

ARCHAEOLOGICAL MANIFESTATIONS OF A MECHANICAL ADOBE MANUFACTURING SITE NEAR ESCONDIDO, CALIFORNIA, 1947-1975

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A historic site with evidence of adobe manufacturing by the Adobe Brick Manufacturing Company, which operated from 1949 to 1970, was recently identified and documented by NWB Environmental Services archaeologists during a utilities project survey. Archaeological features include machinery remnants, adobe brick remnants, and a water well. The Adobe Brick Manufacturing Company produced millions of adobe bricks that were used for the construction of housing communities, commercial buildings, and other structures near Escondido in San Diego County. This historic site provides evidence of the resurgence in the use of adobe in Escondido, California from the 1940s until the early 1970s when the company ceased operations.

Archaeological remains of an adobe manufacturing site were identified and documented by NWB Environmental Services archaeologists near Escondido, California during a utilities survey. The site was the location of a production facility for the Adobe Brick Manufacturing Company which operated from 1949 until the early 1970s. Remnants of the production site are present at four loci within undeveloped areas of the Vineyard Municipal Golf Course, which is situated 1.7 miles northeast of Lake Hodges and surrounded by residential development (Figure 1). Abandoned machinery, water and power infrastructure remains, and linear alignments of cured adobe block fragments are present.

Historical research determined the brick fragments to be products of the Adobe Brick Manufacturing Company. This prominent company was operated by a local Escondido resident and orange grower, Lawrence R. Green. The company provided Southern California adobe builders and architects a ready supply of adobe bricks until it went out of business in 1971. During its operation, the company produced building materials for a number of historic homes that remain extant in Escondido and throughout San Diego County. This paper outlines the historical context of adobe manufacturing in Escondido, the role of Lawrence R. Green in adobe's local success, and the archaeological features of 29698-S-1.

HISTORY OF ADOBE MANUFACTURING METHODS

The earliest use of adobe is evident in recordings from ancient Egyptians over 5000 years ago. In fact, the word 'adobe' originates from a Middle Egyptian word for 'substance' (Kemp 2000:79). Early manufacturing methods were compositionally and technologically simple. The adobe mixture, made with water and organic material such as soil and straw, was combined with feet and hand tools, then was formed with wood frames. Bricks were set in the sun to dry, thus requiring a climate conducive to these methods. The soil used in the composition was typically a mixture of sand, silt, and clay. In the historic Spanish Period of Southern California (1769–1821), Spanish soldiers and missionaries were the first to mass-produce adobe bricks in California (Englehardt 1920:93), and production continued through the Mexican Period (1821–1846) and the American Period (1846–1970).

As a building material, adobe has advantages and disadvantages. The materials required are often plentiful, the process of manufacturing is simple, and the building blocks produced provide good insulation. However, adobe absorbs water and can be brittle depending on the quality of material used and whether the material dries evenly. Adobe producers employed a variety of strategies to remedy these issues. For example, they combined additives such as shell, bone, and animal blood with the soil in an attempt to reduce water damage, and they covered exposed surfaces with plaster to protect them from moisture.



Figure 1. Site location map.

Ultimately, plastering surfaces and early additives did little to protect the adobe from moisture, calling for further innovation in later years. Emulsified asphalt was invented in 1924, and it became the first effective adobe soil additive as an emulsion of oil and water. When added to soil, the additive covered the soil particles with a protective film, stabilizing the adobe brick. Bitudobe Emulsified Asphalt Stabilizer was licensed by the American Bitumuls Company in 1937 and received approval from the Federal Housing Administration (FHA) for use as a building material (Figure 2). Government building standards helped increase its use by providing specific requirements for building materials that fit Bitudobe's characteristics. The product was strictly licensed, and soil samples were sent to company laboratories for testing. The company would determine the correct amount of additive to be used as a standard in the adobe manufacturing process (American Bitumuls Co 1946:29; Comstock 1948:30).

Following the standardization of Bitudobe, the Foster and Klieser Company of San Francisco developed an adobe brick using Bitudobe additive and sold it under the trademarked name Caladobe (Foster and Kleiser 1944:49). Caladobe was marketed during a shortage of construction materials and housing during the Second World War; stabilized adobe was a viable alternative. The company also sold and leased special adobe mixing machines.

A shift in technology occurred after the turn of the twentieth century when the use of mechanical adobe mixers became the primary method of adobe manufacture. Cement mixers could be used, but large mixers with paddlewheels were more efficient (Minerals Information Service 1959). The lay down machine, which automated the forming and setting of the bricks, was invented by Hans Sumpft in 1941 (US Patent 2524683). A crew of four men using a lay down machine could produce thousands of bricks per day, whereas before they could only produce around 400 a day (Bryson 1964). The lay down machine revolutionized adobe manufacture by greatly reducing labor and increasing production.

