green section of Figure 1.8 is the tallgrass prairie region. The grass that grew in the tallgrass region could reach a height of twelve feet tall. In winter, the grass would die and leave the ground barren, so settlers needed to harvest sod after the spring growth but before the grass started to die. The most popular grasses in this area were Big Blue Stem and Indian Grass. The tallgrass prairie had high precipitation and soil moisture and as the landscape transitioned to mixed grass there was a decrease in precipitation and increase in evaporation, which equaled a decrease in soil moisture, a characteristic of the mixed prairie.⁶⁶ The mixed prairie (represented by the middle green in Figure 1.8) was almost completely treeless, earning it the name “The Great American Desert.” The predominant grass that grew in mixed prairie was Little Bluestem and Buffalo Grass. These grasses had an average height between two to four feet tall. An area with lower precipitation was the shortgrass prairie or the high plains prairie, represented by the lightest green in Figure 1.8. There was little difference between shortgrass prairie and mixed prairie. The height of the grasses varied and the more common grasses in the shortgrass prairie were Blue Grama and Buffalo Grass. Each of these three regions had soil qualities and the grasses to make sturdy sod bricks for building.

The grasses that mainly composed the three prairie regions of the Great Plains all had good qualities to make sod bricks. Settlers cut Slough Grass along the sides of the slough, a soft muddy ground like a swamp, where it was tough and easily cut into rows.⁶⁷

⁶⁶ Laura Brown, *Grasslands* (New York: The Chanticleer Press, 1985), 32.

⁶⁷ Evelyn Slater McLeod, “Our Sod House,” *Beaver*, Autumn 1977, 12, Minnesota Historical Society.

The further one went into a slough, the wetter the ground would be and therefore have more compacted soil and root systems. Big Blue Stem grass was also very popular because it was very thick which prevented weed growth.⁶⁸ Less weeds were ideal because weeds were not as strong as the grasses, which provided the thickness desired for sod bricks. Settlers cut the longer grasses of Slough Grass and Big Blue Stem, and used them as a sheathing layer over the boards of a roof. The bundles of cut grasses or thatch were lighter and easier to replace than actual bricks of sod. Buffalo Grass was short and tough with wiry woody roots that stayed compacted together, which made it ideal for bricks.⁶⁹ The sod bricks consisted of the grass, root system, and dirt, which made it a compact building material.⁷⁰ The grasses also had stolons, a root-like extension that produce plants rapidly and provide an additional soil-binding property.⁷¹ Unlike Slough Grass, which grew in landscape depressions, Buffalo Grass grew on top of hills.⁷² Soil with the most moisture made the firmest sod bricks, which made for a sturdy building. The best time to cut and grasses for sod bricks was in the fall because the roots of the prairie grasses' roots were woody, tough, and wiry.⁷³

Virgin sod is a rare commodity today. The main goal of the settlers and of the United States, creating the Homestead Act of 1862, was to turn up the prairie and cultivate the land. Farming and agricultural use are the main reasons for the decline in

⁶⁸ Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 31.

⁶⁹ *Ibid.*, 32.

⁷⁰ James, *Sod House Pioneers*, 3.

⁷¹ John J. Webb Jr., "The Life History of Buffalo Grass," *Kansas Academy of Science* 44 (58-75): 58.

⁷² Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 32.

⁷³ *Ibid.*, 34.

natural prairie landscape. Through plowing, fires, and urban development, the prairie lost space and biodiversity was reduced. Through droughts such as the Dust Bowl, insects, including grasshoppers, and humans, the grasses had started to disappear.⁷⁴ The prairie can recover but it has to have open undeveloped land, adequate rainfall, and the correct plants reintroduced.

Site Selection

In order to survive the families settling on the prairie often dug a well first and then built their dwelling nearby. It was also known that it was best to pick a spot near the “thickest and strongest” sod for building.⁷⁵ The sod used for construction was primarily taken from the site of a future field, rather than the immediate surrounding the dwelling. A wagon transported the sod to the building site because the large number of bricks needed for construction. The weight of each brick averaged fifty pounds.⁷⁶ The builder cleared the site for the house and compacted the dirt down to create a firm solid floor before he started to build. Later a settler could add a wooden floor or matted hay over the compacted dirt. Once the site was prepared with a compacted area outlining the future house, construction could begin.

⁷⁴ F.W. Albertson and J.E. Weaver, *Grasslands of the Great Plains: Their Nature and Use* (Lincoln NE: Johnsen Publishing Company, 1956).

⁷⁵ Barns, *The Sod House; Reminiscent, Historical and Biographical Sketches Featuring Nebraska Pioneers, 1867-1897*, 59.

⁷⁶Ibid., 60; McLeod, “Our Sod House,” 12.

Construction Methods

There are many different varieties of sod structures and construction methods. The following description outlines the most common construction method according to literature. There were several different sod-cutting tools implemented on the Great Plains. First, the most common plow was the proper plow, also called a turning plow or common plow (Figure 1.9). This plow worked well for cultivating the land for farming. It has a sloping moldboard that would dig into the ground and overturn the prairie to form a furrow or trench. The moldboard would cast off the overturned prairie ribbon to the side of the furrow. A proper plow usually broke the ribbon of the cast off prairie, which made the sod ribbons unusable for sod bricks.



Figure 1.9: Proper Plow (photographed at Sod House on the Prairie Site)

Another plow that was useful in cutting long ribbons of prairie sod was the cutting plow also called a grasshopper plow or sod plow (Figure 1.10). The cutting plow has adjustable rods instead of a high moldboard. It has a knife, or front metal piece that digs

into the prairie but the adjustable rods are lower to the ground compared to the other plows. The guiding rods gently move the cast off prairie ribbon to the ground keeping the ribbon intact. A settler could then cut the intact prairie sod ribbon into the desired lengths for their sod bricks.



Figure 1.10: Grasshopper or Sod Plow (Oklahoma Historical Society)

The most useful tool settlers used to cut ribbons for sod bricks was a sod cutter (Figures 1.11 and 1.12). A sod cutter would cut a row of sod with the desired length and thickness making two cuts of very uniform distance from one another per pass of the cutter. A sod cutter has two iron knives on a wooden form that were the desired width apart for the sod brick and a blade at the back below the knives to cut down the desired thickness below the wooden form. To use it, someone sat on the sod cutter and oxen or horses pulled it down a row. Then a builder would cut the row of sod into individual units the desired

length with a spade or axe.⁷⁷ Sod was best when cut and laid wet, which provided optimal cohesion between units.⁷⁸ Sometimes cutting and building sod houses was an activity between neighbors or an entire community. If a settler did not have a plow or the correct plow for sod bricks, someone in the community usually traded the use of their plow for labor during harvest.⁷⁹ “Two people could build a small one room sod house in three or four days, if they had a team, a proper plow, and knew what they were doing.”⁸⁰



Figure 1.11: Sod Cutter



Figure 1.12: Sod Cutter Side View

⁷⁷ Ibid; McLeod, “Our Sod House,” 12.

⁷⁸ Verney A. Kear, *Sod Houses and Dugouts in North America* (Colby, Kansas: Prairie Printers, 1971); Oringderff, *True Sod: Sod Houses of Kansas*, 30; Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 39.

⁷⁹ Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 40.

⁸⁰ Oringderff, *True Sod: Sod Houses of Kansas*, 29.

With the sod bricks cut and on the prepared ground surface, the builder would lay the first row of sod bricks in the rectangular foot print with the grass side down.⁸¹ Settlers laid every third or fourth course crosswise, rotating the sod block ninety-degrees as with a common bond in brick, to lock the sod bricks together and form a stronger wall (Figure 1.13).⁸² Also similar to masonry construction, the brick joints were staggered, so no vertical joints lined up. The walls were between two and three sod brick thick (two or three wythes). This mass of material helped the structure transmit and resist forces and increased the walls' insulative properties.⁸³

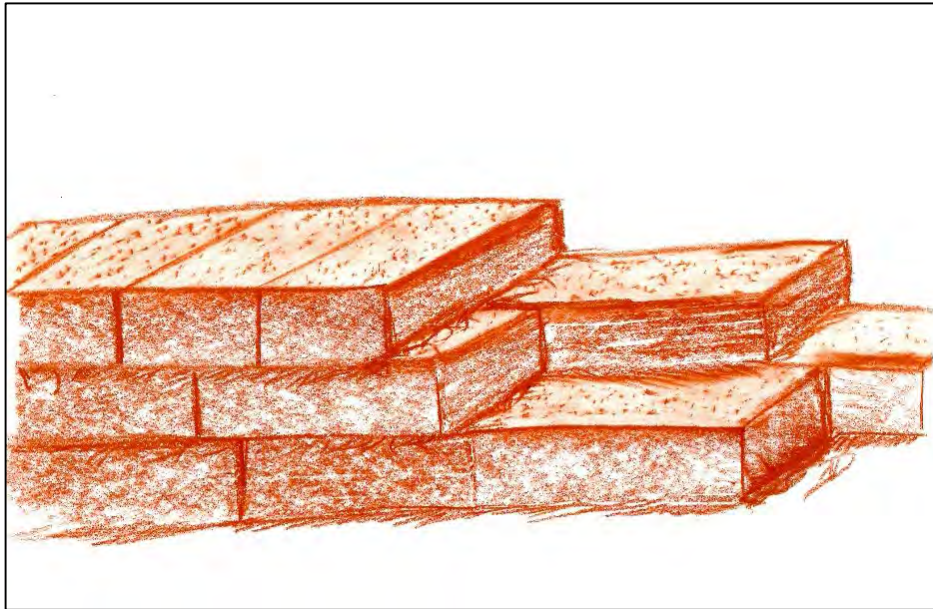


Figure 1.13: Sod Bricks Stacking Pattern (Naomi Doddington)

⁸¹ McLeod, "Our Sod House," 12.

⁸² Barns, *The Sod House; Reminiscent, Historical and Biographical Sketches Featuring Nebraska Pioneers, 1867-1897*, 60; Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 42.

⁸³ Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 42.

The builder continued to stack up course of sod bricks until the desired height of the exterior walls. Loose dirt or sod filled any holes to make sure the wall was compact and cohesive. Some sod houses started with a wider bottom and narrowed towards the top. This helped with stability especially when the sod settled. If settling occurred unevenly, the sod wall could collapse very easily; if the sod house had a strong sturdy base, it was less likely to collapse.⁸⁴ Window and door frames needed to be sturdy so settlers usually bought lumber for these items. A trip for window glass and lumber usually took a couple of days and groups of settlers went together. When the frames for the windows and door were in place, the sod would be stacked until the top of the frame.⁸⁵ Next, the builder would employ planks, boards, or tree saplings as a header. The header extended into the sod walls on both side of the window frame to support the sod wall above. Between the header and the window frame, the builder would leave a space filled with paper or cloth to account for settling. The header supported the weight of the sod above and without the void to account for settling, the wall's extra load could crush a window frame and glass. The void filled with paper or cloth allowed the sod to settle without affecting the frame. The window frame process is shown in Figure 1.14. If a settler could afford it, window frames would have glass. If window glass was not available nearby or too expensive, the family used buffalo robes, quilts or greased clothes as coverings.⁸⁶

⁸⁴ Ibid., 43.

⁸⁵ Oringderff, *True Sod: Sod Houses of Kansas*, 61–62.

⁸⁶ Dick, *The Sod-House Frontier, 1854-1890; Kansas & Nebraska to the Admission of the Dakotas*, 114.

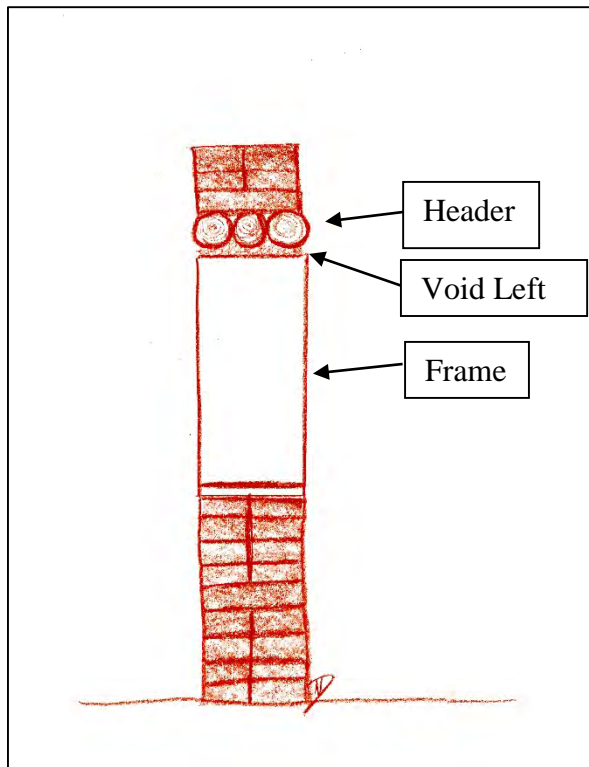


Figure 1.14: Window Profile (Naomi Doddington)

The most common roof form over sod houses was a gable roof. The pitch of the roof was important, if the roof was sloped too shallowly, it would cave in. The structure would not be able to transmit weight of the sod laterally to the walls properly if too shallow. If the pitch of the roof was too steep, however, the sod would slide off the roof, leaving the interior exposed.⁸⁷ Steep roofs required longer timbers, therefore shallower roofs, using less timber, were more common. Other roof forms over sod structures were the hipped roof and shed roof.⁸⁸

⁸⁷ Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 49.

⁸⁸ *Ibid.*, 52.

The rooftop sod bricks were thinner than the sod bricks used for the walls because they needed to weigh less to reduce the strain on the roof.⁸⁹ It was important that they weighed less because the roof framing, which supported the bricks, were small saplings, sometimes covered in tarpaper. Most sod houses used “crooked limbs, brush, coarse prairie hay and a thick covering of sod and dirt,” if the family could not afford lumber or it was not available for roof framing.⁹⁰ “To hold up such a load a forked tree was planted in each end of the house and ridge pole log placed from one gable to the other resting in the forks.”⁹¹ Settlers would bind small sapling trees to form the length of a ridgepole and splice the length of the tree so the tree had a flat surface to more easily attach perpendicular logs.⁹² The builder laid the bricks on the roof grass side up for more protection from the weather.⁹³ If the dirt side was up, one could expect greater erosion of the soil. To finish the roof, the builder filled the joints between the bricks with dirt. This practice became part of the cyclical maintenance of the house because it would wash away.⁹⁴ Later after the roof was constructed, more sod or mud had to fill spaces left open at the top of the wall around the rafters.⁹⁵ The width of the eaves was important because wide eaves made the roof vulnerable to uplift. Tying the roof into the walls or weighting it to the ground, a settler could lower the risk of his roof blowing off. More extensive sod

⁸⁹ Barns, *The Sod House; Reminiscent, Historical and Biographical Sketches Featuring Nebraska Pioneers, 1867-1897*, 60.

⁹⁰ *Ibid.*, 61.

⁹¹ *Ibid.*

⁹² McLeod, “Our Sod House,” 14.

⁹³ Oringderff, *True Sod: Sod Houses of Kansas*, 93.

⁹⁴ Barns, *The Sod House; Reminiscent, Historical and Biographical Sketches Featuring Nebraska Pioneers, 1867-1897*, 60.

⁹⁵ McLeod, “Our Sod House,” 15.

roofs would contain more lumber to support the sod roof from collapsing and keep more water out of the interior. These roofs would have sheathing boards with more frequent rafter beams. Following the Civil War, tarpaper became wide spread because of its wartime application when the military needed tarpaper to protect ammunition dumps.⁹⁶ After the wartime application, builders started to use tarpaper in construction as a water membrane for roofs.⁹⁷ The lifespan of the tarpaper on a roof was about five years.⁹⁸ If a settler could afford it, the roof was a place where he spent more money to avoid it leaking and thus reduce the risk of roof collapse.

The exterior of a sod house did not have ornamentation; sod houses were simple and blended into the prairie landscape. A common decoration on the outside, if any was present, was animal antlers to show off hunting success.⁹⁹ Interior finishes and additions varied. Most sod houses were divided into two rooms by hanging a cloth to create a living and sleeping space.¹⁰⁰ Interior sod partitions were difficult to construct because they did not tie into the exterior walls; even a single brick width took up a lot of space in the small sod house. Also, the interior addition would settle and would never be flush with the exterior walls.¹⁰¹ After the builder finished the walls and roof, he shaved the walls smooth for later plastering and aesthetics.¹⁰² Settling would still happen for five or

⁹⁶ Kear, *Sod Houses and Dugouts in North America*.

⁹⁷ Ibid.

⁹⁸ Ibid.

⁹⁹ Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 90.

¹⁰⁰ Donald S. Gates, "The Sod House," *Journal of Geography* 32 (January 1933): 357.

¹⁰¹ Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 91.

¹⁰² Ibid., 92.

six weeks (sometimes two years) and plastering before the walls settled would result in cracking and peeling of the plaster. Due to this, settlers often waited to finish the interior walls.¹⁰³ Other interior wall treatments included lime wash or newspapers. Settlers using a sod house as temporary living space commonly left the walls, floors, and ceilings unfinished.

Similar to sod houses, dugouts used stacked sod bricks. The main interior portion of a dugout was a portion of a hill usually near a river or a lake that a settler excavated. The roof was the top of the hill of the excavated section. The dug hill provided interior space and the front façade would be stacked sod bricks. Sometimes stone or wood would be available to create the interior walls.¹⁰⁴ Dugouts were usually cheaper than sod houses and more practical for a single person starting out. Elder Oscar Babcock from North Loop Nebraska in 1872 gave an itemized list of what it cost to build his fourteen square foot dugout to show how inexpensive it was to build. For an eight by ten window, eighteen feet of lumber, latch and hanging for the door, piping for the stove and three pounds of nails, it cost him \$2.78 ½ in 1872.¹⁰⁵ In 2016 dollars, this dugout would have cost about fifty-four dollars to build. Dugouts were usually smaller and seen as less desirable than sod houses. Usually settlers used dugouts as temporary housing until they could at least build a sod house. Dugouts were very crude structures, but they did serve

¹⁰³ Ibid.

¹⁰⁴ Edward Everett Dale, "From Log Cabin to Sod House," *Journal of the Illinois State Historical Society* 38, no. 4 (December 1945): 402–403.

¹⁰⁵ Dick, *The Sod-House Frontier, 1854-1890; Kansas & Nebraska to the Admission of the Dakotas*, 112.

purposes such as post offices and blacksmith shops as well as homes, barns and storage.¹⁰⁶

There were many hardships associated with settling. The settlers were resourceful and used readily available resources. There are many advantages and disadvantages of living in a sod house or dugout. Some advantages include the insulating properties of sod, which kept houses warm in the winter and cool in the summer. Sod is also fire resistant which would force fires to move around the structure leaving it safe. Some disadvantages to a sod structure are the leaking roof, little light or ventilation, and the pests that would live and move through the sod walls. As evident by the settlers, replacement of sod houses with wood framed, settlers must have experienced more disadvantages than advantages.

Sod Structures Enduring Today

Very few sod structures from the nineteenth century still stand today. This is partially because settlers saw these buildings as temporary structures. The loss of the structures also occurs because of the ephemeral nature of sod brick. Most evidence of remaining sod structures is limited to depressions in the ground. Some states such as Oklahoma, Kansas, and Nebraska are fortunate to have original sod houses from the nineteenth century still standing. There are six sod houses total listed on the National Register of Historic Places from Nebraska, Oklahoma, Kansas, and Colorado. One of the National Register of Historic Places sites is the McCully Sod house in Alfalfa,

¹⁰⁶ Ibid.

Oklahoma. The remaining nineteenth-century sod houses are very fragile artifacts and need considerable attention to keep them available to the public. Oklahoma now has a protective roof structure over the McCully sod house at the Sod House Museum to shield the fragile sod from the elements that would increase the rate of decay. The Oklahoma Historical Society applied many restoration techniques to keep this structure standing. The main maintenance plan now is monitoring structural conditions.

Southwestern Minnesota is part of the Great Plains Region and history shows it to have hosted sod houses; however, no standing original sod structures remain. Without original buildings to interpret for this period of time in the region's history, preservationists and curators have looked to reproduction or reconstruction to tell the story of sod structures to the contemporary public. Enough documentation exists to construct reproductions of the nineteenth-century sod structures. Museums and sites build replicas out of many materials, not just sod, which brings up questions about authenticity. One example is the dugout replica the Laura Ingalls Wilder museum in Walnut Grove, Minnesota, which is built out of concrete. The dimensions are from Laura Ingalls Wilder's book *On the Banks of Plum Creek* and a concrete box follows those proportions. It represents a dugout but is located in a museum's outdoor exhibit. The exterior of the concrete box has sod bricks laid up against it to look like a sod dugout from the exterior. Another example of a replica is in a museum exhibit at the Minnesota Historical Society. The core of this sod house is made of a lumber frame and foam exterior and the dimensions were from the Rollag family diary entry. To achieve the look and feel of sod, the exterior foam has a coating of glue, dirt, and hay coating. Also, there

is one reproduction of a sod house made completely out of sod with a timber roof and floor located in Sanborn, Minnesota. Research on the people who constructed each of these original structures informed the projects. The objective was to closely replicate the look and feel of the sod houses of southwestern Minnesota. Analysis of how these reproductions, as a group, interpret the nineteenth-century vernacular architecture form is currently lacking from scholarship.

This thesis looks at the different techniques used to build replicas of nineteenth-century sod houses and dugouts. Specially looking at three sod structures replicas discussed previously reconstructed in Minnesota, as case studies to compare techniques and to compare to images of nineteenth-century sod structures to understand authenticity. Each replicas has its own unique building construction and materials. Analysis of the three replicas and one original sod house will inform the determination of a best practice to balance authenticity and practicality when constructing a nineteenth-century sod structure. Chapter Two will discuss the methodology of the following chapters. Chapter Three discusses the literature surrounding sod structures. In Chapter Four, nineteenth and early twentieth-century images of sod structures are analyzed for their size, window coverings, flooring, roof materials, roof type, roof penetrations, and wall materials to show that there is not one set authentic sod structure but many different varieties. Chapter Five explains the criteria for the analysis for each of the sites. Later, Chapter Five describes each of the four case study sites in detail from the location, building materials, construction techniques, interpretation, and real histories behind the structures. After the analysis criteria and sites are explained, Chapter Five

goes into an explanation of how the case studies compare. After the analysis, each site receives an average where it fits on the scale between authentic and inauthentic yet practical. Lastly, Chapter Six uses the material from authenticity and practicality to find a balance for sod structure replicas and interpretation. There are many considerations when thinking about finding a balance between authenticity and practicality when constructing a replica of a nineteenth-century sod structure, such as health and safety for visitors and programming built around sod structure maintenance. This thesis explores the available methods of reconstructing nineteenth-century sod structures from the Great Plains Region of the USA, to identify a best practice balancing authenticity and practicality when building and interpreting sod structure replicas.

CHAPTER TWO: METHODOLOGY

The first step in analyzing sod structures is through researching existing literature on the subject. For this thesis, the material covering the mid-nineteenth-century westward expansion is extensive including themes such as settling property claims, railroads, and farming the Great Plains. A variety of research provides context for the time period. Many secondary sources, such as journal articles and books, are available. The journal articles are from a variety of disciplines, such as geography, anthropology, and history, and are available through several online databases. The College of Charleston's library collection and Inter-Library Loan system provided access to these sources.¹⁰⁷

Primary resources used in the research portion of the thesis were discovered in either published literature or materials from the Minnesota Historical Society's Gale Library in St. Paul, Minnesota. These sources include diaries, interviews, personal accounts written to magazines, local history books, and a survey. Each of these sources discusses the construction of sod structures and/or the living conditions for inhabitants of a sod structure. The county-by-county survey is part of the *Compendium History of the Dugout and Sod House in Minnesota* by Jean Caspers and the Fort Ridgely State Park and Historical Association. The Minnesota archive hosts documents that detail sod structure construction and furnishings. Also, since three of the case study sites visited are

¹⁰⁷ These two methods were used because the College of Charleston is the local academic library, and the Inter-Library Loan system gave access to resources not available at the College of Charleston.

located in Minnesota, looking through a Minnesota archive provided context to the people who could have inhabited the sites.

After the railroads became more popular in the Great Plains, people began to take photographs of the lifestyles on the prairie. These images as a whole collection can be analyzed to understand sod structures as a type. The Appendix and Chapter Four systematically looks at period images. Through the Minnesota Historical Society, North Dakota Historical Society, South Dakota Historical Society, Oklahoma Historical Society, and Kansas Historical Society, there is much evidence about the appearance of sod houses and dugouts during the nineteenth century. The Library of Congress hosts the Solomon D. Butcher Collection, which consists of about 2000 images from nineteenth-century Custer County, Nebraska. The images for the analysis incorporates all of the images available in the five archives listed before and not the Solomon Butcher Collection because the collection is analyzed in other literature and is so large.¹⁰⁸ This thesis analyzes sixty-four historic images from the different archives to show that each sod house and dugout has commonalities and difference in the types. Each inventory form contains an image and descriptors of the image including location, size, description, window coverings, flooring, roof materials, roof type, and wall material. The size associated with half of the images are scaled from the images. Dimensions were not associated with the images in the archives. Each image that had a front view of the sod

¹⁰⁸ Roger Welsch evaluated the Solomon D. Butcher Collection for his book *Sod Walls*. He focused on construction and arrangement, family structures, tool and equipment, animals, ornamentation, the structure's location within Custer County, door placements, and roof types. More information about the collection can be found at the Nebraska Historical Society and in John Cater, *Solomon D. Butcher: Photographing the American Dream* (Lincoln, NE: University of Nebraska Press, 1985).

structure was scaled off the door. For each image, the door was estimated to be three-feet wide. Using a scale, the door size was compared to the whole sod structure, giving a length. These inventory forms are condensed into a table included in Chapter Four. The data was used to find authentic and inauthentic standards, as well as patterns, in nineteenth-century sod structures.

