
The Farmers' Tower: The Development of the Tower Silo

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The tower silo has come to be a feature in what Americans see as the traditional farmstead. Much like a lighthouse marks the shoreline, each silo boldly marked where a farmer lived his life and earned his living. Silos were often the first, and sometimes only, indication that someone was farming beyond the next rise on the prairie. Silos seem timeless; however, these structures are just over 100 years old and common to the landscape for even less time. Methods of silo construction evolved over time, allowing silos to be larger, more efficient, and increasingly popular. These changes occurred through construction, engineering, and design as new materials and building techniques became available.

For centuries there had always been a problem of how to store and carry over crops from one growing season into a winter or dry season of less available animal fodder. The term "silo" comes from the Latin word *silus*, which means cellar. The process of storing crops in underground pits has been used since ancient times. The pit technique applied primarily to grain crops however, and only in the last 150 years has the ensilaging of grass crops developed. The fermented end product created by using a silo is called ensilage, or silage. Ensilaging is unique because even though it required no technological or mechanical advances, it is a recent agricultural development.¹

Silage results from storing a crop under anaerobic conditions. In this method of crop preservation the entire stalk of a grass crop, which includes corn and other grain crops, is finely chopped and placed in a pile. The pile may be contained in a pit, as in early silos, or a tower. In any storage container, the silage must then be packed and is usually covered. The packing process removes the air from the fodder and prevents decay. Farming practices that involve the localized feeding of a large number of animals can benefit greatly from silage, as it is a densely stored fodder located in a single location.

As stated in *History of the Silo in Wisconsin*, "There was a time when land was cheap and coarse feed abundant.... At the time of the

¹ N. S. Fish, *The History of the Silo in Wisconsin* (Wisconsin Magazine Of History. Volume: 08 /Issue: 2 1924-1925), <http://content.wisconsinhistory.org/u2/wmh,4312> (accessed January 27, 2010), 160. John Scott, *Farm Buildings: A Practical Treatise* (London: Crosby Lockwood and Son, 1914), 62.

advent of the silo in this state, land was increasing in value and feed was becoming high-priced." Due to the high cost of feed, some farmers could no longer afford to keep large herds of animals over the winter months. Many were forced to sell off their herds in the fall and then buy them back in the spring. Because of this disadvantage, farmers were eager to try the new method of ensilaging their summer crops for winter fodder and for carrying through bad periods.²

During the 1920s, land in the Midwest was still financially available to nearly every farmer. As a result, there was not an immediate growth in silo numbers in the Midwest, even though scientist/agriculturalists brought the concept of using silos from Europe directly to the University of Illinois in Champaign, Illinois. The New York and New England area, however, due to their intensive dairying operations and high land costs, had an immediate need for what the silo could provide. Meanwhile, in the Midwest, a strong distrust of the silo as a way to store crops took years to overcome in spite of the research conducted at the University of Illinois in Champaign showing the potential benefits of the silo.³

In New England, an intensive dairying operation existed in the late 1800s due to the increasing urbanization occurring along the East Coast. This was a period of rapid industrialization with large numbers of people moving to cities. The new urban dwellers created a steadily increasing market for milk and other dairy products regardless of the season. Climate also contributed to the rise of silos on the East Coast. The growing season was shorter with a cooler average temperature; corn was often not able to fully mature. Rapidly growing hay crops were typical, but with the introduction of silos, it was now to the farmer's advantage to grow corn and to harvest whether the crop was mature or not. The switch from hay to corn as a primary feed crop benefited the farmer in several ways. Corn yielded more crops per acre and possessed better value as feed, and farmers could utilize the whole plant as a feed product.⁴

The interesting dispersal of the silo from Europe to Illinois, and back to the East Coast, before realizing its greatest popularity back again in the Midwest, helps explain the silo's construction method dispersal as well. In Europe, the silo consisted mainly of a trench or pit filled with silage and then packed down and covered with any type of green plant material to prevent the rotting of the fodder underneath.

² Fish, *The History of the Silo in Wisconsin*, 160.

³ Allen G. Noble, "The Diffusion of Silos," *Landscape: A Magazine of Human Geography* 25, no. 1 (1981): 11-14. *America: History & Life*, EBSCOhost (accessed January 29, 2010), 12.