In addition to the archival research component and the image comparisons, the study engaged one remaining and three replica sod structures in the study through analysis and documentation. During the 2015 summer and winter, three locations were visited: *Sod House on the Prairie* in Sanborn, Minnesota, The Laura Ingalls Wilder Museum and Site in Walnut Grove, Minnesota, and the Minnesota Historical Society's Prairie Frontier exhibit in the Then Now Wow gallery in St. Paul, Minnesota. The site visits provided a visual examination of different construction and preservation techniques employed at each site. Also, time on site opened lines of communication with site managers regarding the unique construction and maintenance plans for each site. This information helped identify how the different sites relate to other strategies of replication and management. The sod structures were all evaluated according to criteria to assess the level of authenticity of the reconstruction. The spectrum of criteria ranges from a highly authentic nineteenth-century sod structure, to an inauthentic yet practical and more accessible approximation of the structure. The first site visit was the Sod House on the Prairie located in Sanborn, Minnesota. Stan and Virginia McCone own a sod house and a dugout, which Mr. McCone constructed from 1987 to 1988. Unfortunately, Mr. McCone is in late stages of Parkinson's disease, so the walk through the property was with Mrs.

McCone, who witnessed the construction and is versed in discussing the sod buildings as she frequently gives tours. It is usually a self-directed tour, but Mrs. McCone walked along to provide additional information during the site visit on August 3, 2015.

The next site visit was the Laura Ingalls Wilder Museum located in Walnut Grove, Minnesota. Joel McKinny is the collections manager at the museum and walked through the exhibits and replica dugout to provide further details. The dugout is one of the museum's outdoor exhibits and has interpretive signs explaining the structure. Also, during the same visit to the Laura Ingalls Wilder Museum exhibit, there was a visit to the original dugout site mentioned in Laura Ingalls Wilder's *On the Banks of Plum Creek*. The Gordon family currently owns the site, and Mr. Gordon maintains the landscape and participates in cutting sod for the replica located in town. Mr. Gordon opened up his barn to show the pallets of sod that are in storage for the next time sod needs to be added to the façade of the replica. The dugout site is undisturbed other than a sign describing the dugout location and its history with the Ingalls family. Several pictures and notes help describe what the Laura Ingalls Wilder Museum does to maintain the replica.

The third site is located in the Minnesota Historical Society's third floor gallery, Then Now Wow. The replica sod house was built based off the dimensions described in the Rollag family diary. Communications about the exhibit were through emails with Aaron Novodvorsky.

The fourth site studied is the Oklahoma Sod House Museum, which the Oklahoma Historical Society owns and operates. This is a unique site because it has remnants of an original nineteenth-century sod house that Marshall McCully built in

1894. Renee Trindle, the director of the Sod House Museum, gave details about the restoration. Information about this property has been gained through emails and materials located on the museum's website but not with a site visit. A rendering of material and construction details of the McCully sod house provided by Renee Trindle guided understanding further (Figure 5.5).

Through visiting and discussing these sites with owners, directors, and managers, this study helps analyze the sites further and illuminates the various construction and maintenance techniques and options. This information helped identify where each site fits on the spectrum ranging from authentic to inauthentic yet practical. The areas analyzed on a scale with one being the most authentic and five being inauthentic yet practical are location, setting, sod building materials, construction methods, sod cutting, roof materials, flooring, and interior finishes. These evaluated areas are based on the National Register for Historic Places criteria for evaluating integrity.

After the evaluation criteria were created, there was a second site visit in December 2015 to the *Sod House on the Prairie* site, the Laura Ingalls Wilder Museum, and the Minnesota Historical Society's Then Now Wow prairie exhibit. The set criteria areas of evaluation and the scales at each of the sites helped assess the sites more thoroughly than before.

The criteria on the scales were used to evaluate each case study site and each site received an overall average. This overall average is a combination of all the scores in each criterion category. The end of the analysis compares the four sites to each other in all criteria categories.

With the image analysis and the four case studies' analyses, conclusions about authenticity become apparent. Each image in the image analysis shows different sod structures but gives boundaries to what is authentic and inauthentic to a nineteenth-century sod structure. The case studies showed that there are different ways to construct and maintain a replica of a sod structure. Both these analyses help define characteristics of a replica that can balance authenticity and practicality. The different examples allow for recommendations for future replicas interpreting nineteenth-century sod structures and define the characteristics of an authentic yet practical replica.

CHAPTER THREE: LITERATURE REVIEW

Academic literature addressed sod houses and dugouts starting in the 1930s, while people who lived in these types of structures were available for interviews. The literature uses many written personal accounts and oral histories as sources of information. Though there is a small amount of scholarly literature written about sod houses and dugouts, there is good discussion among scholars. There are pioneers in the research field who explored all aspects about sod structures. As each sod structure is different with its own history, each piece of literature expresses the different experience of the authors.

There are a few early sources that later literature on sod houses references frequently. Cass Barn was a pioneer doctor in 1930s and joined in the exploration of sod houses and the prairie. Dr. Barns was a practicing physician in the prairie towns of Nebraska and he collected his thoughts and stories in his publication of *The Sod House: Reminiscent, Historical and Biographical Sketches Featuring Pioneers, 1867-1897*. This written work is one of the personal accounts that many future authors use as a common source. Another book commonly cited is *Sod House Memories*; the book is three volumes compiled of The Sod House Society's members' personal stories and accounts of living in sod houses and dugouts that members submitted to the editor Frances Jacobs Alberts over fifteen years.¹⁰⁹ Roger Welsch's wrote *Sod Walls: The Story of the Nebraska Sod House* in 1968 and many works reference afterwards. He focuses on sod houses and not the overall context of the time period. The main descriptions in *Sod Walls*

¹⁰⁹ Published with The Sod House Society of Nebraska; There are also three volumes in this collection from the years 1963, 1967, 1972.

are from Nebraska, the Solomon Devoe Butcher photograph collection, and oral histories.¹¹⁰ Roger Welsch, a 1960s scholar on sod construction, trained as a folklorist, focused on oral traditions and histories. Welsch explains sod house related life with descriptions of the sod, construction, and accounts related to sod structure living conditions. In addition to description of European decedent's sod houses, Welsch includes pre-European history briefly in his work on sod houses, which is something fairly unique in the literature. Everett Dick, a history professor from the University of Nebraska, published *The Sod House Frontier, 1854-1890* in 1954. This book was one of his earliest books about the Great Plains expansion and sod house construction. Dick presents prairie life as a whole and all the aspects that were involved living on the Great Plains, such as town building, ranches, and technology. *The Sod House Frontier* focuses on Nebraska, Kansas, and later the Dakotas.

The literature concerning sod house construction is largely consistent. Many of the primary sources such as diaries and personal account include descriptions of sod cutting and construction methods. Most include sod brick size and the processes for stacking sod bricks upon one another.

Several authors propose different views on the time period of sod houses. Welsch argues people still built sod houses until the 1940s.¹¹¹ He distinguishes that these

¹¹⁰ Solomon Butcher photographed farms, sod houses, towns, people, landscapes, etc. in Custer County, NE in the early twentieth century. He published a book, *Pioneer History of Custer County, Nebraska* in 1901 with his photographs. He later sold all his plates to the Nebraska State Historical Society before he died in 1927. They are now located in the Picture Room at the Nebraska State Historical Society and labeled the Butcher Collection.

¹¹¹ Roger L. Welsch. *Sod Walls: The Story of the Nebraska Sod House*. (Broken Bow, Nebraska, Purcells, Inc., 1968) 20.

twentieth-century sod houses differ from earlier nineteenth-century sod houses. As different materials became available on the Great Plains, sod houses changed. Some of these twentieth-century sod houses have composite shingles, better timber for roofing and a couple were even two stories tall.¹¹² Cass Barns defines the sod house frontier era as 1867-1897. Nebraska became a territory in 1867 and admitted into the Union in 1897, so Barns' era for sod house construction ties to notions of settlement and statehood as opposed to including examples of later sod houses.¹¹³ Everett Dick proposes a date range for sod houses in his title *The Sod-House Frontier, 1854-1890*. Both Barns and Dick show that the main sod house era is in the mid to end of the nineteenth century. Dick chose 1854-1890 because 1854 was the Kansas-Nebraska Act of 1854, which opened up the territories for land settlement and 1890 was the year settlers purchased the last land in eastern Colorado.¹¹⁴ For this thesis, the sod structure era will begin in 1862, when Congress enacted the Homestead Act of 1862, to 1900, a wider range than Barns and Dick. The rationale for excluding the 1900-1940s examples put forward by Welsch is that later sod houses are constructed with different materials. The sod houses completed into the twentieth century and beyond the Great Plains sod houses were more complex than the sod houses of the peak period.

¹¹² This two-story home would not have existed when the first settlers built sod houses because to build a sturdy second floor, a flooring system would have to be implemented involving more wood than was available. Wood was difficult to find and buy so the option of a second floor was not a priority to spend money on or find extra wood.

¹¹³ Cass G. Barns. *The Sod House; Reminiscent, Historical and Biographical Sketches Featuring Nebraska Pioneers, 1867-1897*. (Madison, Nebraska, 1930) 124.

¹¹⁴ Everett Dick. *The Sod-House Frontier, 1854-1890; Kansas & Nebraska to the Admission of the Dakotas*. (Lincoln, NE, Johnsen Pub. Co., 1954) 1-2.

Sod structures fit into the category of impermanent architecture, structures not meant to last long and made from perishable organic materials. Cary Carson et al.'s *Impermanent Architecture in the Southern American Colonies* is one of a few pieces of literature describing impermanent architecture. Examples outlined in Carson's work describe impermanent architecture in the Southern American Colonies, but it is not a phenomenon unique to the region. The main remaining evidence of impermanent architecture is archaeological in nature because the superstructures themselves have disappeared. Impermanent architecture is a result of the simple fact that many people wanted to settle before they made an investment into a house.¹¹⁵ The settlers depended on basic walls and roof until they could afford to build a better structure. When landowners built new permanent buildings, some kept temporary housing intact. Many settlers continued to use the sod structures for barns and other farm activities even once they built a more permanent residence. This notion of impermanent architecture was actually part of their original design per Carson's definition. Sod structures are an important, yet impermanent part of the architecture of the Great Plains.

There are many different interpretations of sod structures and if settlers built them as temporary structures. Sod is a decomposing material and with rain and wind, a sod house can deteriorate quickly. The range of how long sod structures were supposed to last is estimated from six years to eighty years with the correct maintenance. Rollie Henkes, a writer for John Deere Inc.'s *The Furrow* magazine and editor of *Woodlands*

¹¹⁵ Cary Carson et al., "Impermanent Architecture in the Southern American Colonies," *Winterthur Portfolio* 16, no. 2/3 (Summer-Autumn 1981): 135-96.

and Prairies magazine, believes that sod structures were only supposed to last for a few harvests or six to seven years.¹¹⁶ After a few harvests, a settler would hope for enough money to construct a wood frame house. Dick also believes settlers designed sod houses to only last six to seven years.¹¹⁷ Sod houses were only temporary housing until the settler could build something new and better. David Danbom, a historian and retired agricultural history professor at North Dakota State University, Louise Mears, a geography professor who worked throughout the Midwest, and Welsch describe the lifespan of a sod house is between ten to twenty years.¹¹⁸ Mears suggests settlers meant to replace their roofs more frequently than the ten to twenty year life of the walls as needed.¹¹⁹ Mears does not give a suggestion as to why the roof needed replacement frequently but the roof of the house is exposed to weather and thus likely to deteriorate faster than the walls. If a sod structure has perfect conditions and well maintained, Verney Kear, the founder of the Sod and Daughters of the Soddies, believes, a sod structure can last twenty-five to fifty years.¹²⁰ Kear also believes that if there are perfect conditions, maintenance, and the exterior of the sod structure has stucco, a sod house can last seventy to eighty years. Literature still disputes the average life of a sod structure. If a wooden frame house was not an option, the sod house received maintenance and repairs

¹¹⁶ Rollie Henkes, "Where the Soddy Survives," *The Furrow* 81, no. 6 (1976): 30–31.

¹¹⁷ Everett Dick, *The Sod-House Frontier, 1854-1890; Kansas & Nebraska to the Admission of the Dakotas* (Lincoln, NE: Johnsen Pub. Co., 1954), 115.

¹¹⁸ David B Danbom, *Sod Busting: How Families Made Farms on the Nineteenth-Century Plains* (Baltimore: Johns Hopkins University Press, 2014), 36; Louise W. Mears, "The Sod House as a Form of Shelter; Where? What? Why?," *Journal of Geography* 14, no. 10 (June 1916): 388; Roger L. Welsch, *Sod Walls: The Story of the Nebraska Sod House* (Broken Bow, Nebraska: Purcells, Inc., 1968), 9.

¹¹⁹ Mears, "The Sod House as a Form of Shelter; Where? What? Why?"

¹²⁰ Verney A. Kear, *Sod Houses and Dugouts in North America* (Colby, Kansas: Prairie Printers, 1971).

to extend its life considerably, enduring as long as the family continued to invest in maintaining it.

Settlers built different sod structures to meet their needs and the sod structure dimensions reflected that. Many oral accounts tell the size of the sod house or dugout they lived in or helped build. No consistent size appears to dominate. Some were one room, others were two rooms, and in rare cases had three rooms. Many sources give a wide range and long list of dimensions of sod houses and dugouts. They range from twelve to twenty feet wide and fourteen to forty feet long.¹²¹ Although dimensions differed, there were a few commonalities such as most sod houses were rectangular, one-story, consistent construction methods, and there was a door and at least one window. Dugouts were usually smaller than sod houses. Roger Welsch believes that there is no true style because of the “variations of geography, climate, resources, and the skills of the builder.”¹²² The variety of reports on the dimensions of sod houses reveals less about discrepancies in the literature than it does about different configurations of sod house construction. Different settlers and families needed different sizes to fit their lives.

Another point of difference among the literature is the size of the sod brick employed. Unlike the dimensions of the structure, there was a narrow range of brick

¹²¹ Cass G. Barns, *The Sod House; Reminiscent, Historical and Biographical Sketches Featuring Nebraska Pioneers, 1867-1897* (Madison, Nebraska, 1930), 59; Leslie Hewes, “Making a Pioneer Landscape in the Oklahoma Territory,” *Geographical Review* 86, no. 4 (October 1996): 592; Bill James, *Sod House Pioneers* (Monticello, AR: James Quick Print, 1980), 5–10; Barbara Oringderff, *True Sod: Sod Houses of Kansas* (North Newton, Kansas: Mennonite Press, Inc., 1976), 25, 29; Donald S. Gates, “The Sod House,” *Journal of Geography* 32 (January 1933): 356; Roger Welsch, “The Nebraska Soddy,” *Nebraska History*, 1967, 337; Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 34; Dick, *The Sod-House Frontier, 1854-1890; Kansas & Nebraska to the Admission of the Dakotas*, 112.

¹²² Welsch, *Sod Walls: The Story of the Nebraska Sod House*, 25.

sizes. The common dimension is one foot wide, eighteen inches to two feet long, and about three to four inches thick.¹²³ The thickness depended on the species of grass, because the roots are what holds the sod brick together and root depth varies by species. There are accounts that have sod bricks being thirty-two inches long.¹²⁴ As long as the bricks locked together when stacked, the size did not influence the structure.

In sod structure literature, there is much focus on Nebraska and Kansas's settlement. Authors such as Cass Barns, Roger Welsh, and Everett Dick focus on Nebraska and Kansas. There is a photography collection located at the Nebraska's Historic Society by Solomon Devoe Butcher. His photographs inspired much interest in sod structures. The photographs are one of the few collections showing sod structures and the people who inhabited them. Authors leave out many states where sod structures have existed such as Minnesota, the Dakotas, Oklahoma, Texas, Colorado, and Montana. These states have documentation on the existence of sod structures in the area but the literature does not frequently acknowledge them. Cass Barns literature focuses on Nebraska because he was a pioneer and a practicing physician in Nebraska prairie towns. Everett Dick was a history professor at the University of Nebraska in the 1950s. He had easy access to archives and materials related to Nebraska. There are materials in other states but less published sources draw on these resources.

¹²³ Jean Caspers, *Compendium History of the Dugout and Sod House in Minnesota* (Minnesota: Fort Ridgely State Park and Historical Association, 1980), 13–14; Gates, "The Sod House," 355; Mears, "The Sod House as a Form of Shelter; Where? What? Why?," 387; Kear, *Sod Houses and Dugouts in North America*.

¹²⁴ Evelyn Slater McLeod, "Our Sod House," *Beaver*, Autumn 1977, 12, Minnesota Historical Society.

Because the research in this thesis centers on Minnesota sod structures, a more narrowed framing of the literature looks at sod structures in Minnesota. The Minnesota Historical Society archives were useful because three of the four case studies are from southern Minnesota. Jean Caspers' *Compendium History of the Dugout and Sod House in Minnesota* (1980) provides a guide through the counties of Minnesota using interviews, windshield surveys of sod structure depressions, pictures, references in county history books and archaeological evidence to place sod houses and dugouts in each county.¹²⁵ Caspers discusses why a survey and these accounts are necessary to Minnesota's history and future research on sod structure sites. Many of the interviews Caspers conducted were with the last surviving generation who lived in sod structures making them invaluable to future research. In the *Compendium History of the Dugout and Sod House in Minnesota*, Caspers outlines terminology of sod houses and dugouts, construction methods, possible ethnic origins, and the Minnesota county-by-county survey. He agrees the topic has blurred lines and the settlers built what they needed to survive with the materials available.

Many other personal stories and articles from local publications give details accounts about building sod houses and dugouts through the Minnesota and Midwest. History Channel's *Save our History* episode "Save Our History: Frontier Homes" studied a sod house reconstruction.¹²⁶ In this documentary, the host observes four types of

¹²⁵ Jean Caspers. *Compendium History of the Dugout and Sod House in Minnesota*. Minnesota: Fort Ridgely State Park and Historical Association, 1980.

¹²⁶ Found at College of Charleston library link:

<http://digital.films.com.nuncio.cofc.edu/PortalPlaylists.aspx?aid=9527&xtid=43021>.

structures studied throughout the United States. The episode features the *Sod House on the Prairie* in Sanborn, Minnesota. Although authors do not discuss Minnesota very much in related sod structure literature, where states such as Nebraska and Kansas feature more prominently, Minnesota still played a vital role in the frontier of westward expansion and its associated sod and dugout house construction.

Sod is the main material in sod structures and its composition is important to understand the original structure and possible reconstruction techniques. The literature on the topic of sod can be very broad and scientific with many types of prairie and grasses and many different regions. Some of the literature on the history of prairies are more creative and add an artistic touch.¹²⁷ The other side of literature is for an audience with a science background.¹²⁸ In related disciplines like ecology, botany, and geology, scientists study the Great Plains and prairie restoration for purposes such as erosion control, soil conditions, and returning prairie for parks.

Sod's physical properties are important to understand from an ecological perspective. It is significant to recognize how the grass grows and which grasses have the strongest roots. The roots are what keeps the sod together as settlers cut sod into bricks. Roger Welsch's *Sod Walls* overlaps properties of sod and grasses with a description of sod structures. Welsch provides illustrations of each grass used in sod

¹²⁷ For example, Robert Sayre's *Recovering the Prairie* collection of chapters argue that the only way to know what the unplowed prairie looked like is through imagination. We can use artist's interpretations through art or words but people cannot know for sure what the prairie once looked like.

¹²⁸ John J. Webb Jr. "The Life History of Buffalo Grass." (*Kansas Academy of Science* 44 (58-75), April 1941). <http://www.jstor.org/stable/3624868>. Article is analyzing the growth and soil research around Buffalo Grass specifically.

bricks. Most sod structure literature does not go into details about the prairie and the grasses desired for sod bricks.

Through researching sod structures, many children's and fictional literature appear in searches. One of them is Glen Rounds' *Sod House on the Great Plains* is a book explaining life and construction of a sod house to a juvenile audience. Also, sod structures appear in other recognized children's literature such as Laura Ingalls Wilder's *On the Banks of Plum Creek*, Linda Hublaek's *Butter in the Well: a Scandinavian woman's tale of life on the prairie*, and Willa Cather's *My Antonia*.¹²⁹ All these titles share a story about a pioneer family and the living in a sod structure. *On the Banks of Plum Creek* is based on Wilder's own experience as a child living in a dugout. Hublaek's *Butter in the Well: a Scandinavian woman's tale of life on the prairie* is a fictional piece but based on research and a Swedish immigrant family who lived in Kansas. Willa Cather's *My Antonia* mentions the characters living near and around sod houses and dugouts. Though fictional literature, these books are based on research and true personal accounts. The Walnut Grove dugout contains the actual site of the book's setting, which inspired the Laura Ingalls Wilder Museum's dugout replica. Fictional literature introduces the westward expansion and sod structures to young audiences and teaches about an important part of history.

Through the literature, there are few sources written on reconstructing sod houses for interpretation. One article by Pricilla Franham, a past Executive Director at Ramsey

¹²⁹ Three are listed but there are many fictional literature pieces that include sod structures in them.

County Historic Society, talks about planning and what led to having a sod house replica on the Gibb Museum farm site in St. Paul, Minnesota. The project started when archaeologist found remnants and a floor plan of a sod house that related to Gibb family accounts. The article goes through the planning process with the Board of Trustees but does not go into detail about executing the replica on site of the sod house. There is a gap in literature and studies about reconstructing or replicating nineteenth-century sod structures. There are replicas and reconstructions standing today indoor and outdoor environments, but no detailed description of how organizations planned, built, and maintained the replicas and reconstructions exist.

CHAPTER FOUR: HISTORIC IMAGE ANALYSIS

There is not one specific set of instructions for reconstructing a sod structure that is correct because there was no one way to build a sod house. Knowledge of how to build a sod structure was passed orally from settler to settler. For this reason, every nineteenth-century sod structure and settler has its own history. Table 4.1 summarizes the sixty-four inventory forms in the Appendix. Presented in the appendix, each inventory form includes an image and descriptions including, location, date, and estimated size. The inventory forms show each sod structure's architectural features as well including window glazing materials, flooring, roof materials, roof type, roof penetrations, and wall materials. These images from the nineteenth and early twentieth century capture settlers' lives and built environment at a specific point. The images show the variation of sod structure designs throughout the Great Plains. Each one of these sod structures is an individual, different from all others. Gathered from five different archives, the images cover a wide range of geographic locations as well as dates.¹³⁰ The inventory forms' date range is limited to a time span from 1870 to 1923. The period of study established in the introduction is 1862 to 1900 but the image analysis was expanded to 1923 to include two interior images. The earliest date is 1870 because that was the earliest date associated with an image of a sod structure. Some images did not have a date associated with them, so the year column is blank for those sod houses. The images

¹³⁰ The archives include the Minnesota Historical Society, the Oklahoma Historical Society, the Nebraska Historical Society, the South Dakota Historical Society, and the North Dakota Historical Society.

analyzed and presented in the Appendix exhausted most of the five archives' collections of sod structures.

With the information gathered from the images and archives, the standards for an authentic sod structure becomes apparent and the lack of some materials shows that certain materials are inauthentic to nineteenth-century sod structures. Put simply, this nearly exhaustive investigation reveals the materials and modes of construction that did and did not exist in the nineteenth century, and thus informs what to replicate to approach authenticity.

Table 4.1: Summary of Sod Structure Architectural Features

Location	Year	Size ≈	Window	Flooring	Roof Materials	Roof Type	Roof Penetrations	Walls
Dakota T.	1880	11' L part	g	nv	lb, tarpaper	shed	sp	sb
Dakota T.	1880		g	nv	sb, lb	shed	sp	sb
Kansas	1880		g	nv	sb, lb	curved shed	nv	sb
Kansas	1870	interior	nv	wood	lb	gable	sp	nv
Kansas	1870	25'L	g	nv	sb, lb	gable	sp	sb
Kansas	1879	24' L	g	nv	sb, lgs	gable	sp	sb
Kansas	1880	40'L	g	nv	sb, lgs, lb	gable	sp	sb
Kansas	1885	25' L	g	nv	sb, lb	gable	sp	sb
Kansas	1890		g	nv	lb	gable	sp	sb
Kansas	1890		g	nv	sb	gable	nv	sb
Kansas	1890	16.5'L	g	nv	sb, lb	gable	sp	sb
Kansas	1890		g	nv	sb, lb	gable	sp	sb
Kansas	1890		g	nv	sb, lb	gable	sp	sb, dugout
Kansas	1870s		g	nv	sb, lb	gable	sp	sb
Kansas	1880s		g	nv	sb, lb	gable	sp	sb
Kansas			nv	nv	sb, lb	gable	sp	sb
Kansas	1890		g	nv	sb, lb	gable	none	sb
Kansas	1870	24' L	g	nv	sb, lgs	shed	sp	sb
Minnesota	1900		g	nv	sb, lb	gable	sp	sb
Minnesota	1886	21'L 20'W	g	nv	sb	pyramid	none	sb, stone
N. Dakota	1895	32' L	g	nv	sb	curved shed	2 sp	sb
N. Dakota	1900		g	nv	sb, lb	curved shed	sp	sb
N. Dakota	1885		g	nv	sb, lb	gable	2 sp	sb
N. Dakota	1895	23"W	nv	nv	sb, lgs	gable	sp	sb
N. Dakota	1895		g	nv	sb, lgs	gable	sp	sb
N. Dakota	1896		g	nv	sb	gable	sp	sb
N. Dakota	1897		g	nv	sb	gable	sp	sb
N. Dakota	1903		g	nv	sb	gable	sp	sb
N. Dakota	1906		g	nv	sb, lb	gable	sp	sb
N. Dakota	1909	28'L	nv	nv	sb	gable	sp	sb
N. Dakota	1910	26'L	g	nv	sb	gable	sp	sb
N. Dakota	1923	interior	g	wood	lb	gable	nv	sb, plaster
N. Dakota	<1923	interior	nv	wood	lb	gable	nv	sb, newspaper
N. Dakota	189?		nv	nv	sb	gable	sp	sb
N. Dakota	190?		g	nv	sb, lb	gable	sp	sb
N. Dakota			g	nv	sb, lb	gable	s chimney	sb
N. Dakota	1896		g	nv	sb	gable	sp	sb

N. Dakota	1887	32'L	g	nv	sb, lb	gable, shed	sp	sb
N. Dakota	190?		g	nv	lb	shed	sp	sb
N. Dakota	190?		g	nv	sb	shed	2 sp	sb
Oklahoma	1893	35' L	g	nv	shingles	gable	sp	sb, wood
Oklahoma	1897	45'L	g	nv	sb, lgs,lb	gable	sp	sb
Oklahoma	1900	18' L 15'W	nv	nv	sb	gable	sp	sb
Oklahoma		34' L	g	nv	sb, lgs, thatch	gable, shed	sp, s chimney	sb
S. Dakota	1913	17' L	g	nv	sb, lb	curved shed	nv	sb
S. Dakota			g	nv	sb, lb	curved shed	sp	sb
S. Dakota			open	nv	sb, lb	curved shed	sp	sb
S. Dakota	1890	>27'L	nv	nv	sb, lb	gable	nv	sb
S. Dakota		30'L	cloth	nv	lb	gable	sp	sb
S. Dakota			g	nv	lb	gable	nv	sb
S. Dakota			nv	nv	lb	gable	sp	sb
S. Dakota			g	nv	lb, tarpaper	gable	nv	dried clay
S. Dakota			g	nv	sb	gable	sp	sb
S. Dakota		19'L	nv	nv	sb, lb	gable	sp	sb
S. Dakota		28'L	g	nv	sb, lb	gable	sp	sb
S. Dakota			nv	nv	sb, lb	gable	sp	sb
S. Dakota		16'L	g	nv	sb, lgs	gable	sp	sb
S. Dakota		34'L	g	nv	shingles	gable	sp	sb, wood
S. Dakota			g	nv	sb, lb	gable	sp	sb
S. Dakota	190?	34'L	nv	nv	shingles	hip	sp	sb
S. Dakota	1884	>20'L	g	nv	sb	shed	sp	sb
S. Dakota		15'L	none	nv	lb	shed	sp	sb
S. Dakota			nv	nv	lb, tarpaper	shed	sp	sb

Key

g- glass in wooden frame, often with muttons as part of a multi-light sash

sb- sod bricks

lgs- logs

lb- lumber

s chimney- sod chimney

nv- not visible

none- there are no windows / roof infiltrations

open-windows had no material in the

From the findings in Table 4.1, the bracket for authentic and inauthentic sod replicas can be determined. Differences occur mostly in structure size, roof materials, and roof type and commonalities appear in all the categories. Almost all the sod structures evaluated have sod bricks as their visible wall material with one exception having dried clay on the exterior. There are a few instances a settler used lumber or stone to reinforce the sod structure near the ground or near the roof.

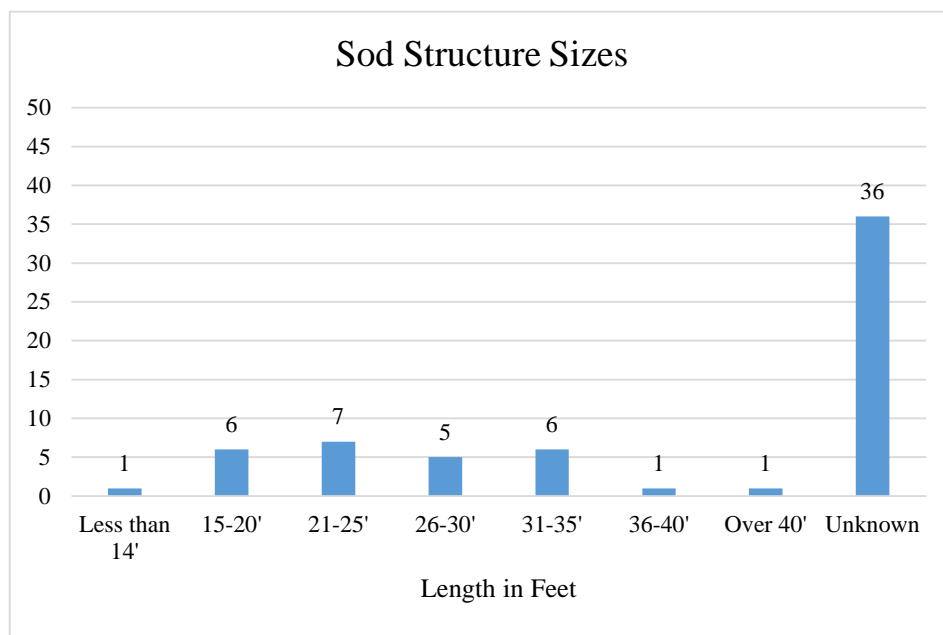


Table 4.2: Sod Structure Sizes Bar Graph

The size of the sod structures varied. Additions to fifteen of the sod houses in the images add extra length. Almost half of the evaluated images do not have a dimension listed in the table, because the oblique angle of the sod structures in the images did not allow for calculating the length for thirty-three images.¹³² The photographers of these

¹³² Information about the scaling the photographs and sizes of the sod structures is in Chapter Two, the Methodology

images did not note structure sizes or the notes are no longer available. Through literature, sod house dimensions differ greatly. The range for the length of a sod structure varies from fourteen to forty feet long according to the literature. The dimensions noted in the inventory forms fit into the literature's range as seen in Table 4.2; though the images witness a few smaller and a few larger structures.¹³³ Additions usually cause sod houses to be greater than forty feet long.

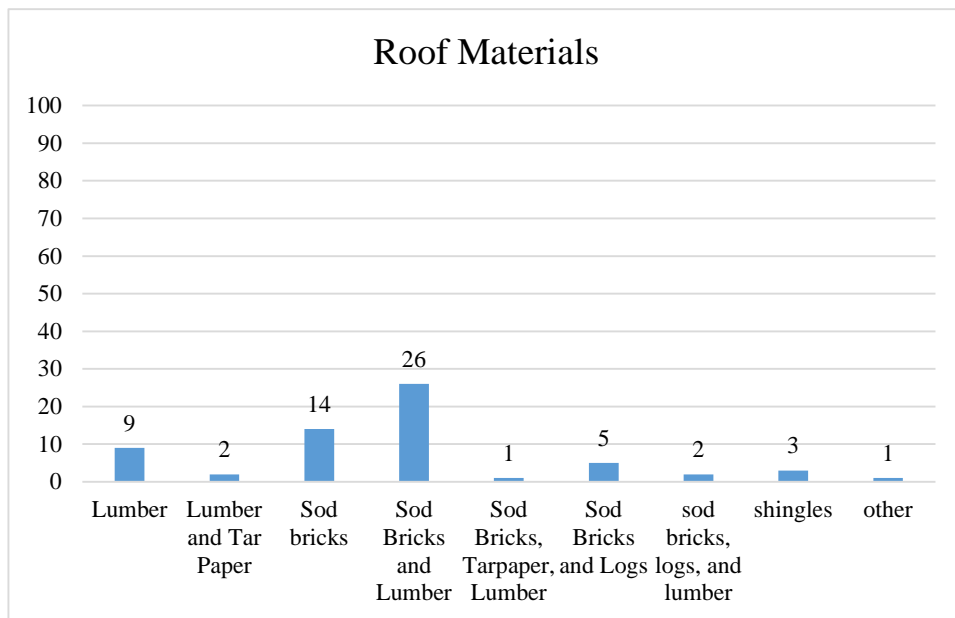


Table 4.3: Roof Materials Bar Graph



Figure 4.1: Sod Bricks and Lumber Roof Example (Nebraska State Historical Society [Digital ID nbhips 11019])



Figure 4.2: Sod Bricks and Logs Roof Example (Kansas Memory, Kansas Historical Society, 209059)

¹³³ Dimensions for the images were scaled from the image making the sizes estimates and are not exact.



Figure 4.3: Sod Bricks, Logs, and Lumber Example (South Dakota State Historical Society)

The sod structure dimensions sometimes dictated roof type. If the structure was large, it needed stronger materials with greater spanning capacity for the roof. The images show that sod structure roofs were usually covered with sod as the insulating and cladding material. There are differences in whether it is most common to use sod, logs, and lumber or just sod and lumber in the roof assembly. The images and literature suggest that settlers put money into their roofs. Many settlers added wood sheathing to hold the sod and keep the roof from leaking. Log and sod type roofs used logs as the rafters with sod bricks laid on top (Figure 4.2). The lumber and sod combination used lumber rafters and sheathing with sod bricks laid on top (Figure 4.1). The third technique observed included log rafters, lumber sheathing, and sod bricks laid on top (Figure 4.3). Fourteen of the images show only sod bricks as the roof material. The roof had a support system under the sod bricks but was not visible in the images. Nineteenth-century tarpaper was also visible in some cases; two of the evaluated sod structures had visible tarpaper. This shows that resources were reaching the Great Plains by the 1880s. It would have still been relatively new material for waterproofing roofs as it was shown in about two of the sod structures. Fifteen structures did not have any sod on their roofs. Some only had lumber sheathing, two included tarpaper, and three rare occasions in later

sod structures used wooden shingles. The wooden shingles are a later addition to a sod structure. Each of the described roofing materials are define in Table 4.3 from the images.

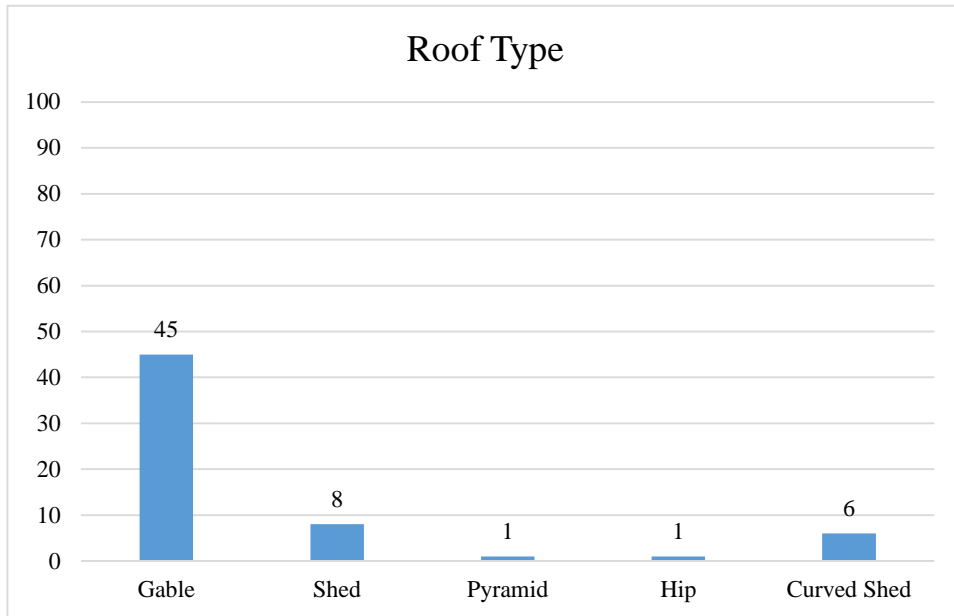


Table 4.4 Roof Type Bar Graph



Figure 4.4: Roof Types with Corresponding Graph (Naomi Doddington)

Three popular roof types appear in the nineteenth-century sod structures depicted in the images. First, the most frequent roof type that appears in images is the gable roof.

Following the gable roof type are shed and hip roofs as shown in Table 4.4.¹³⁴ Most of the shed roofs curve at the middle. There is one image with a pyramid roof.

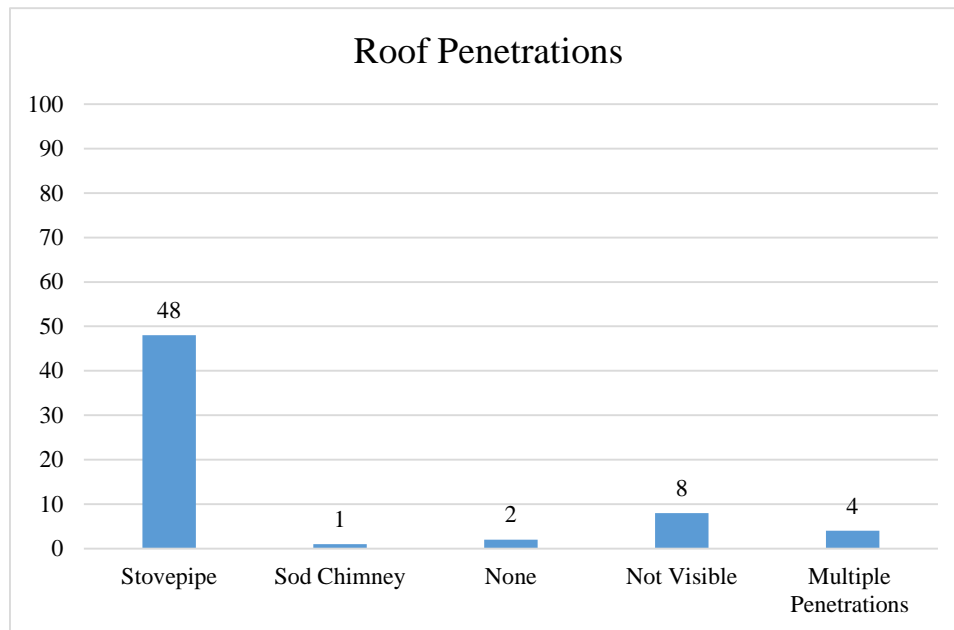


Table 4.5 Roof Penetrations Bar Graph

Roof penetrations prove to be similar throughout the sod structures. Stovepipes are the most popular and widely used in sod structures (Table 4.5). Only four of the images had two roof penetrations. Of these images, one image had two sod chimneys, two images had two stovepipes, and one image had both a stovepipe and sod chimney. Less common, one of the sixty-three sod structures has one sod chimney visible. Roof penetrations were not visible in ten images because of the image angle or because the structure actually did not have any penetrations.

¹³⁴ In a preliminary study that included thirty-six images from Nebraska, there were a higher number of hip roofs than one (as shown in Figure 4.4)

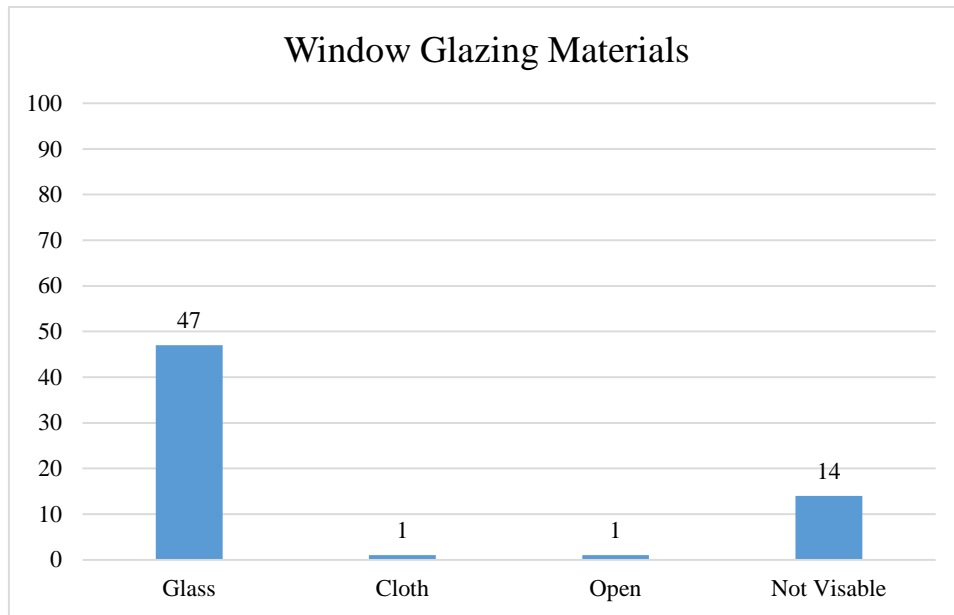


Table 4.6 Window Glazing Materials Bar Graph

Glass is the most common window glazing material for an original sod structure as shown in Table 4.6. Despite its expense, the images show most settlers bought glass in wooden frames often with muttons as part of a multi-light sash. There were a few instances where sod houses and dugouts did not contain any windows or windows were not visible in an image. In one instance, the sod house had a cloth tacked to the lintel above the window instead of a multi-light glass sash window. This configuration was clearly in the minority of cases.

There are three interior images included in the survey. Two of these images date later than 1900, the cutoff date for this thesis. These interior images depict wooden floors and wooden roofs inside the sod houses. They differ in interior finishes on the walls. One of the images shows newspapers on the wall, one shows plaster, and the other image is of a small dugout where the wall finish is not visible due to household objects.

These were included to show that the interior finishes did exist but do not present as a robust sample set from which to draw deductions.

Geographic and Chronological Patterns

The data expressed different patterns when analyzed by geographic location and chronologically. These are important ways to look at the data because geographic location and time period influenced materials and construction techniques.

Roof forms appear to have different distribution by state. The most common roof type in all states listed was gable shown in Table 4.7. South Dakota appears to have the most variation in roof types as the state has representation in numbers in all three types of roof types, gable, hip and shed. Oklahoma has the least variation with only gable roofs. Minnesota had the only pyramidal roof (represented in Table 4.4) showing that that the state had more variation than Oklahoma though all others were gable roofs. Roof forms suggest that a generic replica would demonstrate a gable roof.

The window materials also demonstrate some clustering patterns. The open windows and the one that used cloth, the only non-wood sash, glass window frames are found in South Dakota. This maps the fact that the railroads and windows with glass panes did not arrive in these areas as early as other states. The exercise of finding patterns geographically was complicated by the fact that there is not an equal number of photos representing sod structure in each state due to availability in the archives.

Patterns also appear chronologically. The most common roof type in the 1880s is the shed roof. The 1890s structures mostly have gable roofs but also the greatest number

hip roofs appear, compared to other decades. Shingles appear after 1892 proving them a later addition to sod structures. As depicted in Table 4.8, the most popular decades of log and sod brick combination roofs are 1870s and 1890s. In the early 1880s and 1890s, more sod structure combine logs, lumber, and sod. After the 1900s, there does not appear to be any logs in the roof structures. Logs are replaced by dimensional lumber, likely due to sawmill development in the area or rail access to this type of process. There is an increase after 1890s in the number of structures using only lumber in their roof. After 1900, literature shows that the railroads and towns of the Great Plains are well established having lumber materials available to more of the population. In this data set, length of the sod structures does not appear to correlate chronologically or geographically meaning sod structures of all sizes were built across the prairie and across eras.

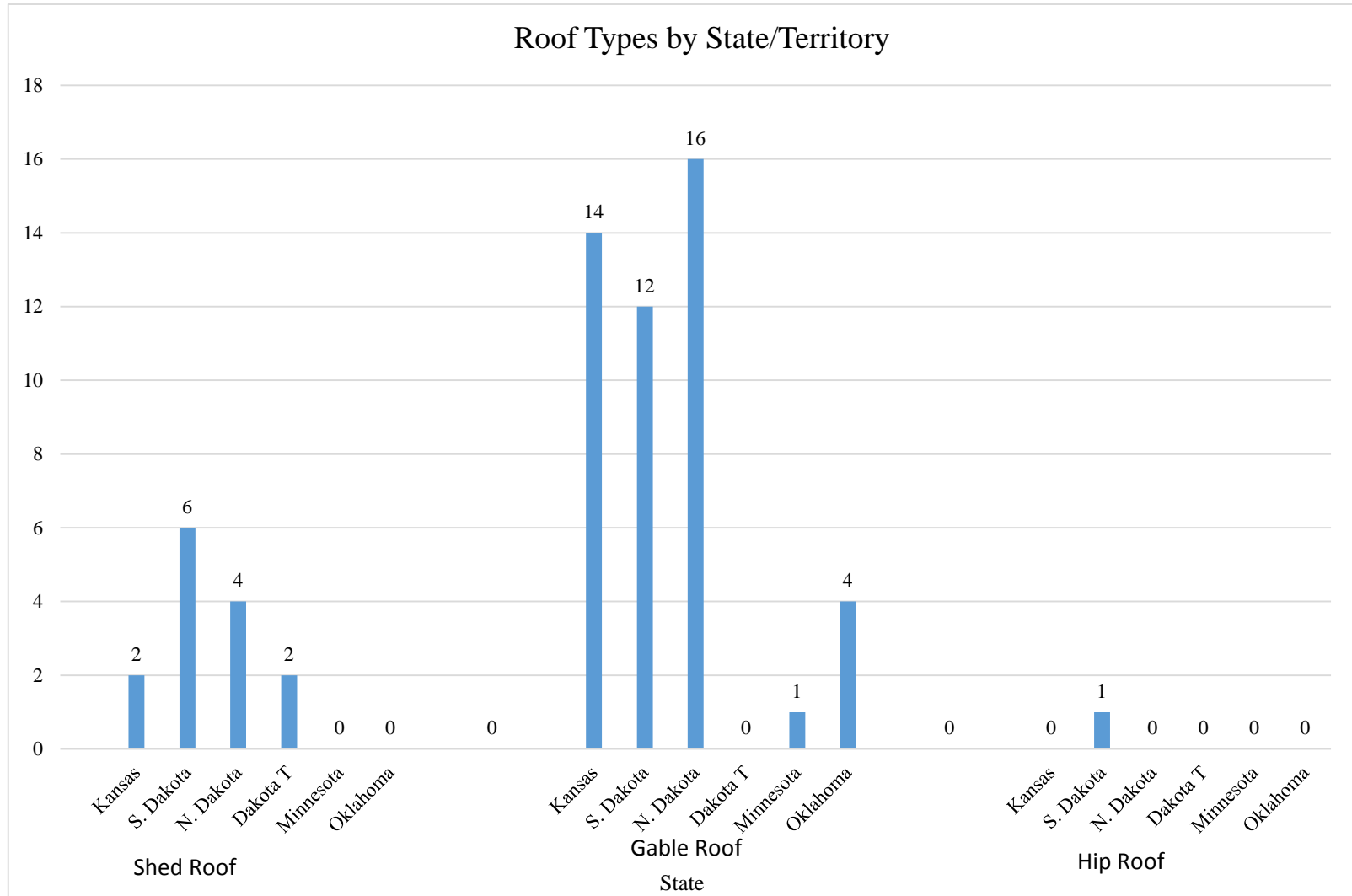


Table 4.7: Roof Types by State/Territory Bar Graph

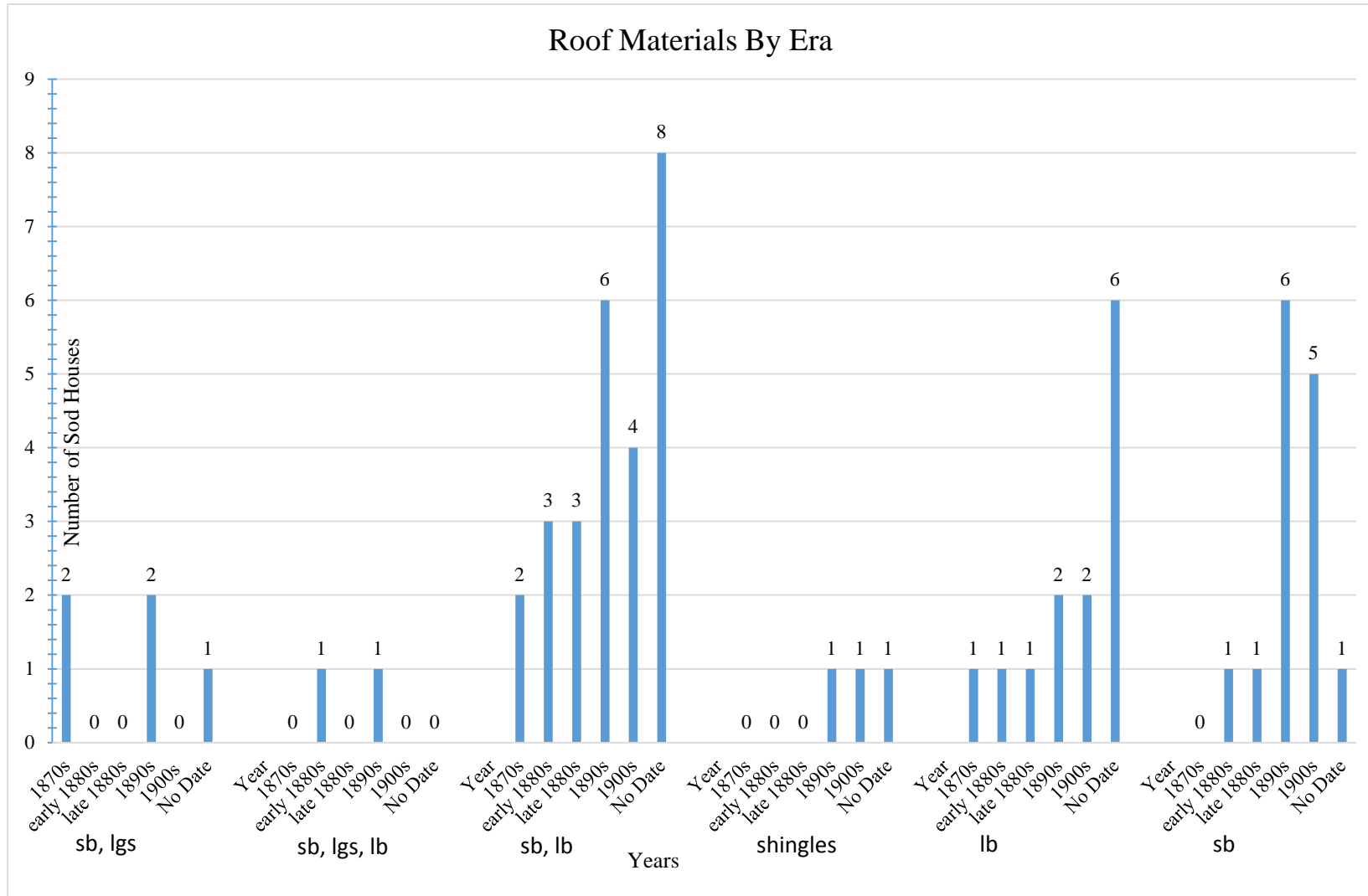


Table 4.8: Roof Materials By Era Bar Graph

Parameters of Authenticity

An authentic sod structure replica would ideally come from a specific historical account. No original structures or personal accounts are the same and so ideally, each replica tells its own story, a specific story with validity through authenticity to the specific details and circumstances. However, if an interpretative program is invested in interpreting a “generic” example of the sod structure type, this research can assist. If a specific history is not used or a site wants to build a structure to represent the architectural type, the following parameters derived from the photo inventory analysis outline a ‘generic’ sod structure.