⁴ C. H. Eckles, *The Silo and Its Use* (Columbia: University of Missouri, 1915), 5. Noble, "The Diffusion of Silos", 12.

When the silo concept moved across the Atlantic to Illinois in the mid-1870s, it remained a pit-type silo until the first tower-style silo was built, probably by Francis Morris, a farmer from Maryland. The exact date is unknown, but an 1877 publication mentioned that Morris' experimental silo had been functional since approximately 1875 or 1876. This migration from East to West and then back East explains how the early silo types and methods developed.⁵

The first tower silos were simple constructions that any relatively handy farmer could build on his own or with help from neighbors. As a precedent for the storage of crops within a barn already existed, many farmers walled off a corner inside their barns. Some barns even featured a central silo. Since this technique used a significant amount of valuable interior floor space, the silo quickly moved outdoors with early versions attached to the outside of the barn. The silos were built by using the existing exterior wall as the fourth wall and building three walls usually as high, or just up to, the roofline.⁶

These first tower silos were square or rectangular in shape and because of this, were quite easily built. The square shape was not the most efficient method however, because air had to be eliminated when ensilaging a crop. As noted earlier, the ensilaging process involved the fermentation of a green crop under pressure. The fermentation heated the material, using up the available air. A rectangular structure containing this material nearly always had areas in the corners where the silage did not properly pack down, therefore allowing air pockets. The air pockets occurred partly due to improper loading, but also because as the silage settled, the corners created friction, which decreased the pressure exerted on the material. Because of the nature of settling material in a square, rectangular silos had a higher rate of spoilage than their round counterparts.

Both interior and exterior rectangular silos usually employed a framed construction method. The framed building technique was familiar to farmers, as all farm buildings were built in this manner. The technique worked well for most needs, but for silos it was insufficient and not suited to holding back the pressures generated by substantial amounts of heavy silage in a tall stack. Because of the weight of silage, many of these silos burst or had a wide variety of problems causing many to be torn down and the lumber reused, or simply abandoned or

⁵ Arn Henderson and Tom Isern, "Wooden Silos of the Southern Great Plains," *Pioneer America Society Transactions* 8, (1985): 1-9. *America: History & Life*, EBSCOhost (accessed January 29, 2010), 1.

Noble, "The Diffusion of Silos", 11.

⁶ Henderson, "Wooden Silos of the Southern Great Plains," 2.

destroyed. (Figure 1) Subsequently, there are only a small number of these early silo forms in existence today.⁷

Farmers quickly realized the shortcomings of the rectangular silo and proceeded to develop many variations of round silos, solving most of the problems associated with rectangular silos. Round silos eliminated corners that promoted rot, enclosed more space using less material, and were structurally suited for the high pressures exerted by tall stacks of heavy materials. With these benefits in mind, farmers began experiments in various designs that initially took advantage of the cheapest building material available—wood.

The silo was built in a variety of designs using wood. The most commonly built type was the wood stave silo. (Figure 2) Stave silos consisted of long planks placed upright on a foundation. The boards used varied in quality and shape. Some farmers used an ordinary plank and nailed it to its neighbor using another strip of wood as a joining agent. A more sophisticated method used tongue and groove joints that were spiked together. Silos of this variety could be ordered as a kit and were sold by regional equipment dealers. Different species of wood were available with pine being the cheapest variety and cypress or redwood being the highest. Different species of wood resulted in the stave silo lasting either for a shorter or longer duration, respectively. On occasion the lower quality woods, such as pine, were coated with a creosote solution to slow the decay of the wood, which also gave the silo a darker color. The stave silo proved to be the most popular type of wood silo construction due to the ease of construction, ready availability of materials, and farmers' familiarity with the construction method. Stave silos were really just very large barrels, built much like the barrels crafted by the local cooper complete with staves and iron bands. Large water tanks, such as those used by the railroad and seen across the country, were also built in this manner.⁸

All stave silos required the use of metal hoops to hold them together. As the silo rose higher, threaded hoops were placed around the entire structure to hold the staves together. The hoops needed to be adjusted periodically as the silo was filled and emptied, and these adjustments came to be one of the primary disadvantages of the wood stave silo. The hoops needed to be loosened when filled to prevent the staves from being crushed under the hoops, and then tightened when empty to prevent the structure from falling over in strong winds.⁹

⁷ Fish, *The History of the Silo in Wisconsin*, 141.