Guidelines

Structure Sizes

Authentic Range: no less than fifteen feet and no longer than forty feet

Most Common: twenty-one feet to twenty-five feet

Roof Penetrations

Authentic Range: none; stove pipes; sod chimneys; multiple

Most Common: a single stove pipe

Inauthentic: brick; plastic; composite/synthetic materials

Window Glazing Materials

Authentic Range: glass in wooden frames, with muttons as part of a multi-light sash; cloth; open; animal hide

Most Common: glass in wooden frames, with muttons as part of a multi-light sash

Inauthentic: composite or synthetic materials; one pane of glass with fake muttons

Roof Materials

Authentic Range: sod bricks and logs; sod bricks, logs, and lumber; sod bricks and lumber; lumber with tarpaper; lumber, sod bricks; sod bricks, tarpaper and lumber; shingles; lumber

Most Common: sod bricks and lumber (contingent upon era)

Inauthentic: composite, or synthetic shingles; synthetic membrane; sheet material

Roof Types

Authentic Range: gable; shed; pyramid; hip; curved shed

Most Common: gable

Inauthentic: mansard; low-sloping roof; vaulted, gambrel; dutch hip roof, etc.

Flooring

Authentic Range: wooden floor, dirt floor

Most Common: wooden floor

Inauthentic: laminate wood flooring, concrete, carpet composite or synthetic materials

The interior finishes are difficult to define as strictly authentic or inauthentic. From the three interior images, only two had clear views of the interior finish. This could be that people did not want photographers coming into their houses. Also, it could be that settlers did not have an interior finish other than the exposed brick and did not want it known. The most authentic interior finish for a replica would be to keep the sod bricks exposed unless otherwise noted. Any sealant or material created after 1900 would be an inauthentic material for a replica.

Another way to evaluate authentic and inauthentic sod structure representations is through analysis of existing replicas. This thesis explores four case studies, three are replicas, and one is an original sod house in the following chapter. The case studies show different materials and techniques used to build a replica or maintain an original sod structure.

CHAPTER FIVE: CASE STUDY ANALYSIS

A truly authentic sod structure is original. Due to the ephemeral nature of the construction type, however, replicas with degrees of authenticity become necessary. An authentic sod structure construction or replica uses historically accurate nineteenth-century materials and methods. It is important when building a replica to understand what is authentic and what is not. Personal accounts give the most accurate way to construct a sod structure, because the historical account describes nineteenth-century aspects settlers used. Today, museums and sites are building replicas to interpret nineteenth-century Great Plains settlement. The historic materials and construction methods are not always available for all sites and traditional methods can be difficult to maintain. Replicas are now built with modern techniques and materials for practicality. These techniques and materials can minimize the maintenance and life safety issues associated with nineteenth-century sod structures including collapsing roofs, leaking sod, and walls falling down. Replacing sod with a composite or synthetic material could allow the replica to have little to no maintenance. Inauthentic yet practical methods, the opposite pole on the spectrum from authentic, is frequently achieved by adding twenty-first century-materials or methods to constructing a replica. Motives for diverging from authentic reconstructions include maintenance, safety, and the ability to tell the historic narrative to a specific audience. Introducing twenty-first-century materials into a reconstruction of a nineteenth-century sod structure can help sites with maintenance, time, and costs. Real sod needs to be replaced and its settling causes structural damages. Synthetic or composite materials may have little to no maintenance, saving time, and money. Also,

twenty-first-century materials may be more practical in interior locations because there is little maintenance and less mess. The following four case studies will show both authentic and practical examples of sod structure replicas.

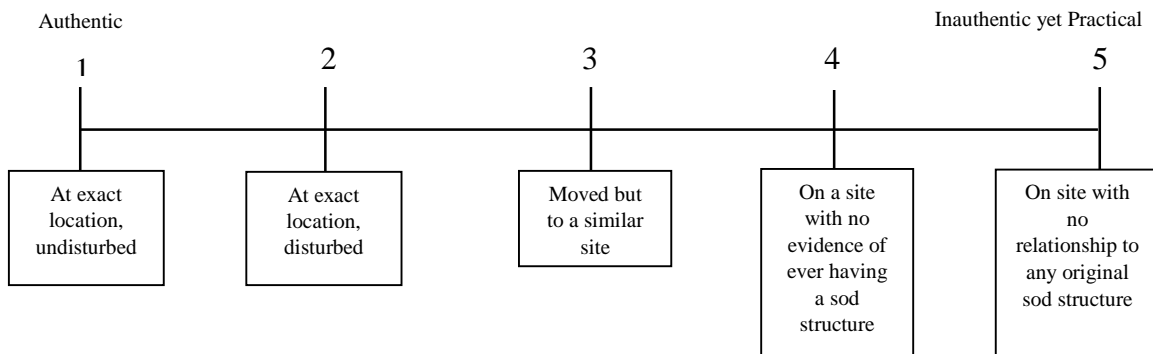
Three of the case studies have a sod structure replica in different settings and each uses different materials. One of the case studies has an original sod house. To analyze these case studies, this chapter examines eight different areas of integrity. Each area uses a ranking scale with one being authentic and five being inauthentic yet practical. The eight areas are location, context, materials-sod, sod cutting, construction methods, roof materials, flooring, and interior finishes. These eight criteria are based on the National Register's Bulletin, "How to Apply the National Register Criteria for Evaluation section eight, How to Evaluate the Integrity of a Property".¹³⁵ The National Register has seven different aspects or qualities to evaluate integrity: location, design, setting, materials, workmanship, feeling, and association. The criteria of this thesis use five of the National Register's criteria and expands them. Materials is one category for the National Register's guidelines but this thesis expands the materials category and focuses on four different aspects of the category (sod, roof materials, flooring materials, and interior finishes). Others that are directly related to the guidelines but splits into two categories in the following criteria is workmanship. In this criteria, workmanship is described in construction methods and sod cutting. Location and setting directly relate to the National

¹³⁵ National Park Service, "How to Evaluate the Integrity of a Property," National Register Bulletin: How to Apply the National Register Criteria for Evaluation, 1995.

Register's guidelines. With the National Register of Historic Place's integrity guidelines, the following criteria explains authentic and inauthentic aspects of sod structure replicas.

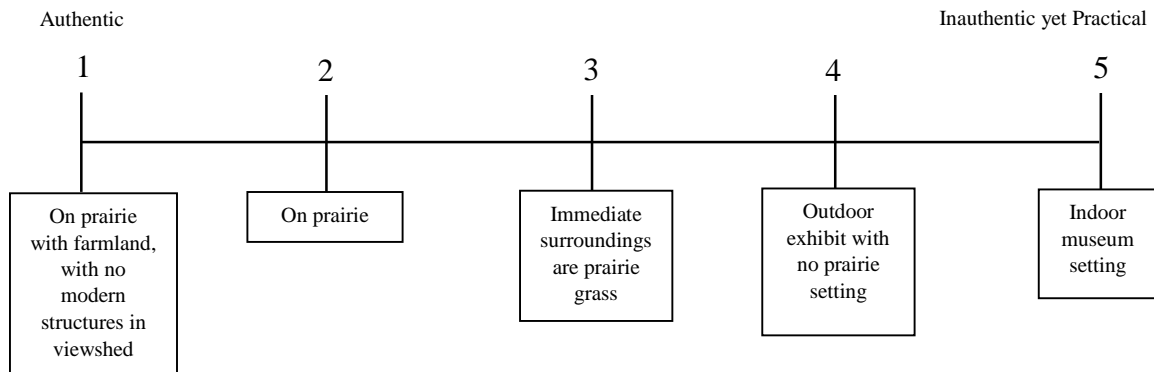
Authenticity Ranking Scales

Location



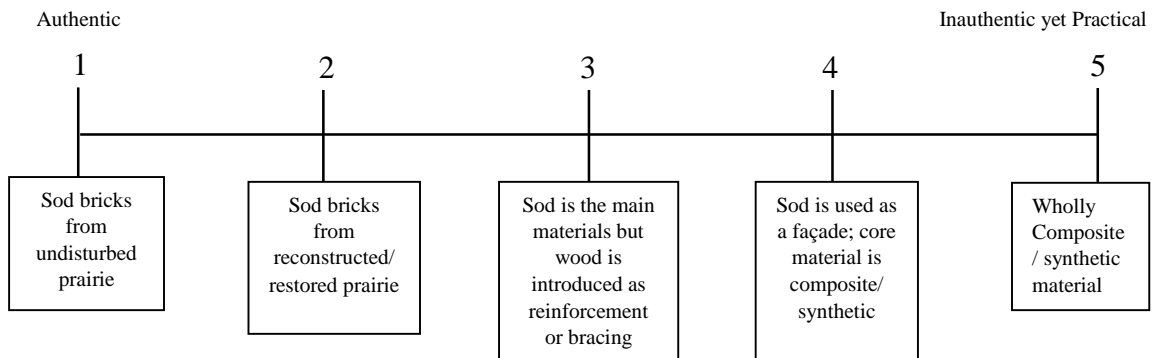
The most accurate location of a nineteenth-century sod structure is on the prairie and most authentic in the exact position where an original sod structure was constructed. To relate nineteenth-century sod structures with other parts of history, a museum setting is inauthentic yet practical. More visiting audiences can be reached through combining histories into museum galleries and having all museum buildings in one convenient location.

Setting



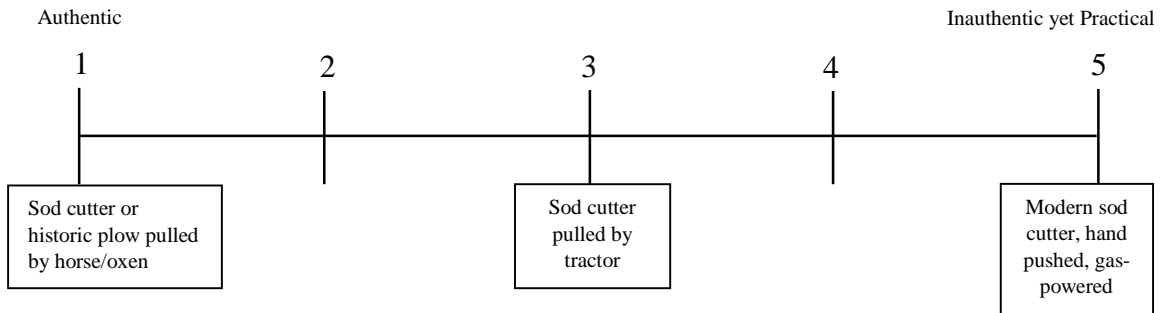
The context and setting of a sod structure opens up possibilities for historic interpretation of a sod structure. A sod structure surrounded by prairie and farmland shows a historic nineteenth-century homestead interpretation. The prairie and farmland setting also gives the chance to interpret the experience of living out on the prairie with no neighbors and wide-open space. Keeping museum buildings together or creating a sod structure in town for the convenience for visitors and creating an immediate prairie can give a visitor the idea of a prairie and a small context of nineteenth-century surroundings. There are ways to give context in an indoor museum setting with photographs and murals but the replica is inherently in an inauthentic setting.

Building Materials- Sod



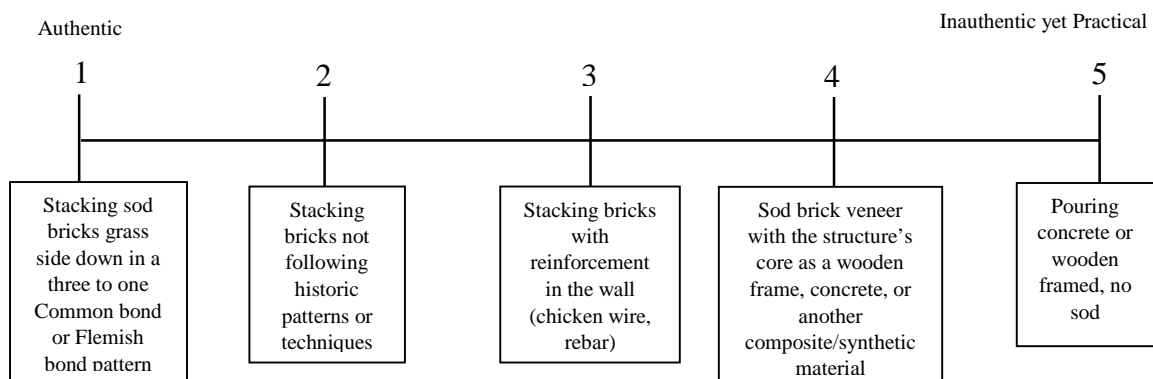
The most authentic building materials are ones that were available on the Great Plains during the nineteenth-century. The most authentic materials are thus sod bricks. Land granted to settlers by the Homestead Act usually consisted of prairie that had never been plowed or disturbed. After years of farming and the United States growing, today it is difficult to find undisturbed prairie. Many techniques are now used to reconstruct and restore prairies to the original prairie composition, a process which engages ecologist, biologist, etc. and is discussed further in the literature review. If small amount or no sod is used in construction, more composite and synthetic materials are introduced. The least authentic choice is not using sod anywhere in the construction.

Sod Cutting



Today there are many techniques and equipment options available to sites to cut sod bricks. Originally, the setters used a sod cutter or plow built from lumber and metal. Oxen or horses pulled the sod cutter or plow. Tractors were used in the early twentieth-century to cut the prairie faster and easier. Now, there are modern sod cutters that are gas powered to cut through the sod faster and more easily. Rental companies rent these sod cutting machines. There are no options two and four on the ranking scale, because there are no other options for cutting sod. Between the literature and communications with site managers, there are only the three ways cited to cut sod.

Construction Methods

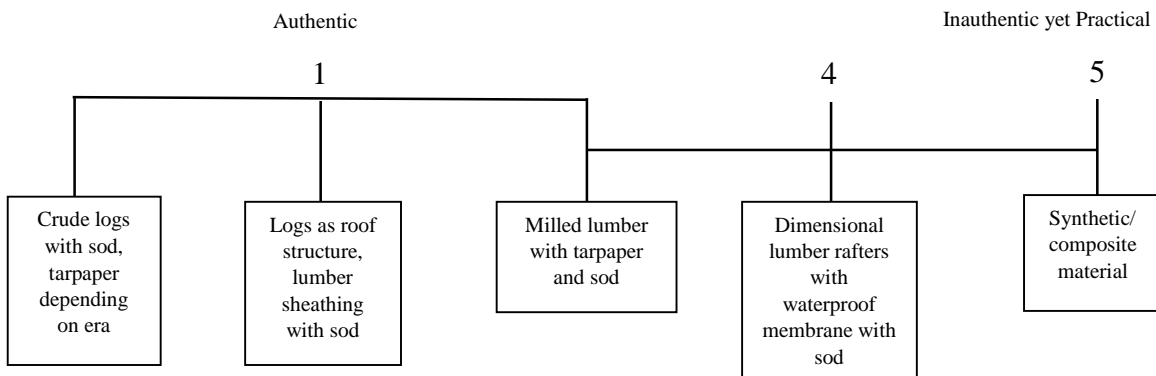


Construction methods differ with the materials used. A sod structure using prairie sod is constructed differently than a concrete or wood framed replica. The most authentic way to construct a sod structure is by following the exact methods used in the nineteenth century. Sod can wear away and become unstable, so a practical stabilization method is adding chicken wire horizontally between some rows or adding rebar vertically throughout the wall. The most practical in terms of durability and ability to assure life safety is a construction method using concrete or a wooden frame. These methods use modern materials and their construction methods reflects the materials (laying a masonry unit wall or framing a dimensional lumber for example) making the techniques the least authentic.

The next set of authenticity ranking scales is designed for a “generic” sod structure replica rather than one that is based on an historical account. Sod structures were each designed differently, but each sod structure endured different phases based on settler’s financial stability. The following observations are based on literature descriptions and the conclusions from Chapter Four’s historic image analysis. The first ranking scale in this section is roof-building materials. There are three different variations according to the historic image analysis in Chapter Four that prove to be authentic. According to the literature, once resources became available, a settler would add lumber into the roof structure for rafters and sheathing meaning that what was authentic to a structure changed as the owner changed their roofing material. The next ranking scale is flooring. Out of the three images analyzed in Chapter Four, wood was

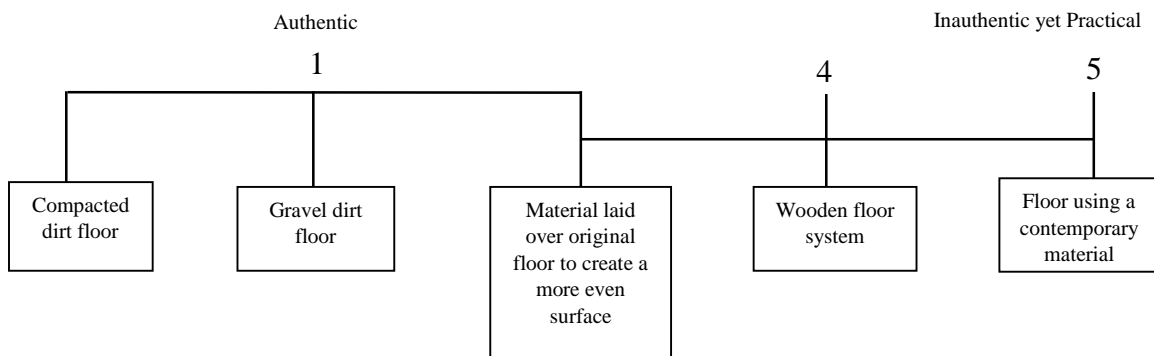
the more popular flooring material. According to literature, the most authentic and used floor was compacted dirt or gravel and after an upgraded roof, a settler would add a wooden floor. The last ranking scale is interior finishes. The image analysis shows two different finishes, plaster and newspapers, and both the images are from 1923. This shows that different finishes were used at the same time. Literature also suggests that exposed bricks, newspapers, whitewash/limewash, and plaster are all authentic to nineteenth-century sod structures. Settlers would increase these details as resources became available during the nineteenth century, making them authentic to the nineteenth-century sod structure. There may not be documentation about an original sod structure, so the improved sod structure may be the most historical accurate. As railroads and populations increased in the Great Plains, greater communications between the settlers helped uniform construction. There were more supplies, such as plows and sod cutters, in larger communities and neighbors would help with construction and information about what details worked well. The following scales are examples from authentic to inauthentic (yet practical) to help guide a “generic” sod structure replica to the interpretation a site wants.

Building Materials- Roof (examples)



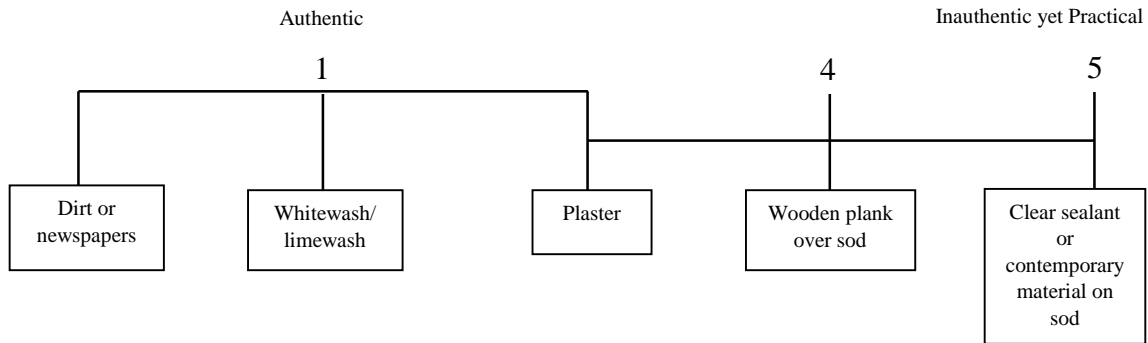
The most authentic roof has materials that were available to settlers during the nineteenth-century. According to the image analysis, lumber and sod brick material combination is popular and used from 1870s to the 1900s making this material combination authentic. Other authentic roof combinations as discussed in Chapter Four are logs and sod bricks, and logs, lumber, and sod brick combination. None of these is more authentic than the other. After the Civil War, tarpaper became popular and the settlers used it as a water membrane under the sod. For safety purposes, replicas use milled or dimensional lumber to support the roof to prevent it from collapsing. Modern waterproof membranes are used now to keep the roof leaking all together. The least authentic roofing materials has no sod and only uses synthetic or composite materials.

Flooring (examples)



As settlers earned money, the floor was often replaced or added to along with upgrading roof material. The floors started out in early sod structure and in low cost sod structures throughout time with compacted dirt floors. Maintaining or replicating the original floor of a specific sod structure is the most authentic. A dirt floor would be an authentic choice for a “generic” replica. Laying gravel and dirt over a compacted dirt floor has the same idea as a dirt floor but helps with drainage and traffic issues. Wooden floors were also used early as seen in Chapter Four’s analysis of an 1870’s sod structure. More practical would be a wooden floor system to help drainage. The most inauthentic yet practical for visitor wear and maintenance is using a contemporary material.

Interior Finishes (examples)



The interior finish varied throughout sod structures especially as a variable based on time and affluence. The most basic and authentic interior finish is dirt or mud compacted against the walls. Also, newspapers were used to keep the sod from falling out. After, the sod settled, settlers coated the walls with a whitewash, limewash, or plaster coating. This would keep the sod intact and last longer. The most inauthentic yet practical interior finish on sod is a clear sealant or contemporary finish on the sod to keep animals out and the dirt intact.

The next section of this chapter introduces and describes the four case studies. Each description includes the location, owners, construction techniques, materials, and maintenance measures that each site employs.

Site Descriptions

Site visits and personal communication provided information about each site for further description and analysis. The following are descriptions of each site, including location, background, and construction of each sod house or replica.

Oklahoma Sod House Museum

The Oklahoma Sod House Museum is located in Aline, Oklahoma and operated by the Oklahoma Historical Society. The builder and original owner of the sod house was Marshal McCully (shown in Figure 5.1). In 1894, Marshal McCully built the sod house and sold it to the Historical Society in 1963.