⁸ Eckles, *The Silo and its Use*, 9. J. R. McCalmont, *Silos: Types and Construction* (Washington D. C.: U. S. Department of Agriculture, 1948), 2. Allen G. Noble, "The Evolution of American Farm Silos," *Journal of Cultural Geography* 1, no. 1 (1980): 138-148., 142.

⁹ J. R. McCalmont, *Silos: Types and Construction* (Washington D. C.: U. S. Department of Agriculture, 1948), 2.

There were also other variations in wood silos. One interesting type was the hoop silo. (Figure 3) Long planks of wood the length of the diameter of the silo were thoroughly soaked in water and then bent around a heavy framework, secured together and then allowed to dry, which created a huge hoop. The silo walls were then built of stacked hoops. Hoop-built silos were never widely popular due to the slow and exacting building process involved and the high degree of hoop failure that occurred. A secure way of keeping the opposing forces in the silo walls together for an extended period of time never developed.¹⁰

The final wood-built silo technique is cribbed construction. (Figure 4) With this technique builders borrowed a construction method used by the towering grain elevators that dotted the countryside along railroad lines. Planks measuring two inches by six or eight inches, depending on the diameter of the silo, were laid flat one on top of another and then spiked together. The boards were sometimes staggered to vary the seam in the structure making it stronger. Cribbed construction created a hexagonal, octagonal, or decagonal structure rather than a round structure. Corners still existed, but the resulting angles were much larger, thus decreasing the problem of poor packing. Cribbed silos were physically attractive, stable, and incredibly strong, but required a massive amount of lumber and therefore seldom made outside of areas with large amounts of wood available. Cribbed silos were also sometimes built out of the salvaged timbers of unused barns, silos, or other farm buildings.¹¹

The wooden silo, while cheap and relatively easy to build, still had a number of problems that brought about its eventual decline in popularity and use. Wooden walls, with all of their seams, were incredibly difficult to make airtight. As noted earlier, the enemy of the ensilaging process is air as it promotes decay. Wooden silos were notorious for many leaks and resulting silage losses. There were a variety of methods used to combat this such as painting the interior, using thin strips of wood as shims, and even lining the silo with steel. These methods usually worked, but they required careful application and constant maintenance. As more farmers adopted the ensilaging process and learned how it worked, they began to look for more advanced and efficient ways of preserving their crops. Further experimentation with various materials led farmers to explore different construction techniques using harder and therefore more airtight, building materials such as brick, tile, and a variety of concrete forms.¹²

¹⁰ Noble, "The Evolution of American Farm Silos", 142.

¹¹ Henderson, "Wooden Silos of the Southern Great Plains," 2.

¹² Helmer Rabild, K. E. Parks, and A. K. Risser, *Homemade Silos* (U.S. Department of Agriculture Farmer's Bulletin #589, 1914), 2.

The adoption of masonry materials created advantages over wooden silos. The structures could be made much taller due to the stability and strength of these materials; more weight could be supported. One of the greatest threats to a wood silo was rot and fire. With a masonry silo, the threat of fire was negligible, rotting was no longer a concern, and they were heavy enough that strong winds could no longer blow them over as had happened to many wooden silos. Also, masonry components were themselves airtight which made the sealing of the building against air leakage much easier to accomplish. Finally, masonry silos were more durable requiring much less maintenance. Some of the earliest silos built from masonry components are still standing today, many with little to no continual maintenance. In contrast, wooden stave silos seldom survived. Researchers Henderson and Isern noted that in all of their travels and studies they knew of only one that still stood in the Plains states.¹³