According to records of the Oklahoma Historical Society, Marshal McCully built the sod house August 1894 in the Cherokee Outlet of Oklahoma. It was government land before McCully bought it to farm. The sod house has two rooms, which are each approximately ten by twelve feet. The rooms are separated by wooden partitions as seen in Figure 5.4 and Figure 5.5. According to documents, McCully used buffalo grass located about one mile from the house site as his building material. The sod blocks used to build the house measure eighteen inches long, twelve inches wide and four inches thick. The walls are about twenty-eight inches thick, made of two wythes of sod bricks. Each row alternates between stretcher and header rows helping to lock the wythes together to make a sturdy structure. McCully plastered the interior sod. He used alkali clay from the creeks and smoothed it over the walls. This kept the sod together and reduced air and humidity infiltration. About once a month, the children of the family

filled the rodent and pests' holes with mud. According to family documents, Marshal McCully offered Mrs. McCully a wooden floor or a tin roof as an improvement to the home after she arrived to the homestead. Mrs. McCully chose the floor. In 1895, McCully added a wooden floor. From photographs it appears that, McCully added the tin roof in 1897. McCully's first wife died of lung problems and shortly after he remarried. At this time in 1909, he built a two-story frame house just west of the sod house. He owned about 240 acres at this time. Sometime between 1909 and 1923, McCully built concrete buttresses to stabilize and hold up the sod structure, the original home on the site. Marshal McCully died on August 26, 1963 at the age of ninety-five. His daughter-in-law sold the acre of land that the sod house is on to the Oklahoma Historical Society for one-thousand dollars on December 31, 1963.¹³⁶

The original sod house is still standing in Aline, Oklahoma. There are two major factors the Oklahoma Sod House Museum believes aided to the preservation of the McCully sod house. One is the bricks interlocking system with one wythe horizontal and one wythe vertically stacked with alternating rows provided a great deal more stability than the typical common bond model. This is interesting to note that one of the factors that would make this sod structure an outlier in the "generic" or "typical" category, may have played a role in its durability. Another possible feature creating greater durability is the plastered interior because it kept the sod together. In 1967, the Oklahoma Historical Society restored the exterior. The first wythe of sod at the four corners of the structure

¹³⁶ This was exactly sixty years to the day of when McCully received his certificate or patent for full ownership of his land.

had deteriorated away, exposing interior sod. The Historical Society went back to the original site McCully plowed for the sod to restore the sod house. The color of the sod procured from the site was different, however, because of the weathering and exposure of the sod house walls to air for seventy plus years. These bricks have weathered but still have their distinct color. In 1967, the Society chose a restoration treatment to return the house to its 1895 appearance, and so a faux sod roof replaced the 1897 tin roof. By 1967, the ridgepoles were about to collapse and the Society implemented seven supporting rods to stabilize the structure. A year later, in 1968, the Oklahoma Historical Society poured new concrete buttresses at the northwest corner, north side, and northeast corner, the same spots McCully had buttressed because the originals deteriorated and did not suffice anymore. Around 1968, steel tie rods were added between the north and south end of the structure to stabilize the east and west walls. The east and west walls were bowing, which had been a problem for McCully as well. McCully added exterior brace boards against the walls to keep them up as long as he needed to the structure but these do not remain today. The tie rods were half-inch diameter and bolted into a steel channel. The Oklahoma Historical Society applied an undocumented coating to the exterior sod to preserve the dirt from crumbling.

In 1990, a structural engineer made a report about the structural integrity of the sod house and recommendations for stabilization. The report suggested removing the tie rods from the structure. Also, the report noticed two cracks in two corners and suggested re-plastering to fix the problem. In 1991, the museum built an addition to the sod house. At the same time, the walls may have been re-plastered which is shown in Figure 5.2.

Along with these additions and repairs, the door entrances had Plexiglas added to keep people from touching the sod (Figure 5.3).

The sod house currently has a structure over and around it to protect from weather. The first structure was a pole barn in 1967. The pole barn left twelve feet of space between the barn walls and the sod house. From the walls of the pole barn to the buttresses of the sod house and a walkway up to the front door, there is a poured concrete slab.

The Oklahoma Historical Society does not do routine repairs on the sod house but monitors it closely. One of the dangers to the structure's integrity is the vibration from trucks on the road next to the museum. The vibration transmitted through the ground could affect the stability of the sod house. In addition, Oklahoma is now in danger of seismic activity. A natural disaster, such as earthquake could cause the walls to tumble.¹³⁷

¹³⁷ Renee Trindle, "Sod House Preservation," July 7, 2015.



Figure 5.1: McCully in Front of his House, 1950s (Oklahoma Historical Society)



Figure 5.2: McCully Sod House Kitchen (Oklahoma Historical Society)



Figure 5.3: Sod House in Museum (Oklahoma Historical Society)



Figure 5.4: Interior Wooden Partition and Support Ridge Poles (Oklahoma Historical Society)

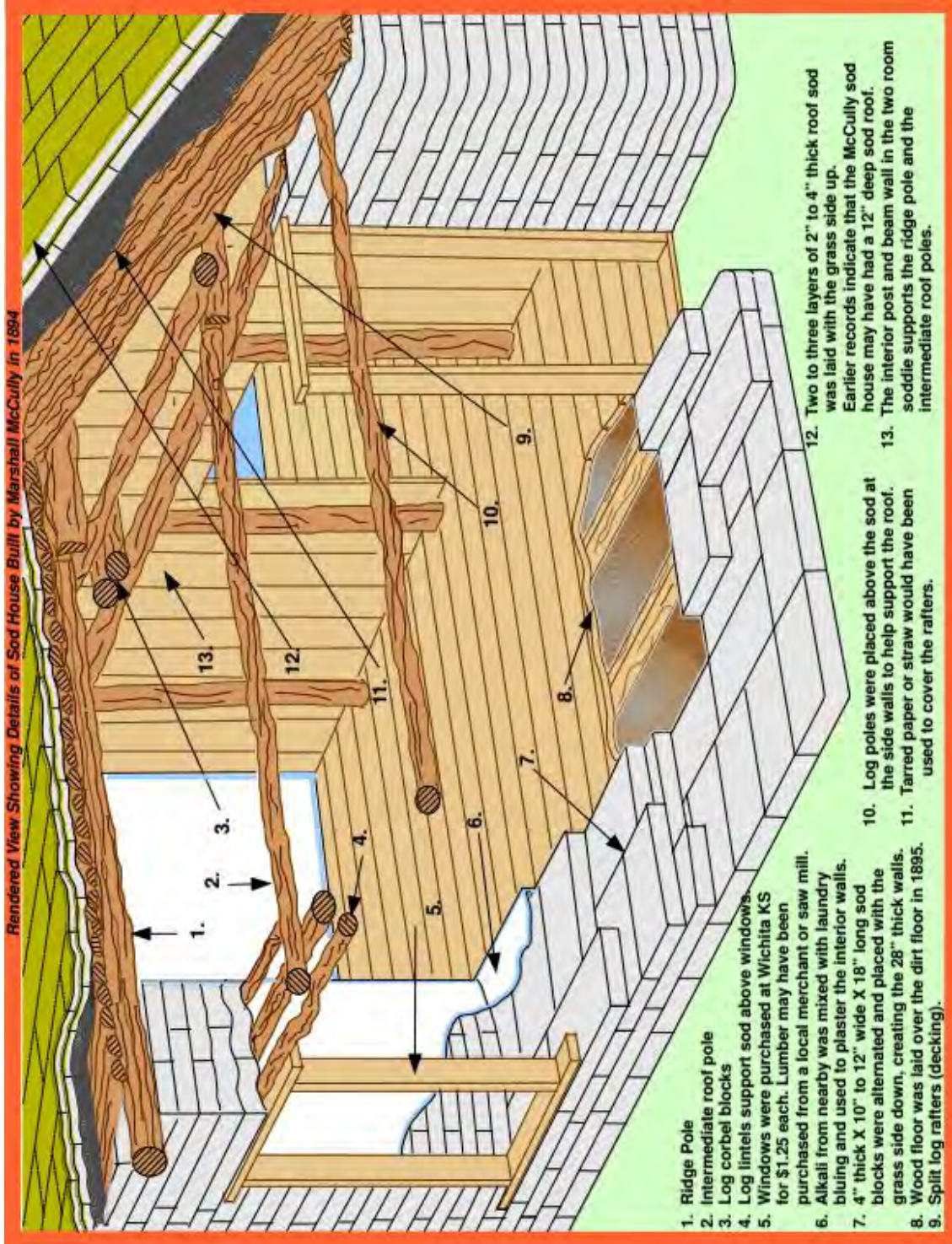


Figure 5.5: Construction Detail of McCully Sod House (Oklahoma Historical Society)

Sod House on the Prairie, Sanborn, MN

Sod House on the Prairie is located in Sanborn, Minnesota and owned by Stan and Virginia McCone. The site includes a sod house, outhouse, small log cabin, dugout, and shed with paths through the prairie located behind their house and farm. Stan McCone started to build the structures in 1987. McCone first built the “soddy,” in the terminology of the family, in 1987 (Figure 5.6) and the dugout was the second structure on the property in 1988 (Figure 5.11). The name of the site at the McCone farm is *Sod House on the Prairie* and the interpreted time period is the 1880s. The *Sod House on the Prairie* receives a couple thousand visitors a year. There is a pay box at the house and then a path that leads through the landscape that allows the visitors to wind through at their leisure. At the beginning, there is a gazebo with information about the site and the *Save Our History: Frontier Home* episode playing the clip about building and living in a sod house with Stan McCone featured. Visitors can enter all the buildings, try on bonnets and aprons, and explore the prairie.

Shortly after McCone built the sod house, Mrs. McCone converted the sod house to a Bed and Breakfast. To be open as a Bed and Breakfast, the structure had to meet modern codes. Some of these codes dictated certain construction techniques and materials. The roof needed to be secured and to be weather tight and the floor had to be finished with a material that could be easily sanitized (wood compared to a dirt floor). The Bed and Breakfast hosted guests year-round and used the two stoves in the structure for heat.¹³⁸ Though there are many architectural features introduced to comply with

¹³⁸ Due to code requirements, Mrs. McCone did the cooking in the farmhouse on a modern stove.

motel and Bed and Breakfast code requirement, the structure's primary structure was still able to be sod.

The sod for the thirty-six by twenty-one foot sod house came from a plot of prairie on the neighbor's property about five miles down the road from the McCone farm. The prairie had never been disturbed making it original prairie as far as anyone knows. As discussed in the introduction to this thesis, the preferable grass for sod bricks is short grass with wiry compacted roots. The grass on the lot where the McCones harvested their sod bricks is a type of slough grass, which the farmer still mows today for hay and uses for pasture. There is no evidence on the original prairie lot where McCone harvested the sod blocks, because the grasses replaced the empty ribbons McCone removed.

The sod house has no foundation. The interior floor finish is wooden lumber salvaged from a flourmill (Figure 5.9). The flourmill was located in Minneapolis' warehouse district in 1890. When developers tore the flourmill down, they sold the lumber as salvage. McCone bought the salvage lumber and used it for the floor and roof system of the sod house and dugout.¹³⁹ The wood is most likely Douglas Fir, which is a very sturdy and hard wood. The walls are still the original sod blocks from 1887. The interior walls have a plaster finish. Historically, the settlers used a limewash or whitewash on the walls but the McCones decided on plaster because of the impression that would crack less and have the same aesthetics. The roof structure is made of timber braces and planks from the historic salvage wood (Figure 5.8). The current roof has a

¹³⁹ The lumber could also be from renovations of the Butlers Square building, Minneapolis.

rubber waterproof membrane with sod blocks on top. The 1987 roof had tarpaper like what the settlers would have put on their roofs for a water resistant membrane. The tarpaper leaked too much for contemporary standards and so the rubber membrane replaced the tarpaper soon after it was installed. The sod bricks on roof are wider and thinner than the sod bricks used for the walls which is consistent with historic trends. There are two stoves in the structure each vented through the sod roof. One pipe protrudes through the roof. To meet safety standards and to make the pipe sturdier, a brick chimney encases the stovepipe. The bricks are from a kiln that closed in New Ulm, Minnesota who gave away extra bricks after closing.¹⁴⁰

The sod bricks for construction are one foot wide, two feet long, and six inches thick. The roof bricks are three feet wide to stretch over the rafters. Due to the fact that Mr. McCone harvested the sod bricks using a sod cutter, the sod has straight edges and uniformity of depth throughout the sod bricks. The walls are two feet thick with two wythes of bricks. When McCone cut the sod, he would cut one strip one foot wide and then leave a foot width of prairie to help regenerate the prairie after its harvested. McCone used a sod-cutting machine pulled by a tractor for efficiency.¹⁴¹ The sod for the roof however used the historic sod cutter pulled by horses. “Save Our History: Frontier Homes” documentary from the History Channel interviews and displays the McCone’s

¹⁴⁰ The New Ulm brick kiln started making Aufderheide Brick in 1880. The kiln stopped production in 1953 and was torn down in 1987.

¹⁴¹ The name or description of this machine is no longer available.

sod house and dugouts.¹⁴² Stan McCone explains historic construction techniques and aspects about living in a sod structure.

The *Sod House on the Prairie* have a maintenance plan and techniques employed on the sod house and dugout to ensure structural stability. A potential threat to the stability of the structure is the tendency for birds and animals to make holes in the sod walls. Another factor besides pests may also threaten the stability of sod structures is the bricks shrink as moisture evaporates and under the load of the roof. One strategy used to mitigate these issues is filling the voids with concrete. The cement loosely sticks to the sod and fills the void. One disadvantage to the cement infill is the change in materials and force transmission may induce voids in various places. Another maintenance routine is replacing the roof sod bricks every five years. The owners' health concerns have deferred maintenance tasks on the structures.

After the sod house, Stan McCone built an eighteen by eighteen foot dugout in 1988 near the sod house. The McCones do not have a hill on their property so McCone built the dugout out of sod bricks, not in a hill. It is a dugout because the floor is below ground level by several feet. The interior has a dirt floor and interior dimension are considerably smaller than the sod house (Figure 5.12). It also has a loft with a ladder built out of lumber. Like the sod house, the dugout roof has a rubber waterproof membrane and a timber frame.¹⁴³

¹⁴² "Save Our History: Frontier Homes," *Save Our History* (New York: A & E television Networks, LLC, February 9, 2001), <http://digital.films.com.nuncio.cofc.edu/PortalPlaylists.aspx?aid=9527&xtid=43021>.

¹⁴³ Virginia McCone, *Sod House on the Prairie*, August 3, 2015.



Figure 5.6: Sod House on the Prairie



Figure 5.7: Sod House, upclose



Figure 5.8: Sod House side view of roof



Figure 5.9: Sod House interior



Figure 5.10: Sod House on the Prairie Dugout view from Sod House



Figure 5.11: Sod House on the Prairie Dugout



Figure 5.12: Dugout interior

Laura Ingalls Wilder Museum, Walnut Grove, Minnesota

The Laura Ingalls Wilder Museum in Walnut Grove, Minnesota has a replica of the dugout described in Wilder's book *On The Banks of Plum Creek* one mile away from the site of the actual dugout. The actual site of the Ingalls' dugout is on Stan Gordon's farm. The Gordons bought the farm in early 1947 and came to know of their property's historic significance later in 1947 after the purchase of the property. The illustrator of the Laura Ingalls Wilder books, Garth Williams, informed the Gordons that the farm had been the setting for the Laura Ingalls Wilder book, *On The Banks of Plum Creek*.

During July weekends, a local organization hosts the Wilder Pageant, located about a mile out of Walnut Grove. The pageant shows the life of Laura Ingalls Wilder and her family when they lived in Walnut Grove, Minnesota through reenactment. The pageant site has its own dugout made of dirt and railroad ties as wooden supports and movable sets of the town buildings. The museum, located in Walnut Grove, consists of a gift shop, schoolhouse, 1898 depot, a chapel, onion-domed house, covered wagon, an early settler's house, and the dugout replica. The gift shop is open year-round for visitors but the museum buildings are open from April to October. The Museum receives about 15,000 to 20,000 visitors total throughout the year.

The sod structure replica is located behind the gift shop on a path that leads guests from each museum building. The board and museum commissioned the replica in 2004. Stan Gordon, trained engineer, designed the concrete dugout from the dimensions from Laura Ingalls Wilder's *On the Banks of Plum Creek*. The replica's core is concrete but

the front interior and exterior façade and surrounding 'hill' is sod. To make the concrete form, the builder constructed the dimensions in a foam formwork (Figure 5.13). After the concrete cured, the formwork was removed. To form the top of the replica, a crane laid long precast slabs of concrete on top of the cast walls. The interior is plaster on three walls to look like whitewash, and the front wall, with the entrance, is a sod brick veneer. There is a false ceiling of logs inside. The floor is made of gravel and dirt, a material usually used as road grade. The interior of the replica is shown in Figure 5.17. There is no membrane on the roof and it leaks during the occasionally heavy rainstorm. The front facade is sod blocks with rebar and chicken wire reinforcement against the concrete structural wall. The sod is laid so the rebar protrudes horizontal through the back of the sod and the chicken wire is between some layers for extra horizontal stability. The sod is from the Gordon farm, near the site of the original dugout.

Since there is no hill at the museum site, the core is set on flat land with dirt pushed against the sides. A prairie mixture of grasses grow on the dirt now to give the impression that the dugout is in a hill with continuous sloping prairie from the sides to the top. The sod bricks on the facade are sixteen to eighteen inches long and taper from eleven inches wide at the base of the wall to six inches wide near the top of the wall. The sod wall can be this thin because the concrete core performs the majority of the structural work. One of the cynical maintenance procedures is watering the sod on top of the dugout and watering the replanted prairie around the site. The sod and prairie need watering about every three days during dry weeks. The sod has to be replaced when it shrinks too much or when birds make holes. The sod has settled about twelve inches in

the past year leaving the rebar and concrete exposed. Figure 5.16 shows the sod settlement. Every couple of years, the façade is refreshed with new sod bricks. Volunteers, usually on the board of trustees, and the local FFA chapter do the sod replacement work. The roof has had prairie grass and seeds added once since 2004. The museum does spot repairs as needed between major sod replacements.

A rented commercial sod cutter cuts the new sod for replacement into long six-inch wide rows. Then a lawn edger cuts the rows of sod into bricks about sixteen to eighteen inch long. In the future, the museum is considering a historically accurate sod cutter for cutting sod bricks. Extra sod is currently on a pallet at the Gordon's farm for expeditious replacement.

The original dugout site located at the Gordon's farm has no modifications or rehabilitation efforts (Figures 5.19 and 5.20). The dugout itself has collapsed into the hill and a sign rests upon it locating the spot. Since the original dugout probably used willow branches for support, after the family moved out of the dugout the willows branches deteriorated quickly because of moisture because they were not dried regularly by use of stove. The dugout probably collapsed within five years of vacancy according to Joel McKiney's, the collection manager, research. The road leading up to the site is graded and has routine maintenance. There is a little parking lot and bridge over the creek. As of now, there is no desire to implement an archaeological investigation. There are signs

around the landscape explaining different features mentioned in the book. The site is only open in the summer months along with the museum's replica.¹⁴⁴

¹⁴⁴ Joel McKinney, Laura Ingalls Wilder Museum Dugout, August 6, 2015, December 15, 2015.



Figure 5.13: Laura Ingalls Wilder Museum Dugout Replica building form (Laura Ingalls Wilder Museum)



Figure 5.14: Newly constructed replica (Laura Ingalls Wilder Museum)



Figure 5.15: Laura Ingalls Wilder Museum Dugout replica, front view



Figure 5.16: Dugout replica, front view



Figure 5.17: Dugout replica interior



Figure 5.18: View of prairie at Laura Ingalls Wilder Museum



Figure 5.19: Dugout at Gordon Farm



Figure 5.20: Dugout at Gordon Farm, closeup

Minnesota Historical Society's Sod House Exhibit in the Then Now Wow gallery

The Minnesota Historical Society is located in St. Paul, Minnesota and the Then Now Wow gallery is the permanent theme for the gallery. In the gallery, there is a sod house and frontier exhibit installed in 2012. The interactive exhibit's target audience is Minnesota sixth graders because that is the year Minnesota Education curriculum teaches the state's history. This exhibit has an interactive plow and a sod house that one can walk through and explore through visual, audio, and tangible elements. The exhibit also has photographs of settlers. The museum had a synthetic sod brick made with the replica to display in a glass case for further interpretation (Figure 5.24). There is information scattered throughout the exhibit about sod house life.

The replica of the sod house is constructed with a wooden frame made from two by four lumber and plywood with a carved white bead foam sandwiching the structural frame. A textured coating made from glue, dirt, and straw coats the foam to convey the texture of earthen sod. The dimensions of the sod house are from the Rollag family diary entry of a pioneer in Minnesota.¹⁴⁵ The dirt is from a southwestern Minnesota farm that Minnesota Historical Society staff member owns. After acquiring the dirt, the vendor sifted it for unwanted organic material and baked it to sterilize it for museum use. The straw mixed with the dirt is raffia. The interior has newspapers plastered throughout (Figure 5.22). Blue Rhino Studio in Eagan, Minnesota constructed the replica in pieces

¹⁴⁵ The Rollag family consisted of five people and they all lived in a sod house now represented in the exhibit, for seven years. They were of Norwegian decent and settled in an area called Beaver Creek in Rock County, Minnesota.

and then assembled in the exhibit gallery. First, the vendor built the interior back panels, the media staff installed the audio-visuals and then the exterior panels and details completed the assembly. The construction took a month with the on-site assembly required two weeks out of the month. The texture of the replica sod is intended to convey a sod house that has been through the weather for three years. One corner of the sod house is painted white with a snowy backdrop to signify the harsh winters in Minnesota. There are visual and audio components of the interpretive experience throughout the house and exhibit with many interactive displays.

The replica is highly protected from weather exposure because it is indoors. Visitors of all ages engage with the exhibit. The exterior and interior texture of the replica presents a tangible display of a sod structure and encourages visitors to interact and touch the rough texture of sod. The exterior glue, dirt, and straw mixture is very durable and prevents wear and tear from the visitors.¹⁴⁶

¹⁴⁶ Aaron Novodvorsky, "Sod House in TNW Exhibit," December 28, 2015.



Figure 5.21: Exterior sod house replica in the Then Now Wow Exhibit



Figure 5.22: Interior newspaper finish



Figure 5.23: Interior roof finish



Figure 5.24: Frontier exhibit



Figure 5.25: Example sod brick:



Figure 5.26: Exterior of sod house replica

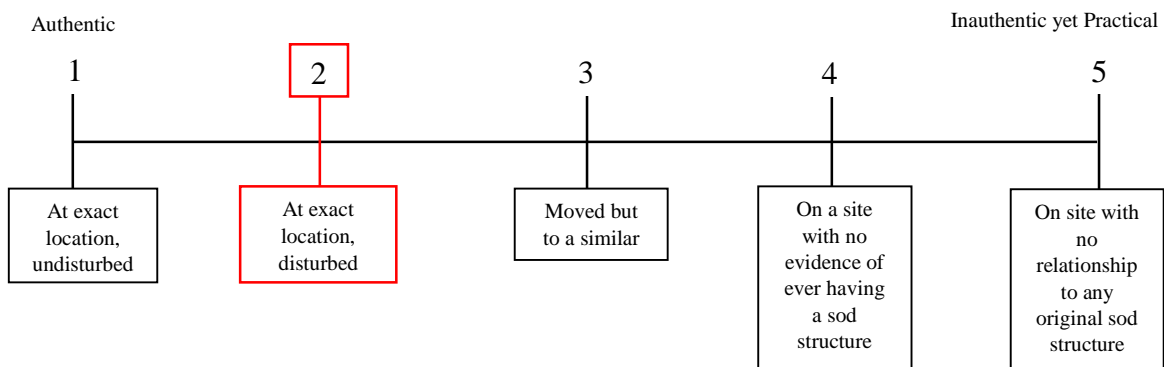
Analysis-Site Ratings

The next set of scales ranks the case study sites to the eight ranking scales previously discussed. Each site will receive a total average score based on all eight categories. The explanations for each ranking is below the scale. After all four receive an average total, they will be compared to each.

Oklahoma Sod House Museum

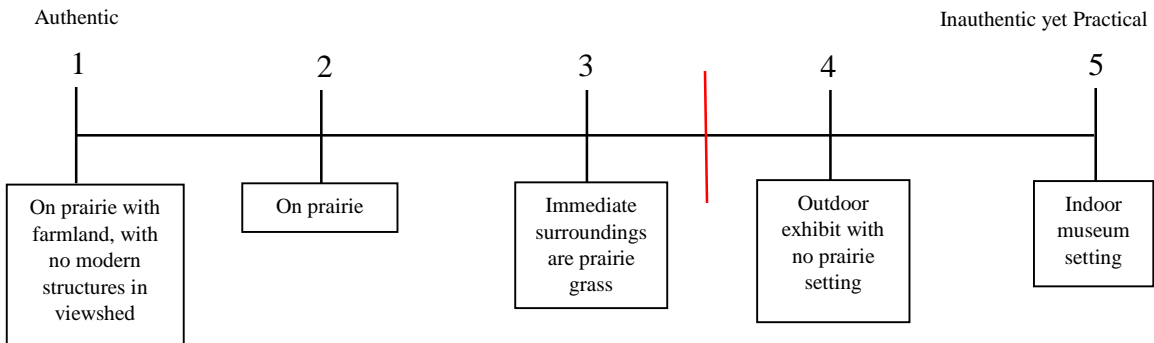


Location – 2



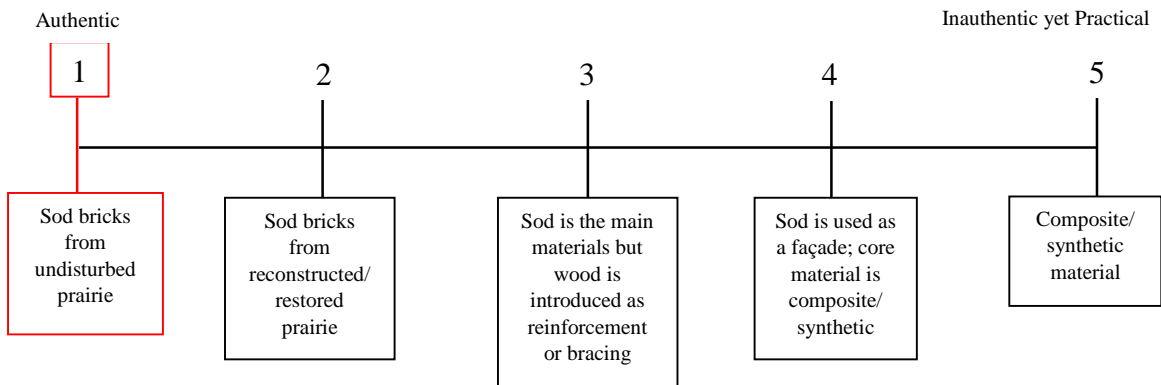
The location is authentic because the sod house is on the same location McCully built it. A major highway located next to the site has disturbed the location. The Oklahoma Sod House Museum receives a two because the site is disturbed from its original prairie.