There were several different types of masonry construction. A wide variety of materials were used in the construction of silos. Brick was a natural candidate; however, they were not usually used because of their high cost and the need for skilled labor in the construction process. After the development of natural gas in the early 1900s, cheap gas-fired ceramic hollow blocks became a material of choice. (Figure 5) Extremely popular, these ceramic block silos are still seen standing on many farms in the Midwest. Ceramic building material was durable, attractive, and helped insulate the silage from freezing. The dark brown and glossy appearance of fired tile proved to be a popular addition to farmyards and some companies offered farmyard “kits” that included tile barns, silos, and other miscellaneous outbuildings in a coordinating scheme. Kits were obviously quite expensive and proved to be short-lived, as farmers seldom wanted the added expense of coordinating their farmyards with a unifying construction material theme at an added expense.¹⁴

There were some disadvantages however, such as the brittleness of the tiles. An accidental collision, even a surprisingly light one, could crack a lower tile leading to problematic replacement issues. Additionally, acidic liquids formed during the ensilaging process tended to eat away at mortar. Some companies did produce a special tile that reduced the exposed area of the mortar, but some preventive maintenance was still necessary. The final and most important disadvantage was that, as often occurred in the evolution of any

¹³ Noble, “The Evolution of American Farm Silos”, 146. Henderson, “Wooden Silos of the Southern Great Plains,” 10.

¹⁴ *Ibid.*, 3. Noble, “The Evolution of American Farm Silos”, 138-148, 146.

utilitarian structure, cheaper and easier methods of construction eventually developed.¹⁵

Soon after the turn of the 1900s, farmers began to use a quick, easy building material—cement. Cement gave way to concrete, which quickly became the building material of choice. This preference took a variety of forms in the construction of silos. Some farmers were able to produce their own concrete blocks and then erected a homemade silo. But commercially-made concrete blocks were also popular and created an attractive, durable, and long-lasting silo at a low cost. Concrete blocks were usually smooth, but some were crafted to include a roughed-out appearance adding an aesthetic quality to the farmyard landscape. Vendors offered a variety of styles which included straight blocks and curved blocks, hollow and solid, and blocks with built-in reinforcement. Block options did not change the outer appearance much, with the exception of choosing curved over straight, but they did create a more durable silo. Curved blocks were more costly, but they gave the silo a smoother appearance on the outside.¹⁶

Another form of concrete construction was closely related to an earlier design. The wood stave silo inspired the concrete stave silo. (Figure 6) The concrete stave silo was built much like the wood stave silo except that the concrete staves were usually only approximately 30 inches long. Short staves were built so they could interconnect with one another. As the silo gained height, bands much like the bands used on wood stave silos were placed around the structure to hold it together. This allowed the farmer to add to or remove height as need or financial ability allowed. (A silo showing this growth is on the right-hand side of Figure 6; note the band of colored staves near the middle, showing that this layer was once the top of the silo.) The concrete stave method was quite popular and many of these silos are still seen and built today in the Midwest. They are distinctive in their appearance due to the vertically striped look and the decorative elements that builders tended to include near the top such as contrasting colored staves in an alternating or solid band. The concrete stave silo was the first style that was universally popular in not only the Midwest, but the rest of the country, therefore becoming the standard in the silo “look.” Consequently, the concrete stave construction technique is still used today.¹⁷

The final concrete construction method was that of the monolithic silo. (Figure 7) The monolithic silo was one solid tube of

¹⁵ Noble, “The Evolution of American Farm Silos”, 138–48, 146–47. Henderson, “Wooden Silos of the Southern Great Plains,” 3.

¹⁶ McCalmont, *Silos*, 29. John C. Wooley, *Farm Buildings* (New York: McGraw Hill Book Company, Inc., 1941), 223.

¹⁷ McCalmont, *Silos*, 28.

concrete, poured more or less at the same time resulting in a seam free and remarkably solid structure. With the monolithic construction technique, air leaks were no longer a concern and exterior structural support was no longer necessary. These silos could last almost indefinitely with minimal to no maintenance. Monolithic silos proved to be especially popular and came to replace other silo construction techniques as the preferred method. Construction costs were comparable with other methods and required only the use of slips and concrete supplies.¹⁸

The monolithic silo appeared across the Midwest as well as the rest of the country. They were easy to discern from other construction techniques due to their clean outward appearance. Monolithic silos had no exterior supports; the reinforcement was all located within the concrete itself, eliminating the hoops seen in many other techniques. They also usually featured an outside dressing that made the silo appear seamless. Of course, some were left unfinished with the slip form marks still visible, but many were finished with a surface coating of cement and paint that created a more finished look. The smooth surface lent itself well to being decorated, and many farmers personalized their silos with personal or commercial messages. (Figure 8) Monolithic construction was the construction technique also used by many grain elevators who took advantage of the large uninterrupted canvas to place their brand name and other advertisements on the exteriors.

The final type of silos was the bonded fiberglass silo, commonly known by the brand name "Harvestore." (Figure 9) These silos developed in Wisconsin in response to the long known fact that the removal of air results in the highest quality silage. Harvestore silos were made from fiberglass bonded to curved sheets of steel and then formed into an airtight structure. To allow for atmospheric change, they featured a large bag inside to adjust the pressure. An added feature of the Harvestore was the automated system built in for ease of unloading, which featured an auger that removed silage from the bottom of the silo rather than the top, as in earlier styles. This new feature created two advantages. First, it did away with the need for the outside chute and ladder and farmers no longer needed to climb to the top daily to unload silage. Second, silage could be continuously added to the top of the stack eliminating the need to completely empty a silo before filling it again.¹⁹

Harvestore silos came in a brilliant blue color that made them instantly recognizable from any other silo. The blue color resulted from the inclusion of the mineral cobalt in the glass material which is bonded to the steel. This was a choice based on the availability and affordability

¹⁸ Rabild, *Homemade Silos*, 2. Eckles, *The Silo and its Use*, 11.

¹⁹ Noble, *Barns of the Midwest*, 108. Noble, "The Evolution of American Farm Silos," 146.

of bulk material at the time of the development of the Harvestore brand. The blue color has since become an identifying feature of all Harvestore structures to present day.²⁰

With all of the conveniences of a Harvestore silo came a hefty price tag as well. The large investment only made sense for certain farmers who had a large herd feeding in a single location, such as a dairy operation. This was the target market for Harvestore silos, and their regional popularity reflects the type of cattle industry in that area.²¹

There are several features of silos that have changed over time that provide the viewer with a fascinating look at the evolution of silo construction methods and design features. Aspects of the silo, such as doors, windows, roofs, and chutes allowed such a simple structure to take on many different appearances and styles. By examining some of the features of a silo, an observer can identify a popular style in a region, or even different options offered by a local contractor.

Silos originally did not include a roof over them. Tests by agricultural colleges and firsthand experience of farmers proved that rain and weather had little effect on silage. A roofless silo did result in slightly increased spoilage, but many early silos remained roofless for ease of filling and unloading the silo. There were many advantages to a roof, such as protection from the weather, keeping out birds, and generally better quality silage. Roofs also increased the stability of the structure, decreased weatherizing, and improved the appearance. There have been many different types of silo roofs, but some of the most popular were gambrel, half-pitch, and dome roofs. The farmer or contractor selected the style individually, but the reason for the roof remained the same; a higher roof meant more headroom and more silage capacity. Some silos were built to match the roof of the barn in a gambrel fashion. Some of these gambrel roofs featured a dormer with glass windows serving a dual purpose, to allow light into the silo and as a potential access point for filling the silo. The most commonly seen roof today is the half dome, especially on concrete stave and Harvestores, due to the ease and rapidity of construction.²²

Many older silos originally had chutes attached to the side. Many of these were removed as modern equipment updates eliminated the need for them. Automatic silage unloaders replaced the chore of the daily climb into the silo to pitch silage down to the ground below. To protect the farmer from weather, and to provide a chute to prevent the scattering of silage as it fell, enclosed chutes anchored to the side of the

²⁰ Harvestore Sales Representative, e-mail message to author, May 1, 2010.

²¹ Noble, *Barns of the Midwest*, 109.