Setting – 3.5



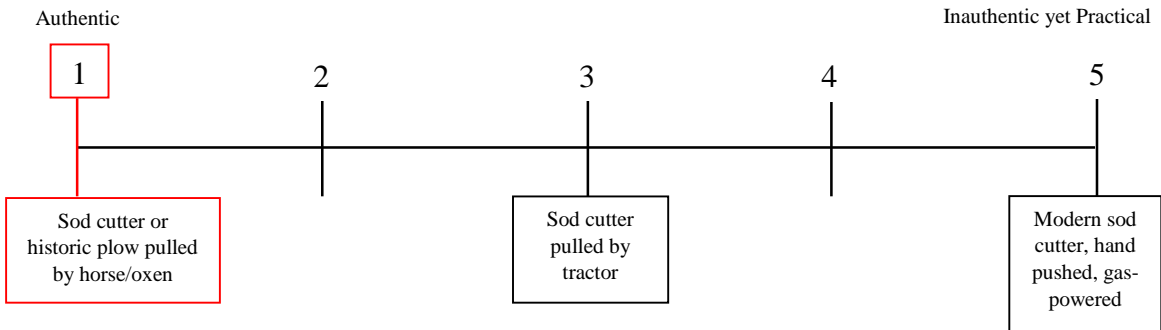
The sod house is now in a barn to protect it from the weather and prevent further deteriorating. The floor of the barn and walkways up to the sod house are concrete pathways. The setting for the Oklahoma Sod House Museum is between a three and four because the prairie surrounds the museum but the sod house viewshed is no longer intact. Also, the concrete walkways is not authentic to the nineteenth century.

Building Material—Sod – 1



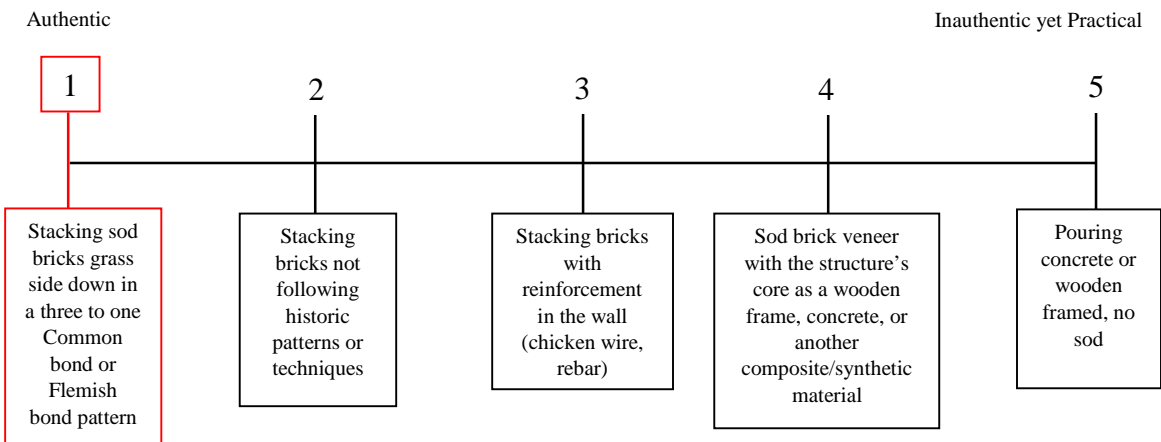
The sod bricks are from the undisturbed nineteenth-century prairie making them authentic.

Sod Cutting – 1



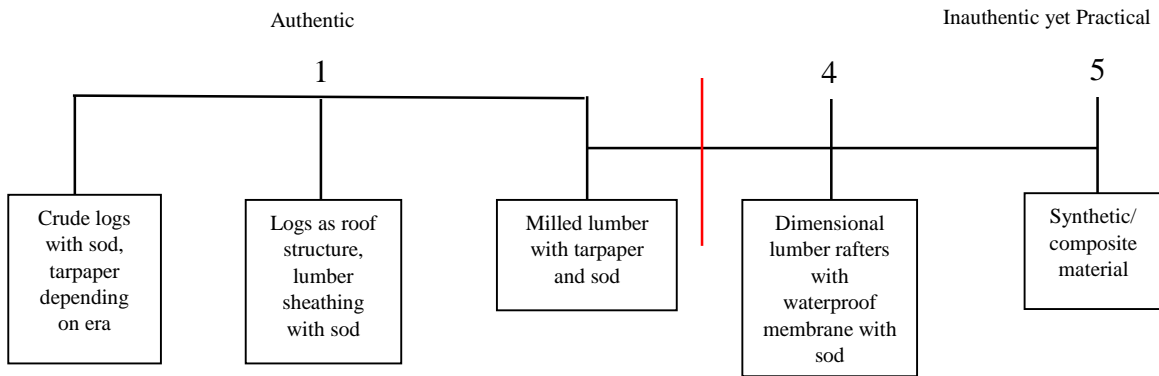
McCully only had nineteenth-century resources when he built the house so the sod cutting is authentic.

Construction Methods – 1



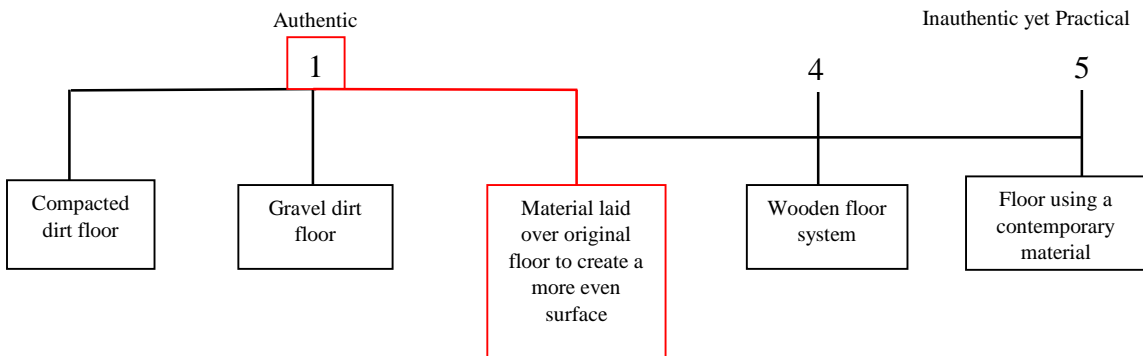
The construction method employed at the Oklahoma Sod House Museum ranks as a one because the building is original to the nineteenth century, McCully stacked the bricks with grass side down, and every other row has opposite brick laying patterns.

Building Materials—Roof – 2



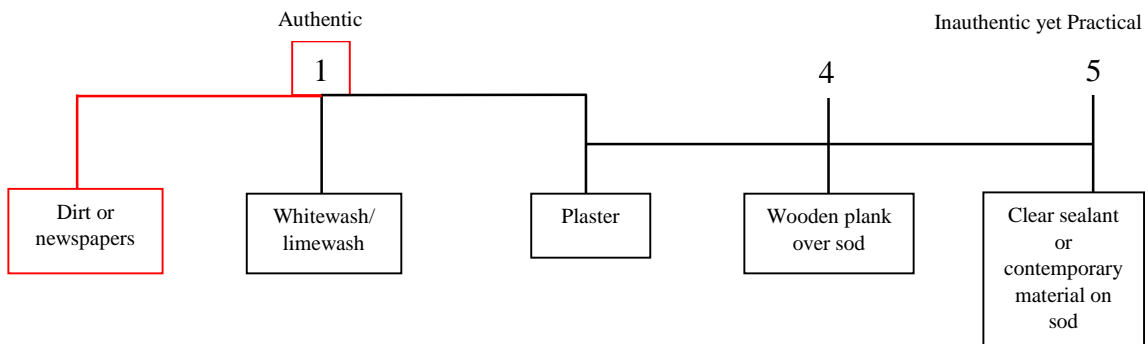
The roof is a mock sod roof with reinforcement. The wooden ridgepoles are original but have several supports added. The roof is a two on the scale because the original ridgepoles are authentic yet the mock plastic sod is not authentic.

Flooring – 1



The floor was originally dirt but McCully added the wood floor in 1895. Though the floor is not original to time of construction, it is still authentic to the time period and original owner. The sod house receives a one because there is evidence of its construction year and that year makes it authentic to the nineteenth century.

Interior Finish – 1



The interior finish is clay packed on to the sod bricks, which McCully added at time of construction. In addition, the McCully family added packed clay as needed through the years for stability and to keep the animals out. Since the interior finish dates to the nineteenth century, it rates a one for authentic.

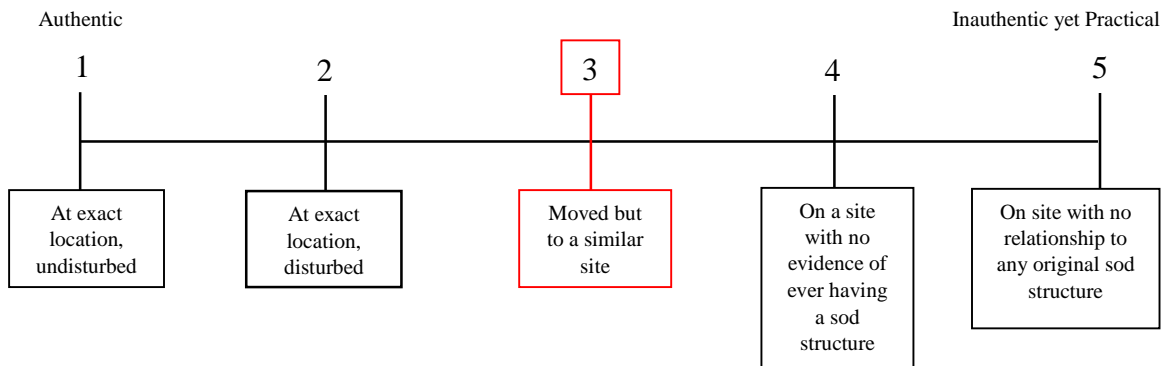
Average = 1.5

The Oklahoma Sod House averages at a 1.5 on the scales. It is almost completely authentic because the Oklahoma Historical Society took an original nineteenth-century sod house and protected it from weather. The features, like the barn, that compromise the authenticity are also, perhaps paradoxically, enabling the ephemeral architecture to endure.

Sod House on the Prairie



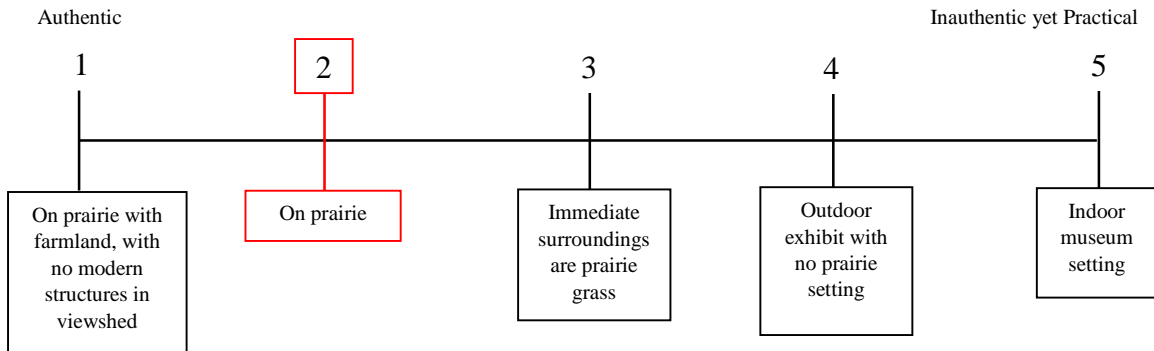
Location – 3



The location of the *Sod House on the Prairie* is on farmland that has been returned to prairie. The geographic location is on southwestern Minnesota’s Great Plains. The sod structures are not on the exact sites of historic sod structures but could be very close.

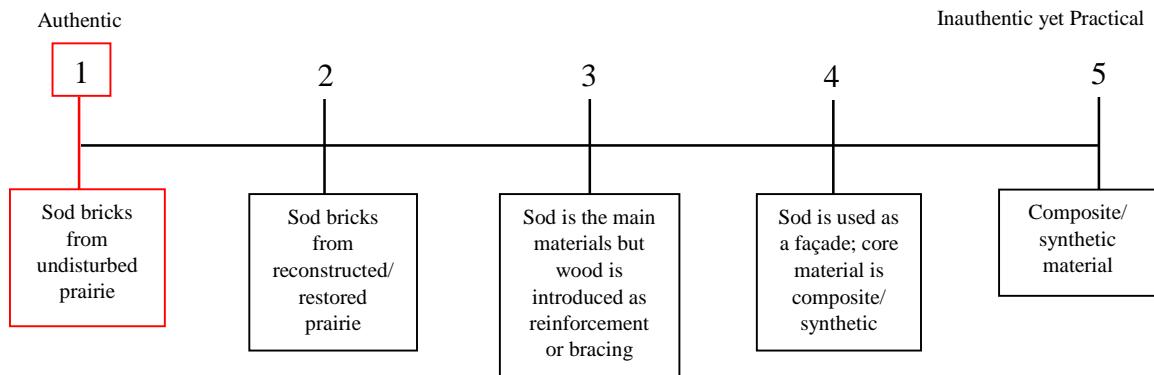
Since it is not at the exact location but in the area that many settlers built sod structures and farmed, the site receives a three.

Setting – 2



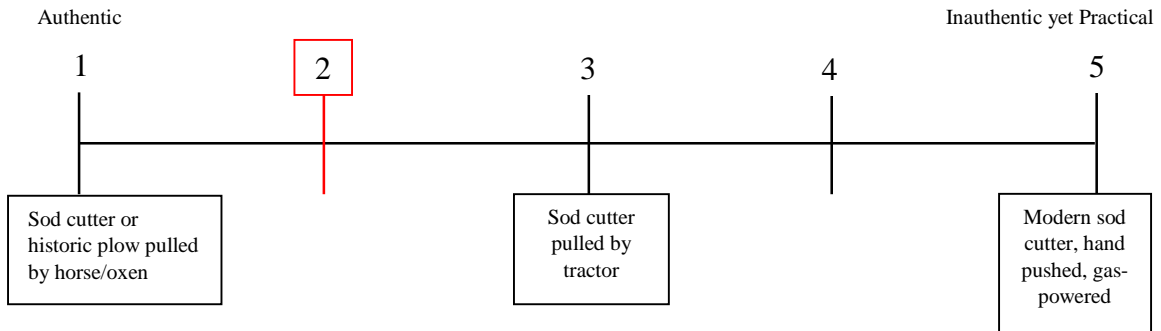
The surrounding area is farmland with a view of crops and prairie. The site has many smaller sod structures and a setting of a nineteenth-century homestead. There is a twentieth-century farmhouse and metal barns also on the McCone’s property. The site receives a two because the viewshed is mostly authentic with crops and prairie but guests can see part of the farmhouse from the sod house site.

Building Materials—Sod – 1



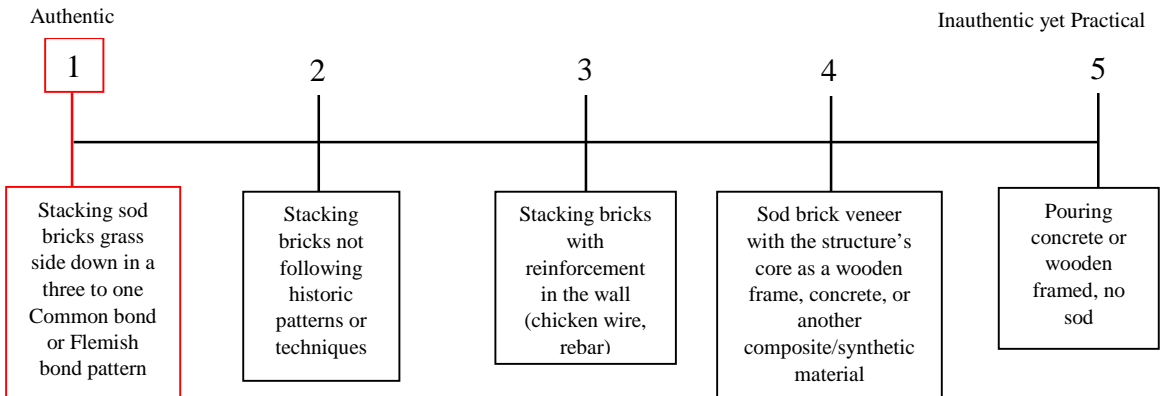
McCone used undisturbed sod from a neighbor's plot. The plot has been in the neighbor's family for over hundred years and the plot has only ever been grazed or mowed.

Sod Cutting – 2



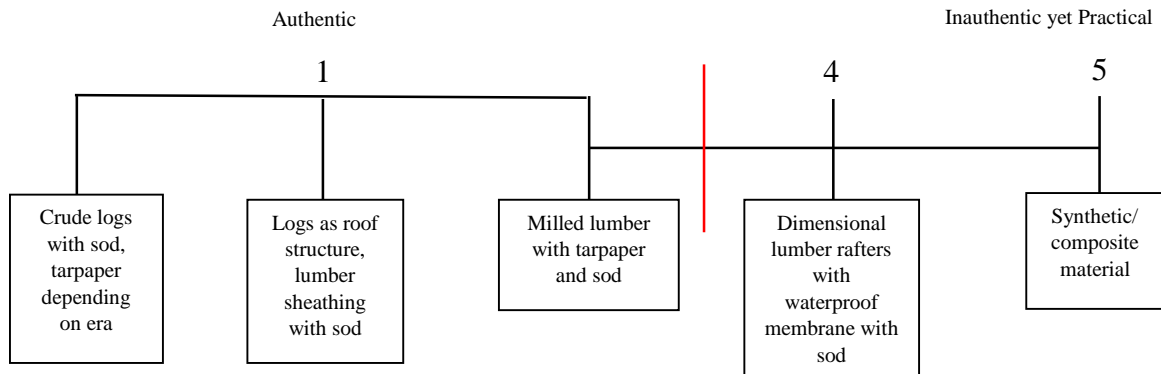
To cut the sod house bricks, McCone used a tractor-pulled machine. For the dugout, he used a nineteenth-century sod cutter and horses. The *Sod House on the Prairie* receives a two because first McCone used a twentieth-century machine but then used an authentic nineteenth-century sod cutter with horses, which is still on display.

Construction Methods – 1



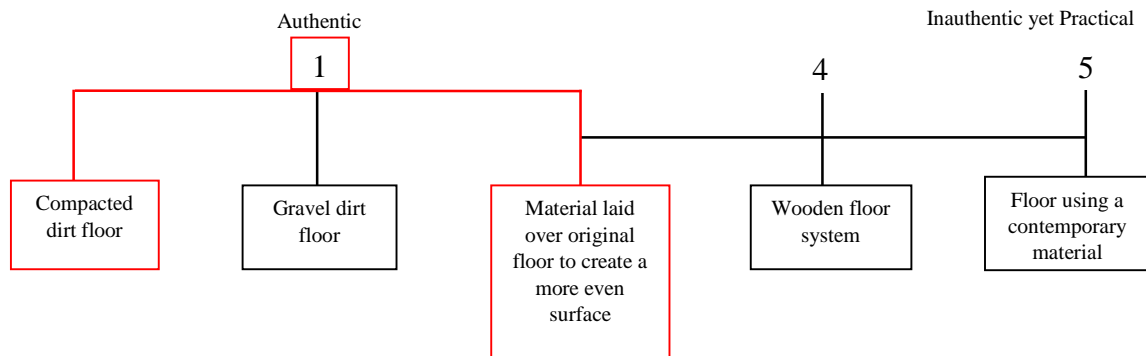
McCone laid the sod bricks following the nineteenth-century practice of placing sod bricks with the grass side down and alternated laying patterns every three rows. He followed many personal accounts to construct the building authentically. It receives a one because the methods mirror those of nineteenth-century construction.

Building Materials—Roof—3



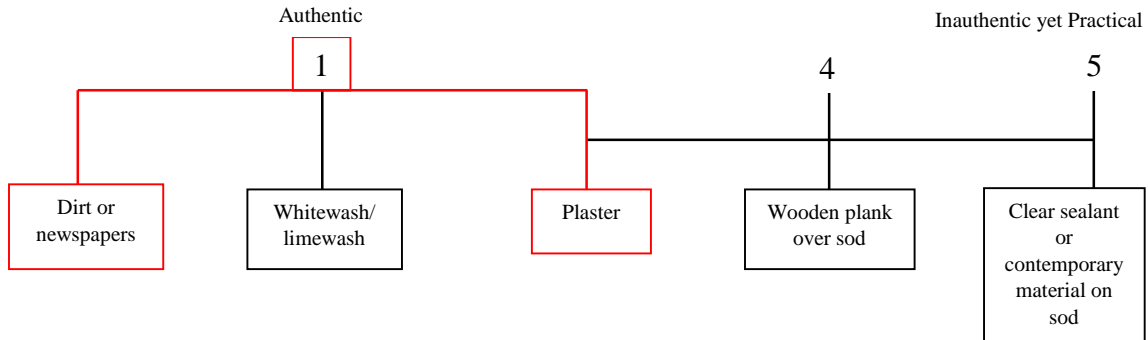
The sod structure’s roofing material contains milled lumber, a waterproofing membrane, and sod. The lumber is from a Minneapolis flourmill that dates to the late nineteenth-century. The roof has a rubber membrane between the planks and the sod. There is real sod from the same prairie as the bricks on the roof. It receives a three because the lumber is from the late nineteenth century and the sod are both authentic but the rubber membrane is a synthetic material used for a practical purpose.

Flooring – 1



The sod house has milled lumber from the Minneapolis flourmill for floorboards. The dugout has a compacted dirt floor. The site receives a one because of the use of the milled lumber is authentic.

Interior Finish – 1



The interior finish of the sod house is plaster. There is plaster because health and safety reasons and to prevent the dirt from falling from the bricks. The dugout interior walls are the exposed sod bricks. The site receives a one because even though the dugout and sod house have different interior finishes, both are authentic.

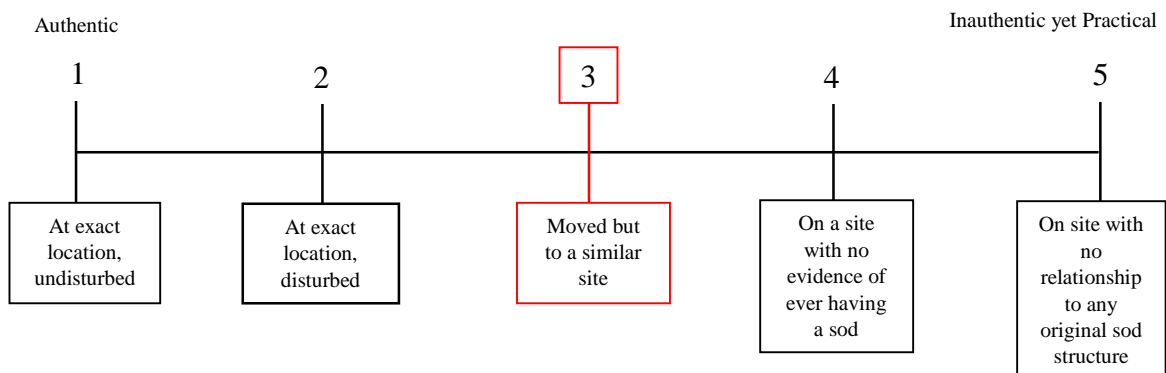
Average = 1.75

The *Sod House on the Prairie* averages a 1.75 score. Compromises on the part of authenticity allowed the building to be used similar to the original programming as housing. The *Sod House on the Prairie* has a several authentic techniques and materials as well as practical materials for health and safety reasons and meet building codes for a Bed and Breakfast. Where possible authenticity was highly valued and overall, it is a very authentic replica.

Laura Ingalls Wilder Museum Dugout Replica

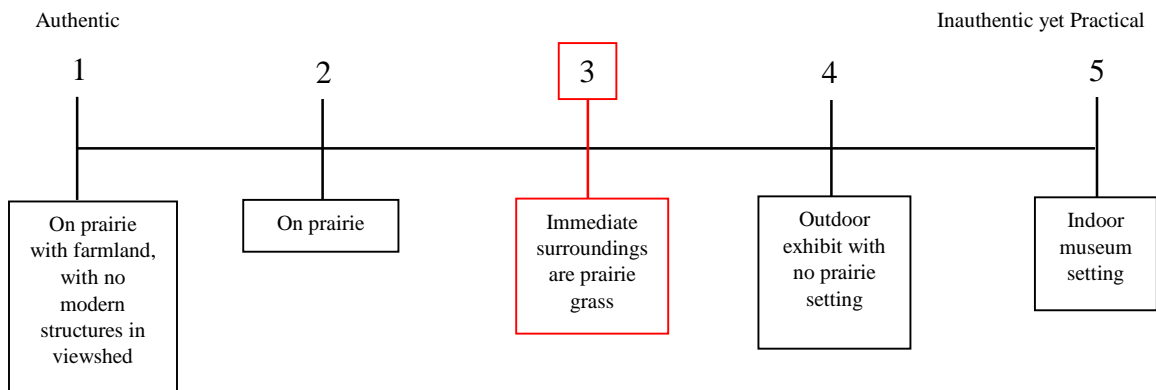


Location – 3



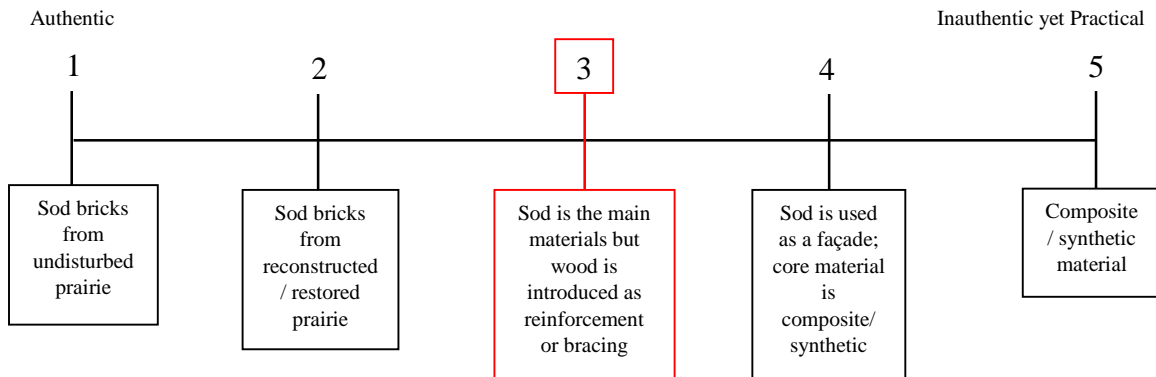
The location of the dugout replica is in town but the actual site of the original Ingalls' dugout is less than five miles away on the banks of Plum Creek at the Gordon's farm. It receives a three because the replica is interpreted and related to a nearby nineteenth-century dugout site, but it is at a distance from the replica.

Setting – 3



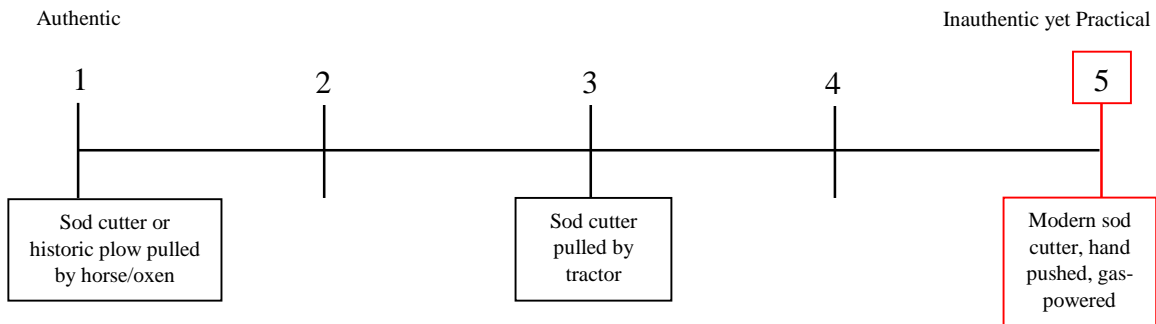
The replica is in town at the museum next to several museum buildings and a small prairie patch for context. Plum Creek, prairie and farmland surround the Ingalls's dugout location give it an authentic viewshed. The Laura Ingalls Wilder Museum Dugout Replica receives a three because the replica has an immediate prairie patch and the nearby original site adds interpretation context.

Building Materials—Sod – 3



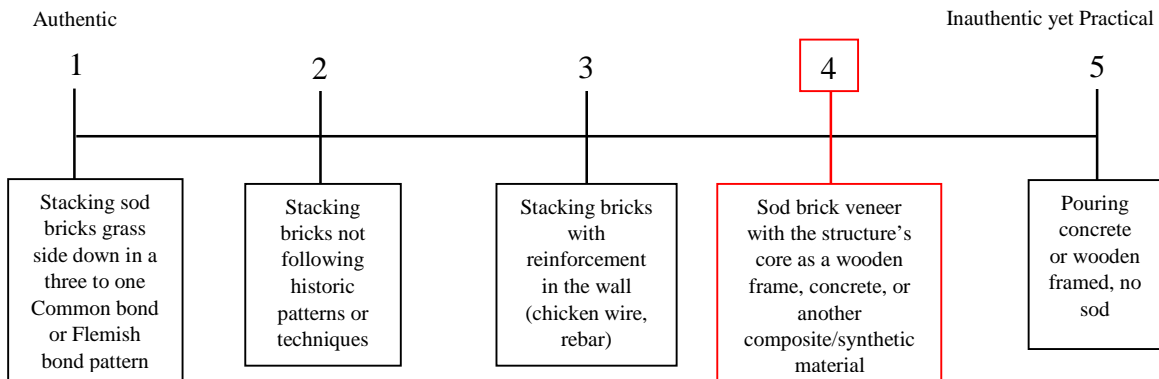
The sod is from the restored prairie located on the same plot as the original dugout site at Gordon’s farm. Also, there is a surplus of sod brick kept in the Gordon’s barn that the museum uses for replacements and repairs. The replica received a three because the prairie is disturbed then restored and the sod brick façade has chicken wire and rebar reinforcement throughout.

Sod Cutting – 5



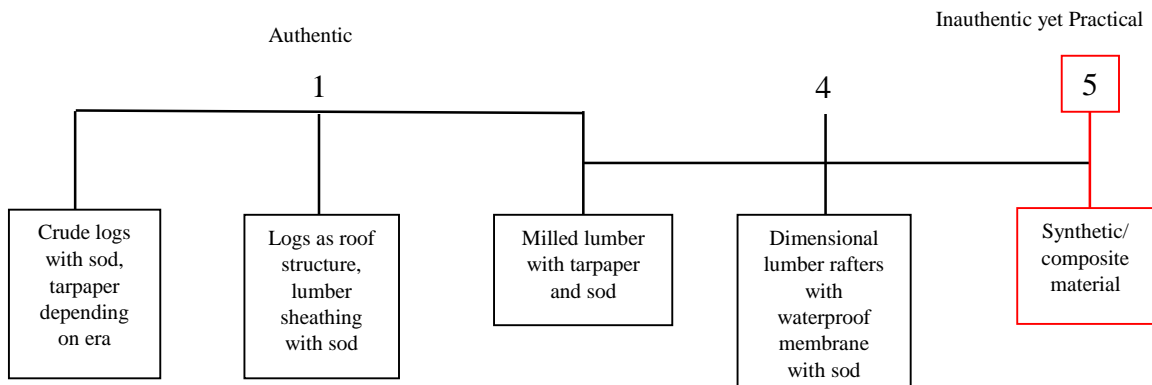
It earns a five because the museum volunteers cut the sod bricks with a rented contemporary sod cutter.

Construction Methods – 4



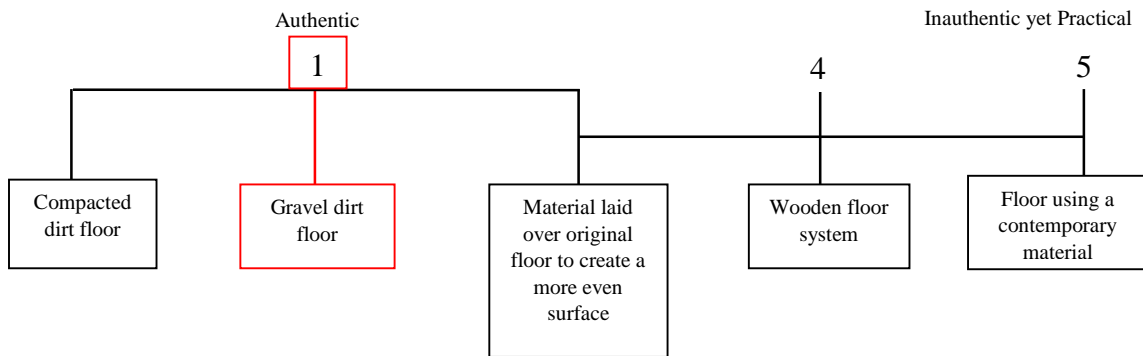
The interior core is partially poured-in place and partial precast concrete. The front façade has stacked sod brick cladding interior and exterior. A backhoe dug the replica's foundation footings and a concrete mixer poured concrete into the footings. Next, foam wall forms were set in place with wooden supports and concrete was poured into the forms. The roof panel is precast concrete and a crane set onto the walls. It received a four because construction techniques used contemporary machinery and equipment to build the concrete core making the techniques more practical than authentic.

Building Materials—Roof – 5



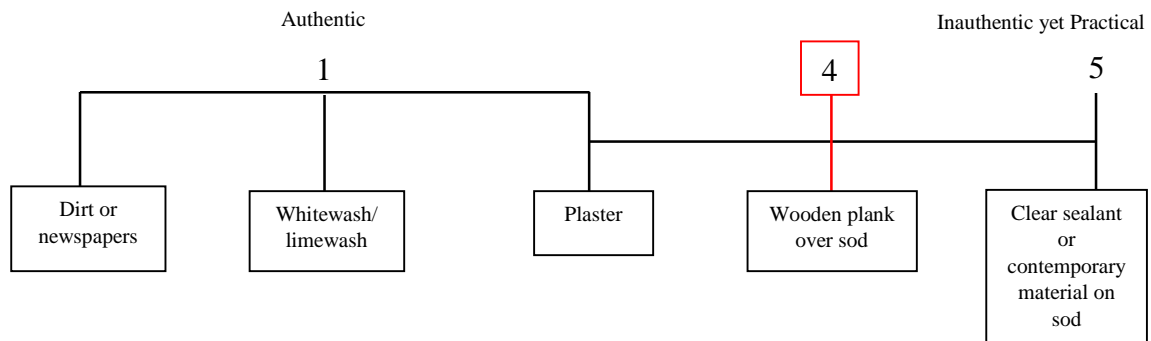
The roof is made of precast concrete with an interior timber façade. The timber façade looks like round timber logs. The replica receives a five because the concrete is a contemporary material and the timber façade is dimensional lumber making none of the materials authentic to the nineteenth century.

Flooring – 1



The flooring of the replica receives a one because it is road gravel with extra dirt.

Interior Finish – 4



The front internal façade is sod bricks with concrete behind it. The other three walls are painted white to look like plaster and the texture of the back walls are that of concrete. It

gets a four because the sod is authentic but three-fourths of the building is made of concrete and paint which is inauthentic.

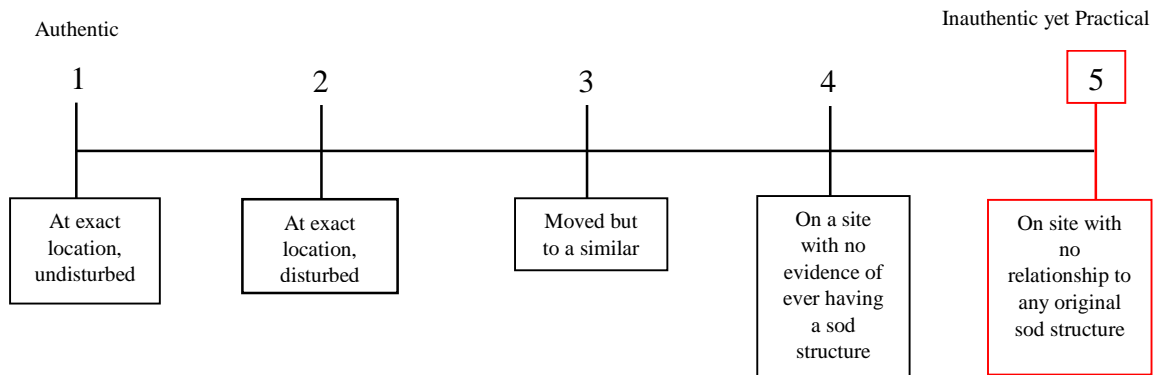
Average = 3.5

The Laura Ingalls Wilder Museum Dugout Replica averages a 3.5 on the scales. It utilizes sod bricks for aesthetics and texture of the front façade but the core is made of concrete. Guest safety was in the decision making process and a sod roof has a higher risk of collapsing. Also, maintenance for the site was a factor and concrete is easier to maintain. This replica is of moderate authenticity. Visually it is more authentic than it ranks.

Minnesota Historical Society Sod House Exhibit in the Then Now Wow gallery

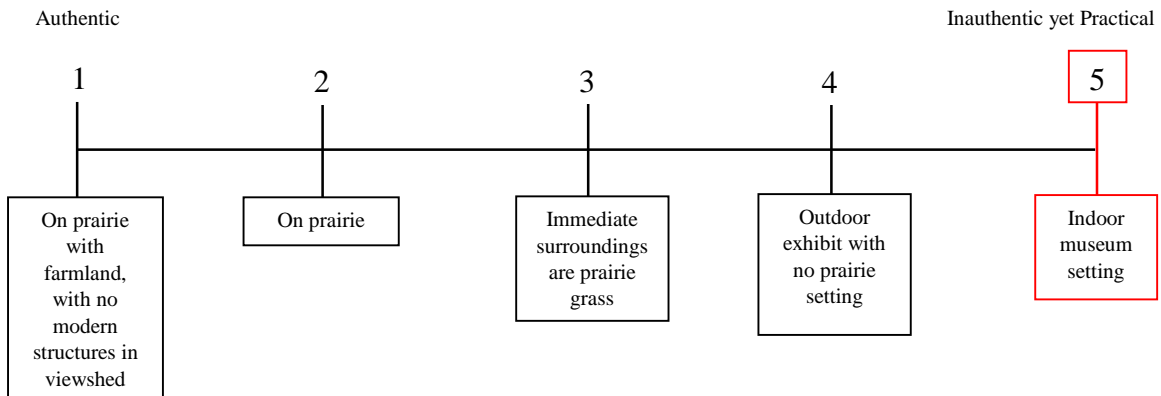


Location – 5



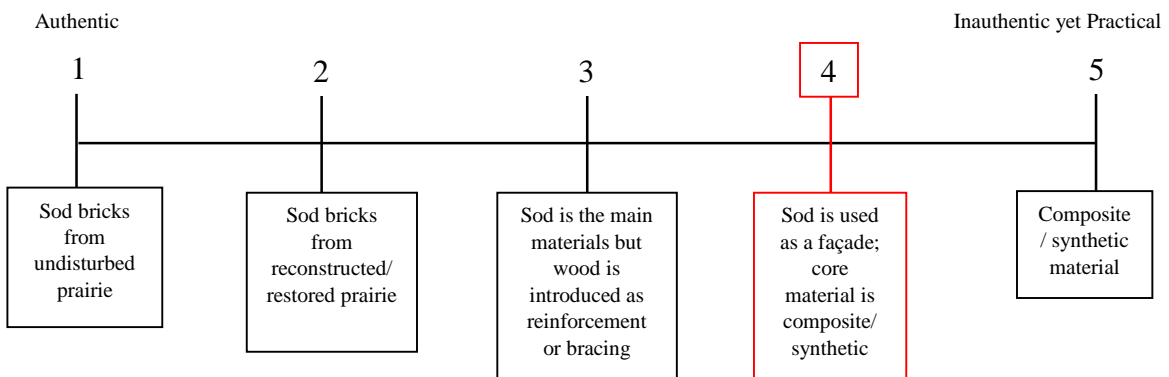
The exhibit is located inside the Minnesota Historical Society’s History Center in St. Paul, Minnesota. It is located in a state that once had sod houses but is located in a city on a river that probably had few or no sod structures. The sod house replica gets a five because its interior location, which is not authentic but a practical means for maintenance and guests.

Setting – 5



The exhibit's sod house is on the third floor of the Minnesota History Center in the Then Now Wow gallery. The Then Now Wow gallery has about eight different exhibits. The exhibit features panels of information, a sod house, and an interactive plow. It receives a five because it is at an interior location with no prairie and the context is on panels.

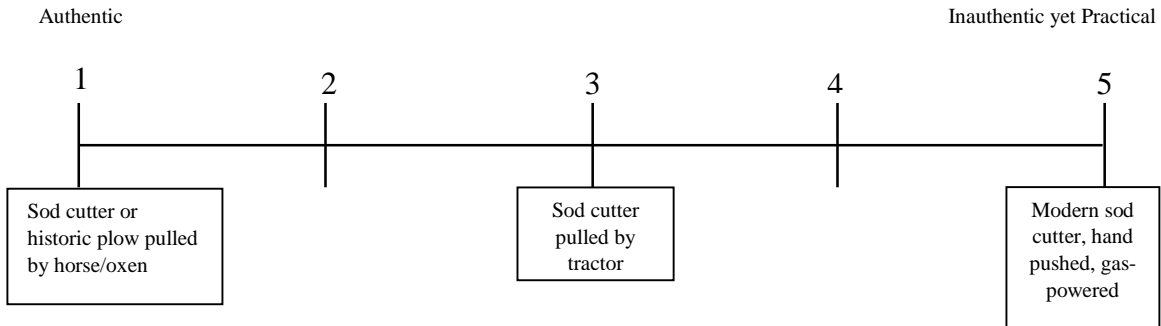
Building Materials—Sod – 4



There is no sod but there is local sourced dirt that is mixed with glue and straw to form the exterior and interior texture. The replica gets a four because there is no sod but there

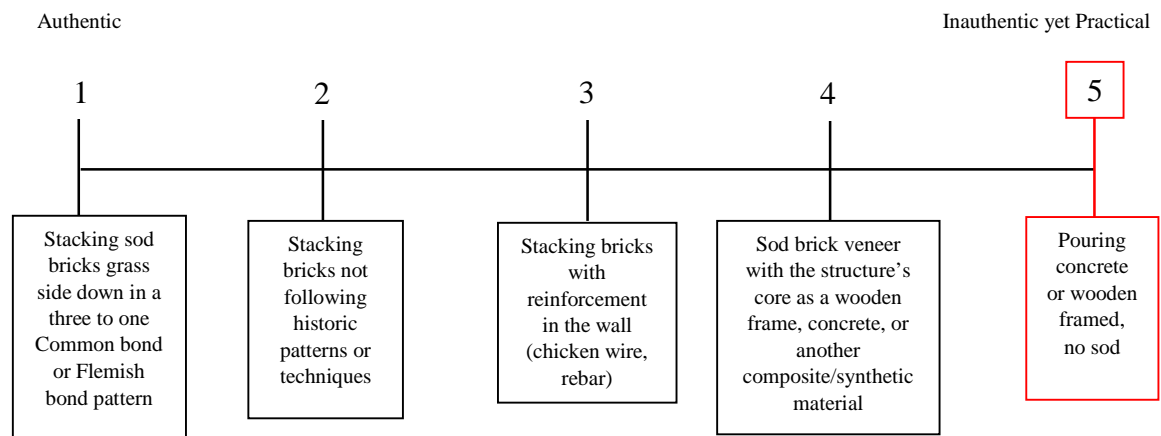
are two materials, dirt and straw, that come from the earth making it practical with some authenticity.

Sod Cutting – n/a



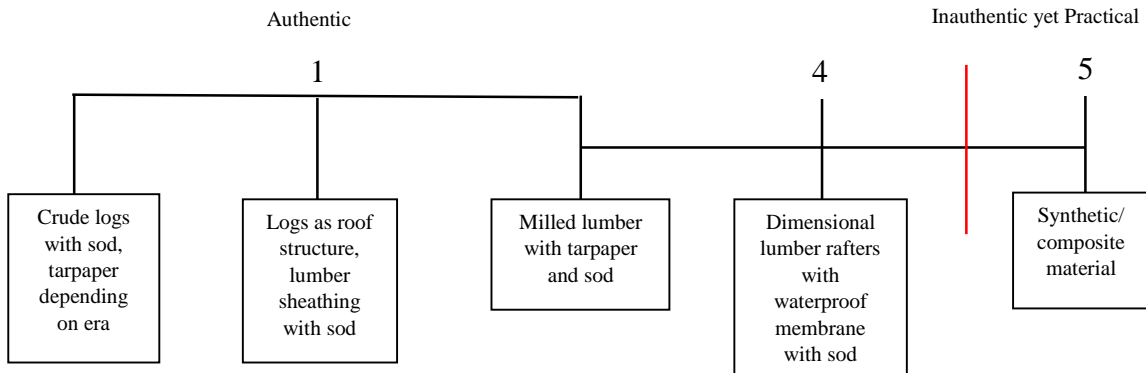
There is no sod in this replica.

Construction Methods – 5



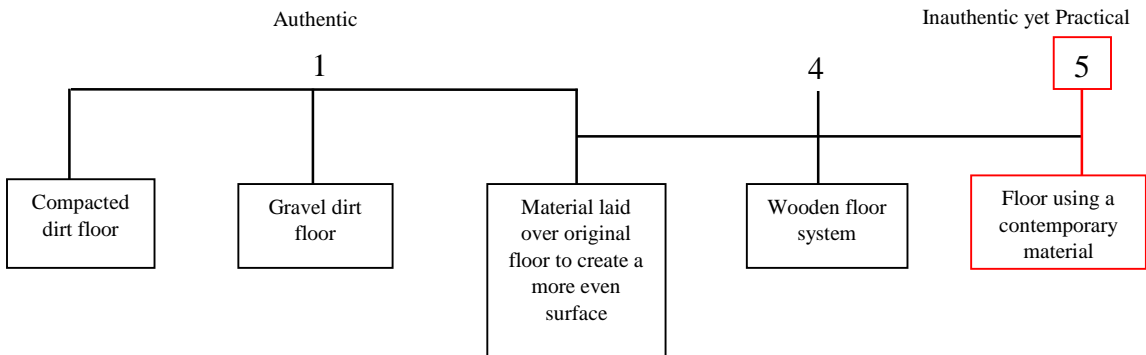
The replica is a lumber and plywood structure with carved white bead foam to give the irregular stacked sod brick look. A mixture of glue, straw, and dirt form the exterior texture. The replica earns a five because the materials are contemporary and constructed with contemporary equipment.

Building Materials—Roof – 4.5



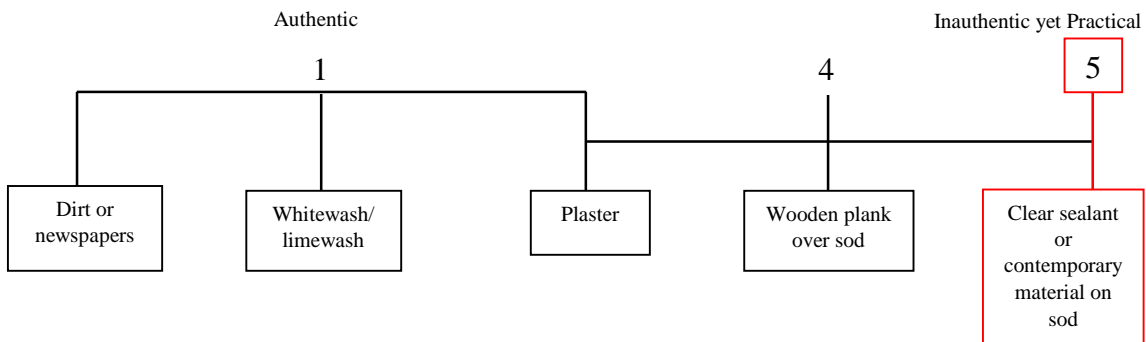
The roof has a plywood and lumber frame with timber placed on the interior to look authentic. The top of the roof is made of fake plastic plants. Because the roof uses a fake façade to look authentic and the plants on top are plastic, the replica receives a four.

Flooring – 5



The floor is that of the History Center, concrete with a thin layer of carpet which gives it a five because the flooring does not represent any form of flooring used in the nineteenth century.

Interior Finish –5

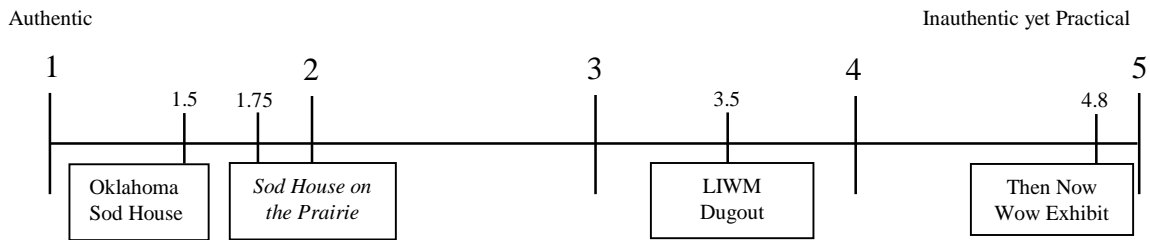


The interior finish is white paint with plastic newspapers. There is an information sign about the use of newspapers as authentic interior finishes but the replica does not use authentic newspapers. Since the newspapers are plastic and are very practical and inauthentic, the interior gets a five.

Average = 4.8

The Then Now Wow Frontier Exhibit averages a 4.8 on the scales [sod cutting was not used in this average]. The replica did not apply to one of the categories, sod cutting, because there is no actual sod involved in the replica. This exhibit is indoors and is very practical in materials and construction. There is little to no maintenance on the replica itself and reaches a wide audience. The practicality of the display can be excused, or perhaps the inauthenticity deserves to be more greatly commended, based on the number of visitors the center educations.