²² Chas. M. Conner, *Forage Crops. The Silo*. (St. Augustine: The Record Co., 1905), 300. Rabild, *Homemade Silos*, 9. McCalmont, *Silos*, 15.

silos were built. Chutes contained the doors and the ladder, the latter of which sometimes consisted simply of the reinforcing rods holding the silo together. Chutes were square and wooden in most wooden silos, but as concrete came into use, chutes became round and made of metal. Many concrete stave silos still retain their rounded chutes.²³

Doors on silos also changed greatly over the course of silo evolution. Multiple doors were convenient on silos to access the silage at different levels of fill. Early silos had few or no doors due to construction methods unable to support a hole cut into the side. Early publications noted that if a door was desired, to make sure to not place them over each other to improve the stability of the silo. That was the reason for staggered doors in early constructions. As methods improved, the number and size of doors increased. Eventually the continuous door developed as a long open slit from top to bottom of the silo. (Figure 10) The supporting hoops as seen in wooden and concrete stave construction bridged these slits. This method became the normal practice with the exception of the Harvestore silo, which did not use doors.²⁴

The location of the silo may seem like a commonsense decision, but in the early days of silo construction there were many contested ideas on the subject. The first square silos were built inside the barn, as it seemed the logical place to put it. If a farmer had a round barn, he usually built it in the middle and used it as a central support for the barn. Silos in the center of the barn quickly fell out of favor because it was found to be especially difficult to fill. Many farmers also believed that the heat that built up from the decaying silage could reach a high enough temperature to ignite and therefore placed the silo a safe distance from any other farm building. Over time, researchers and farmers alike reached a consensus that silos were perfectly safe and should be placed logically. The time required to move silage was greatly reduced if it was near where the cattle were actually feeding, therefore most silos came to be located directly adjacent to the barn or feedlot. The silo and barn in close proximity has come to be the complete picture many Americans think of when imagining what a typical dairy farm looks like.²⁵ (Figure 11)

Changes in the engineering and design of their construction, as new materials and building techniques became available, led to greater size, increased efficiency, and a wider area of use. Silos were not especially attractive structures worthy of note to most people, but by

²³ Ibid., 14. Rabild, *Homemade Silos*, 9.

Noble, "The Evolution of American Farm Silos", 146.

²⁴ Conner, 299. Rabild, *Homemade Silos*, 8.

²⁵ J. R. McCalmont, *Farm Silos* (Washington D. C.: U. S. Department of Agriculture, 1967), 2. Wooley, 219.

understanding the long process of trial and error that resulted in their current forms it is clear that silos, like buildings examined by classic architectural studies, had an equally fascinating evolution of form.

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Illustrations



Figure 1: Rectangular silo built on the exterior of a barn. Note the substantial efforts at additional structural support and bracing to hold back the pressures of the silage. Location unknown.

Source: www.ppixels-n-pen.blogspot.com



Figure 2: Wooden stave silo in Tompkins County, New York, September 1937.
Source: Library of Congress, U.S. Farm Security Administration, Office of War Information.



Figure 3: Wooden hoop silo near Gresham, Wisconsin. Note the dormer on the roof.

Photographer: Not So Far Trucker



Figure 4: Cribbed wood silos near Soda Springs, Idaho.
Photographer: Zetrules



Figure 5: Fired clay tile silo located near Boulder, Colorado.

Photographer: Let Ideas Compete



Figure 6: Concrete stave silos of varying height and diameter. These silos are built with automatic unloaders, seen by the use of small diameter chutes on the side of the structure. This type of silo is still built today. Location unknown.

Photographer: D. Mahalko



Figure 7: Monolithic concrete silo located in Oconto County, Wisconsin built in 1919. Note the dormer window and the attached ladder. This silo also features reinforcing hoops and due to the weathering of the paint, the slip form seams are now visible.

Source: www.townofchase.org



Figure 8: A slip-form concrete silo located near Madison, Wisconsin. Photo taken July, 1937.

Source: Corbis, Russell Lee



Figure 9: An older Harvestore silo located near Hanna City, Illinois. Note the brilliant blue color which identifies the Harvestore brand.

Source:
www.ads.agrisupportonline.com



Figure 10: Fired clay tile silo. Note the continuous door slit, which is bridged by reinforcing rods. There is also no visible ladder, so in this case the rods may have served a dual purpose as a ladder as well. Located near Ashburn, Virginia.

Source: www.ashburnweb.com



Figure 11: The typical barn and silo image most Americans think of when imagining a stereotypical farm. Located in Illinois.

Photographer: Macomb Paynes