Averages and Summary of the Four Case Studies



There are many reasons why there are contemporary materials in a sod structure replica. One reason is safety for guests. Introducing contemporary materials is more practical than trying to find a way to secure a completely authentic structure. A museum needs a space that is safe for visitors to explore without the risk of a roof caving in or a sod wall falling down on guests. The *Sod House on the Prairie* implemented inauthentic yet practical materials, such as a wood framed roof and wooden floor planks, because of health and safety hazards for bed and breakfast building code. Settlers did report different hazards associated with living in sod structures such as cave-ins, walls falling, and roofs blowing off. Practical measures can reduce the risk of the safety hazards. Safety is important for an institute that has many guests visiting who explore the exhibit and site.

Location and setting are variables that have a strong relationship. The further a site, such as the Then Now Wow exhibit, is from the prairie the less authentic the setting. The Then Now Wow exhibit has a large audience that can view the interior exhibit in a gallery with other exhibits together more easily than an exhibit in rural Minnesota thus the volume of visitor education must be weighed against the degree of authenticity of the experiences. An authentic sod structure replica would be out on the prairie near the

location of the original nineteenth-century sod structure. This is not always practical for visitors to explore because of traveling, time, and monetary reasons. Both *Sod House on the Prairie* and the Laura Ingalls Wilder Museum are located in rural Minnesota but the name, Laura Ingalls Wilder, associated with the Museum's dugout attracts visitors. *Sod House on the Prairie* is located about eight miles away from the Laura Ingalls Wilder Museum, making it an attraction for the same audience. The location and audience influences, the building techniques and materials of a sod structure replica.

There are also natural correlations between materials and the context. If the site is indoors, composite or synthetic materials may be preferred. However, indoor exhibits could have authentic materials because they would be protected by the enclosing structure making the materials last longer. If the site is outdoors, there could also be more flexibility with authentic materials. *Sod House on the Prairie* used authentic building materials because they had sod available at a neighbor's land and the wood used was from a nineteenth-century structure. The Laura Ingalls Wilder Museum dugout replica is outdoors, but the site used a practical approach using a concrete structure to reduce maintenance and increase safety. Then the museum added an authentic façade using sod bricks from a restored prairie over the concrete. The museum created a balance for their needs. The Then Now Wow's indoor exhibit used synthetic and composite materials because it is more practical for a low maintenance indoor replica and the larger number of guests who interact with it at the museum. The Then Now Wow exhibit chose inauthentic yet practical materials for its indoor exhibit. These different materials affect different construction methods. Indoor exhibits can still use sod bricks and the sod

bricks may last longer because of the controlled conditions. The Oklahoma Sod House Museum added a structure around the McCully sod house to preserve it longer. If an authentic sod structure is built inside, it will last longer because it will not be exposed to the weather elements that cause deterioration.

Construction methods depend on the materials the replica uses. If the replica uses sod, then the historic methods are clearly the most authentic. If a replica uses synthetic or composite materials, the construction methods will depend on the materials' use and manufacturing. The Then Now Wow exhibit's materials are plywood and a lumber frame with white foam. The construction of this is far different from *Sod House on the Prairie*'s sod walls.

Cutting sod technology has changed from the nineteenth century. To be authentic a site would use a sod cutter or nineteenth-century plow pulled by horses or oxen. An inauthentic yet practical sod cutting practice would be to use a gas-powered commercial sod cutter. McCone used a sod cutter with a tractor the first time he cut sod for the *Sod House on the Prairie* because it was slightly more practical than a traditional sod cutter with horses. He later started using an authentic sod cutter with horses for his second sod structure. On the other end of the spectrum, the Laura Ingalls Wilder site uses a commercial gas-powered sod cutter because it is easier and more readily accessible than a traditional sod cutter. The site is considering making or finding a traditional sod cutter to make the experience more authentic. Depending on the interpretive uses of the sod cutting, a contemporary method would be faster and easier, but the traditional methods are authentic and have the potential to become part of the interpretation.

Each site has a different interpretation of the roof materials, flooring, and interior finishes. The Then Now Wow exhibit and the Laura Ingalls Wilder Museum both use a façade to show an authentic roof structure because of the core materials. Using a façade is inauthentic yet practical because the core materials used in the replica do not allow for an authentic appearance by themselves. The *Sod House on the Prairie* also uses lumber, but the lumber is from a nineteenth-century building, making it authentic to the time period. The Oklahoma Sod House Museum is the most authentic, because it has the original ridge poles in place. The plastic sod on top is inauthentic yet practical because there is less weight on the ridgepoles and the plastic sod is cleaner than real sod for maintenance purposes.

Flooring is difficult to put on a strict ranking scale because different materials of a nineteenth-century sod floor can be authentic. Only one of replica sites has a compacted dirt floor, *Sod House on the Prairie's* dugout. The Oklahoma Sod House Museum has left the 1895 wooden floor addition, so it is authentic to the sod house history. The *Sod House on the Prairie* has a wooden floor for both authenticity but also for practicality. The wood for the floor is from a nineteenth-century structure making it authentic to the time but the wood floor is also in place for practicality, because it is more sanitary for a bed and breakfast than a dirt floor. The Laura Ingalls Wilder Museum replica has gravel mixed with dirt as the flooring. This is the closest flooring related to a compacted earth floor, making it more authentic than inauthentic. The Then Now Wow exhibit flooring is the same as the rest of the gallery, concrete with industrial carpeting. This is inauthentic but practical for the amount of visitors the museum receives and the replica is an indoor

exhibit. Flooring depended on the settler's resources and each site shows different practices because of this variety only blatant deviations from historic materials really undermine the authenticity of a sod replica.

Interior finishes were also dependent on specific settlers and their resources. The Oklahoma Sod House Museum has the most authentic interior finish because it is the same finish McCully used in the nineteenth century, clay packed into the walls. The three replicas' interior finishes are inauthentic but practical for each setting. The *Sod House on the Prairie* originally used plaster because it kept the sod bricks together and provided a cleaner environment. Some settlers used plaster as well but usually later on in the sod house's life according to literature. The Laura Ingalls Wilder Museum painted the interior concrete walls with white paint. The white paint is supposed to simulate whitewash and to cover up the grey color of the concrete. The Then Now Wow exhibit shows newspapers on the walls, which is authentic, however for maintenance and visitor interaction use, the newspapers are plastic. Interior finishes changed through time and there are contemporary equivalents that imitate authentic finishes.

Each case study has its own unique features to interpret a nineteenth-century sod structure. They all range on the scale from authentic to inauthentic yet practical. The most authentic sod structure is the Oklahoma Sod Museum because the museum displays an original nineteenth-century sod structure. The three replicas range from 1.75 to 4.8 on the scale. Each uses different materials but still conveys the interpretation of a sod structure. Two of the replicas use a personal account to base their sod structure; however they use inauthentic materials in both the Laura Ingalls Wilder Museum and the Then

Now Wow exhibit replica. The *Sod House on the Prairie* shows that an authentic sod structure may be possible. The replica at the *Sod House on the Prairie* scored a 1.75 on the scale, showing that out of the three replicas it is the most authentic. The replicas displayed the reasons for inauthentic yet practical materials including maintenance needs. The four case studies showed a range from using original sod materials to using inauthentic yet practical materials.

CHAPTER SIX: CONCLUSION

The last two chapters explained the analysis of this thesis and this chapter will include the conclusions. First, this conclusion must reinforce how significant sod houses were to westward expansion. Second, the message should be made clear that sod structures are a form of impermanent architecture and the very few vulnerable, original sod structures that remain deserve considerable resources and preservation. Next, this chapter discusses the boundaries for authentic and inauthentic guidelines from the analysis of historic images. Fourth, this chapter describes an authentic sod structure and how to build one offering best practices based on the thesis' findings. Lastly, the conclusion explains why inauthentic materials are used and how to add authenticity to a structure that uses inauthentic components to find a balance.

Because sod structures are a most fragile, impermanent yet significant component of the American Great Plains' build cultural heritage, they are vital to interpretation campaigns of this region in the early nineteenth century. Examination of historic images of sod structures reveals that a range of features is associated with sod structures but also establishes hard boundaries to what materials, techniques, and features were never encountered in nineteenth-century sod structures. Original sod structures have nearly vanished from the landscape, so the best alternative to preserving original fabric since nearly none remains, is to maximize authenticity in construction practices, use of traditional materials and methods, and by recreating new structures as part of a living tradition of sod house construction.

Significance

Nineteenth-century sod structures provided housing for millions of settlers trying to cultivate the Great Plains. The West expanded immensely after the Homestead Act of 1862. People moved to the West to start towns and the railroads provided easier transportation of people and resources. Sod structures were a significant part of the western expansion and covered the landscape for decades. The sod structures are distinct to the nineteenth-century Great Plains. These structures are important to the history of the Midwest and West, because they shaped the landscape from prairie to the farming landscape today. Towards the end of the nineteenth and early twentieth centuries, sod structures began to disappear and wood frame construction replaced them.

Since sod structures are made from impermanent materials, there are not many in the landscape today. The few that are still around are very vulnerable to degradation because of the nature of their materials. These handful of standing structures are the epitome of authentic. They are the historic artifacts that show the materials and techniques of a nineteenth-century sod structure. First and foremost, heritage sites need to take care of the few standing sod houses.

After resources are dedicated to maintaining the few existing nineteenth-century sod structures, replicas are the best way to interpret sod structures. Replicas provide examples of the materials, size, and living situations of nineteenth-century settlers to a contemporary audience. It is important to use sod structures for education and

interpretation, because these houses were an integral part of the regional and national history.

The most authentic way to replicate a sod structure is to use information gained from a personal account or history. This follows general best practices in historic restoration; though reconstruction or replication remains a contested subject. Consistently the preservation field has condemned recreation of historic structures when evidence is lacking and high conjecture is required. Following a preservation ethic in creating a replica, a reconstruction based on ample documentation of a specific structure in its specific original location is ideal. Using a primary source such as a diary will give the details of a nineteenth-century sod structure. If the replica follows the source exactly, the replica will be more authentic. If a replica deviates from the personal account, it becomes less authentic. The link between a replica and an historic account adds to an authentic interpretation of nineteenth-century sod structures.

When recreating a sod structure prioritizing authenticity, the materials may be new but the building traditions should not be. Finding the correct sod, stacking the sod in a historic way, adding different features such as glass windows and a stovepipe are all examples of historic traditions with new materials that were used traditionally. These new but historically accurate materials do the least to make the recreation less authentic because authentic traditions and methods are still being used. Building a sod structure has the opportunity to be a living tradition. To be a living tradition, restorers should follow instructions that are historically accurate and passed down through generations. If an original sod structure is no longer a viable interpretation option, a recreation with the

same building tradition makes it as authentic as possible. We tend to think that if something is recreated, it is not authentic because it does not use any of the original materials. Using the same techniques and processes to harvest building materials and construct as they did on the Great Plains in the nineteenth-century is creating an authentic structure. Approaching authenticity as a living tradition valuing exclusively the original fabric, makes building sod structures in the present authentically a possibility.

From examining the case studies and comparing those to historic materials and techniques, it is possible to create an authentic sod structure. First, the location of a replica can be selected to maximize authenticity. Sod structures populated the Great Plains and if an exact spot of a known sod structure cannot be located, then a site on the Great Plains is the next most authentic choice. If the site is on the Great Plains prairie, priority should be given to sites where the viewshed surrounding the site is undisturbed to maximize authenticity. Sites may desire a contemporary visitor center or starting point to the exhibit; this would be a practical addition but should be kept out of the viewshed of the structure.

Finding undisturbed sod for sod bricks can be difficult. Through the decades, people have cultivated and changed the Great Plain's landscape and geomorphology. The grasses today in a field are different from the natural prairie the first settlers encountered. A way to work around the contemporary prairie is prairie restoration. Prairie restorations take time but they can help the correct grasses grow and thrive. Sod

bricks only work if the grass, roots, and dirt form a cohesive whole.¹⁴⁶ The Laura Ingalls Wilder Museum uses restored prairie from the Gordon farm for their sod bricks. They have proven to work for their replica. Prairie restoration will help grow the correct cohesive sod that a replica needs for sod bricks and can also be beneficial for sustainability objective and a richness of interpretation.

To cut the sod, a heritage site needs to find an authentic sod cutter or plow with a team of oxen or draft horses. If a heritage site cannot find an authentic sod cutter, they could make one with wood and iron. If the restoration process is part of the interpretation of the site this measure of authenticity is especially important, if the harvesting of sod is not part of the program then using mechanical advantages become increasingly understandable deviation from authenticity. If sod is used to build an authentic replica, the construction methods are stacking the sod bricks grass side down. This seems to be the original method from the earliest sod houses built and no other technique surpassed it as a technological innovation.

A main reason why contemporary inauthentic materials are used to construct replicas is the ease of maintenance and durability of synthetic materials. Maintenance of a sod structure is crucial to keep the replica safe. Personal accounts have stated that the gaps in the walls need repairs and the sod on the roof needs to be replaced every five years. These experiences and maintenance issues cost time and money. An interpretative site might choose to incorporate an educational program into the maintenance routine.

¹⁴⁶ McCone's first harvest of sod bricks from his own field did not work because the bricks crumbled before he could lay them ; McCone, Virginia. Sod House on the Prairie, August 3, 2015.

Cutting new sod bricks and filling in the gaps of the walls with dirt can be explained to guests and be a hands-on learning experience at the site. This might make maintenance more appealing to some sites if the site can incorporate the maintenance into the programming instead of just a task.

Balance

If a site is low on one scale of authenticity, it can compensate by following authentic practices on other scales. For example, an indoor exhibit will score low on the setting scale but if the exhibit uses authentic materials it will score higher on construction methods and building materials scales. The indoor environment would also act as a controlled environment, so the sod bricks will last longer because they are not exposed to an environment that will degrade them. Another example of finding balance is if a site wants to add contemporary materials to reinforce the structure for life safety reasons, the structure will score lower on materials but the heritage site could use an authentic landscape and rank higher on those scales. By pairing authentic items and inauthentic items, the site can compensate and find a balance of authenticity and practicality.

Another way to include authenticity to a heritage site is through interpretation of the sod structures. While the Then Now Wow exhibit was made of contemporary materials, it interpreted a settler's life in a sod house well. There were many interpretative signs and images about a family who resided in a sod house. Also, the exhibit has an interactive "fighting off the grasshopper plague" and plow exhibit. If an interpretative site uses inauthentic materials, the site can compensate for the

inauthenticity and use interpretive signs and interactive exhibits to explain what the materials do not.

Ideal Replica


There can be a balance of authenticity and practicality when building and interpreting a replica of a nineteenth-century sod structure. Most of the materials used to construct a safe and working replica can be authentic to the nineteenth century.


Inauthentic yet practical materials may help with maintenance costs and time but a site can incorporate programming into maintaining authentic materials adding to the interpretation of a nineteenth-century Great Plains sod structure. The best practices for reconstructing sod structures from the nineteenth century use a site on the Great Plains prairie with a range of authentic materials.


APPENDICES


Appendix A


Historic Image Inventory Forms


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Oklahoma		~23' L	“ ‘An Oklahoma Soddie.’ A couple & 3 girls in front of a sod house.”	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Logs, Thatch, Sod Bricks	Gable Extended shed	Stove pipe Sod chimney	Sod bricks
Dedrick, Taloga, W.A. Rigg Collecion, Courtesy of Oklahoma Historical Society, 10236					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Driftwood, Oklahoma	1893 built 1947 still standing	~34' L	Eli Barton's Sod House	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Wooden shingles	Gable	Stove pipe	Sod bricks Wooden planks
Virginia Dell Geith Collection, Courtesy of the Oklahoma Historical Society, 19334					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Oklahoma	1900	~15' W	“Woman drawing water at a well, a sod house and dugout behind her.”	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Windows Not Visible	Not Visible	Sod Bricks	Gable	Stove Pipe	Sod bricks
Barney Hillerman Collection, Courtesy of the Oklahoma Historical Society, 21412					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Milton, North Dakota	1895	~32' L	Later used as heritage postage stamp. Norwegian family John Bakken	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not visual	Growing sod Bricks	Curved shed	Two stove pipes	Sod bricks
North Dakota State University Libraries, Institute for Regional Studies					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	White River, South Dakota	1913	~17' L	Josef Petr Sod House	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not visual	Sod Bricks Wood sheathing	Curved shed	Not visual	Sod Bricks
Fred Hultstrand History In Pictures Collection, NDIRS-NDSU, Fargo (2028.1)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Barnes County, North Dakota	1887	~32' L	Gjesvold Family Sod House	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not visual	Sod Bricks Wood sheathing	Gable Low-slope Shed	Stove pipe	Sod bricks
State Historical Society of North Dakota (A0271)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Logan County, Kansas	1885- 1890	~25' L	Anderson House	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttuns as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society, 219970					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Finney County, Kansas	1890- 1900	~16' L	Family standing in front of sod house	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society, 214976					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Decatur, Kansas	1880- 1889	~40'L		
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber Logs	Gable	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society, 214863					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Dakota Territory	1880			
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttuns as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Shed	Stove Pipe	Sod Bricks
Minnesota Historical Society, E200 r97					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Minnesota	1886	20' L	Mrs. Beret Hageback seated in front of house	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with mutttons as part of a multi-pane sash)	Not Visible	Sod Bricks	Pyramid	None Visible	Sod Bricks Stone
Lac qui Parle County Historical Society, ML1.3 p2					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	1895	23' W		
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
No windows Visible	Not Visible	Sod Bricks Logs	Gable	Stove Pipe	Sod Bricks
Minnesota Historical Society, E200 p39					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota	1890	~>27' L		
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Windows Not Visible	Not Visible	Sod Bricks Wood	Gable	None Visible	Sod Bricks
Minnesota Historical Society, E200 p55					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota	1884	~>20' L		
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks	Shed	Stove Pipe	Sod Bricks
Minnesota Historical Society, E200 r73					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Nebraska	1880-1890	~16' L door facade		
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Logs	Low-Slope Shed	Stove Pipe	Sod Bricks Stones
KansasMemory.org, Kansas Historical Society, 209284					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1870-1890	~24' L	Russell County	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Logs	Shed	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society, 209059					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1870-1890		L.A. Mead Family Dugout	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Windows Not Visible	Wooden	Lumber	Gable	Stove Pipe	Not Visible
KansasMemory.org, Kansas Historical Society, 205534					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1879	~24' L	William A. Watson Sod House	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Logs	Gable	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society, 215101					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
 <p>NDSU Institute for Regional Studies</p>	North Dakota	1900			
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Curved shed	Stove Pipe	Sod Bricks
Fred Hultstrand History in Pictures Collection, NDIRS-NDSU, Fargo (2028.110)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Oklahoma	1897	~45' L	Beaver County	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttuns as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber Logs	Gable	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society, 7797					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1870s or 1880s		Ford County, George Wilcoxon's Family	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber Wood shingles	Gable	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society, 205637					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1880s or 1890s		Decatur County, Metcalf Ranch	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society, 25152					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota		~15' L		
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
No Windows	Not Visible	Lumber	Shed	Stove Pipe	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota				
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Lumber	Gable	Not Visible	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota			Post card	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Windows Not Visible	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota			Post Card	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Lumber Tarpaper	Gable	Not Visible	Dried Clay
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota			Atley's Sod House at Standing Rock	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber on addition	Gable	Stove Pipe	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota		~34' L	Post card	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Cedar Shingle	Gable	Stove Pipe	Sod Bricks Wood in Gable
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota			Lind County	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Sod Chimney	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota		~28' L	Post Card	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota			Harford-Hanson Homestead, Minnehaha County	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Curved Shed	Stove Pipe	Sod Bricks Wood Addition
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota			Eillignson-Melbery Residence	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota			Redfield Sod House	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Windows Not Visible	Not Visible	Lumber	Gable	Stove Pipe	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota		~30' L	JS Homestead	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Oil Cloth tacked to the lintel above and below the window	Not Visible	Lumber	Gable	Stove Pipe	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota		~19' L	Black Hills Clam Shack	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Windows Not Visible	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota			Marietta-Gambrel Residence	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Windows Not Visible	Not Visible	Lumber Tarpaper	Shed	Stove Pipe	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota			“The Way We Used to Live in the West” Post card	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
No Glazing in Window Opening	Not Visible	Sod Bricks Lumber	Curved Shed	None	Sod Bricks Lumber Baseboard
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota		~16' L	Perkins County	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Logs	Gable	Stove Pipe	Sod Bricks
South Dakota State Historical Society					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	189?		Perkins County	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Windows Not Visible	Not Visible	Sod Bricks	Gable	Stove Pipe	Sod Bricks
Fred Hultstrand History in Pictures Collection, NDIRS-NDSU, Fargo (2028.044a)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	1909	~28' L	Sullivan Family	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Window Glazing Not Visible	Not Visible	Sod Bricks	Gable	Stove Pipe	Sod Bricks
Fred Hultstrand History In Pictures Collection, NDIRS-NDSU, Fargo (2028.5)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
 <p data-bbox="499 802 781 821">NDSU Institute for Regional Studies</p>	North Dakota	190?		Talcott Family	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Lumber	Shed	Stove Pipe	Sod Bricks
Fred Hultstrand History In Pictures Collection, NDIRS-NDSU, Fargo (2028.114)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
 <p>NDSU Institute for Regional Studies</p>	North Dakota	1896		Nelson Sod House with Post Office	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks	Gable	Stove Pipe	Sod Bricks Wooden Addition
Fred Hultstrand History in Pictures Collection, NDIRS-NDSU, Fargo (2028.80)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	1895		Milton	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Logs	Gable	Stove Pipe	Sod Bricks
Fred Hultstrand History in Pictures Collection, NDIRS-NDSU, Fargo (2028.073)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	1885-1905		Walsch County	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Two Stove Pipes	Sod Bricks
Walsh County Historical Museum (WC-15)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	1910-1915	~25' L	Spitzer Sod House	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks	Gable	Stove Pipe	Sod Bricks
State Historical Society of North Dakota (00270-026)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	1897		“Little Old Shanty on the Claim”	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks	Gable	Stove Pipe	Sod Bricks Wood Addition
Fred Hultstrand History In Pictures Collection, NDIRS-NDSU, Fargo (2028.15)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	190?		“Prairie Living”	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
Fred Hultstrand History In Pictures Collection, NDIRS-NDSU, Fargo (2028.264)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	190?		“Raising a Family”	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks	Shed	Two Stove Pipes	Sod Bricks
Fred Hultstrand History In Pictures Collection, NDIRS-NDSU, Fargo (2028.108)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	Before 1923		Interior	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Window Glazing Not Visible	Wooden	Lumber	Gable	Not Visible	Sod Bricks Newspapers
State Historical Society of North Dakota (B0378)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	1906		Morton County	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
State Historical Society of North Dakota (C3490)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	South Dakota	190?	~34' L		
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Window Glazing Not Visible	Not Visible	Wooden Shingles	Hip	Stove Pipe	Sod Bricks
Fred Hultstrand History In Pictures Collection, NDIRS-NDSU, Fargo (2028.35)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	1903			
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttoms as part of a multi-pane sash)	Not Visible	Sod Bricks	Gable	Stove Pipe	Sod Bricks
Fred Hultstrand History In Pictures Collection, NDIRS-NDSU, Fargo (2028.113)					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
 <p>NDSU Institute for Regional Studies</p>	North Dakota	1923		Elling O[h]nstad Sod House	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Wooden	Lumber	Gable	Not Visible	Sod Bricks Plaster
Fred Hultstrand History in Pictures Collection, NDIRS-NDSU, Fargo					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	North Dakota	1896		Ole Myrvik's Sod House	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks	Gable	Stove Pipe	Sod Bricks Wooden Addition
Fred Hultstrand History in Pictures Collection, NDIRS-NDSU, Fargo					

<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1870	~25' L	Rhees Singley's Sod House	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society 205872					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1890-1930		Sherman County	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	None	Sod Bricks
KansasMemory.org, Kansas Historical Society, 305573					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas			Frank Wright's Sod House	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Windows Not Visible	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society, 305573					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1890-1940		Pantzer Homestead	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks	Gable	No Visible	Sod Bricks
KansasMemory.org, Kansas Historical Society, 305550					


<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1880s-1890s		Guessed to be last sod house used in Ellis County	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Curved Shed	No Visible	Sod Bricks
KansasMemory.org, Kansas Historical Society, 305134					

<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1890-1899		Norton County Post card	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society, 312154					

<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1890-1940		Pantzer Homestead	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Lumber	Gable	Stove Pipe	Sod Bricks
KansasMemory.org, Kansas Historical Society, 211963					

<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Kansas	1890-1900		Finney County, Half dugout half sod hosue	
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with mutttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks, Partially Underground
KansasMemory.com, Kansas Historical Society, Image 214975					

<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Minnesota	1900			
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Sod Bricks Lumber	Gable	Stove Pipe	Sod Bricks
Minnesota Historical Society, E200 p48					

<u>Image</u>	<u>Location</u>	<u>Year</u>	<u>Size</u>	<u>Description</u>	
	Dakota Territory	1880			
<u>Architectural Features:</u>					
<u>Window Glazing Materials</u>	<u>Floorings</u>	<u>Roof Materials</u>	<u>Roof Type</u>	<u>Roof Penetrations</u>	<u>Wall Materials</u>
Glass (in window frames, with muttons as part of a multi-pane sash)	Not Visible	Tarpaper Lumber	Shed	Stove Pipe	Sod Bricks
Minnesota Historical Society, E200 r96					

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