THE ADOBE BRICK MANUFACTURING COMPANY

In San Diego County, the Adobe Brick Manufacturing Company operated during the peak of post-Second World War adobe construction in Southern California, and integrated modern and mechanized manufacturing methods to create stabilized adobe bricks beginning in 1949. The company was founded and led by prominent community leader and entrepreneur Lawrence R. Green (Calarco 2008:66). Green acquired a Caladobe mechanical adobe mixing machine from Foster and Kleiser Company and a Sumpft lay down machine from Fresno (San Diego Union 1 May 1949:28). He then set up his main manufacturing operation southwest of Kit Carson Park in 1949; the area is presently occupied by a Westfield Shopping Mall. The manufacturing site was later (as early as 1968) moved to the area east of the park where the current site is located (Ainsworth 1966:20). The company office was located in the nearby town of Escondido.

Aspects of a typical day at the manufacturing site were featured in *The San Diego Union* in 1964, and in the *Independent Press* in 1965. The production of adobe bricks took place from April to October; the hot climate and ample sunshine were necessary to dry bricks. Local soils were mechanically excavated and stockpiled near the mixing machine using a tractor (Bryson 1964). A conveyor belt placed soils into the mixing machine, and water and additives were introduced into the mix. After the soil and additives were thoroughly combined, the soil was placed into a gasoline-powered lay down machine that spread the adobe material onto a paper mat. Rollers on the front of the machine fed the paper mat as the device maneuvered into place. The lay down machine then cut the brick to the specified size. The typical size was a 12-x-16-x-4-in brick, while the smallest brick sold was 12 x 4 in. (Loeffelbein 1965:226). The machine could in one setting cut 20 to 35 bricks, which were then laid in rows that could be up to hundreds of feet in length (Loeffelbein 1965:226; Mineral Information Service 1959:5). After three days, the bricks were rotated and placed on edge to promote drying. It took four to six weeks for the bricks to cure. At the height of production, the operation could produce an average of 4,500 bricks per day (Bryson 1964:14).



Figure 2. Bitudobe was the first effective soil additive (American Bitumuls Company, 1943).

From the start of company operations in 1949 until 1971, the Adobe Block Company became the main supplier of adobe bricks in San Diego County. The use of adobe as a construction material in Escondido increased dramatically as a result of the company's operation. Many adobe structures were built locally in Escondido as well as in other locations throughout San Diego County, creating one of the largest concentrations of adobe buildings in California. The company contributed to the construction of entire communities in San Diego County and left a legacy of historic and architecturally unique adobe buildings that exists in the area today (San Diego Union 1 May 1949; Calarco 2008). Many adobe builders in the county were customers of the Adobe Block Company, including the Wier Brothers, who were noted for their quality work and unique designs. The use of adobe in San Diego County diminished after Green died, and the cost of construction with adobe became too expensive by the late 1970s.

SITE DESCRIPTION AND FEATURE INTERPRETATION

Site 29698-S-1 is located in San Diego County, California, 1.7 miles northeast from the northeast end of Lake Hodges, on the USGS 7.5 minute Escondido quadrangle. The area is presently occupied by the Vineyard at Escondido Municipal Golf Course. Fifteen archaeological features were recorded at four loci within an undeveloped area near the edge of the golf course.

Many of the features that were recorded were identified as remnants of the Adobe Brick Manufacturing Company which operated on the site from 1968 until early 1971. Each archaeological feature that is present on the site represents a specific activity that was necessary for the mechanical production of adobe bricks. Intrasite activity areas include soil mixing equipment, drying and curing areas, and water supply facilities. Historic aerial photographs, newspaper articles, and other sources of information were used to identify and interpret the features located on the site.



Figure 3. Aerial image of Feature 1 (scale in feet).

Locus A

Feature 1 is located at Locus A on the east side of the site and consists of machinery remnants from a mechanical adobe mixer (Figure 3). Parts of the mixer are attached to a metal chassis, with additional machine remnants present on the chassis. The metal chassis is comprised of two steel I beams; other attached parts include wheel hubs, axles, a transmission case, and other miscellaneous parts. A 12-ft-long metal mixing bucket is attached to one end of the chassis. Paddlewheels attached to a shaft are present inside the bucket (Figure 4). Gears that were used to turn the shafts, sheet metal, wood, and other parts are also present. Remnants of a conveyor belt are present, consisting of a metal frame constructed with 1 1/2 in. angle iron. Rollers are attached to the conveyor belt frame (Figure 5). The metal conveyor frame is jammed between the metal chassis and a separate, large metal and wood frame. This frame is a remnant of a simple crusher that received soil from the conveyor and fed it to the mixing buckets. Soil is present inside a metal grate that is mounted on a wooden deck (Figure 6). All three elements of the feature are resting on their sides and have been damaged. Metal parts have been bent and twisted, and many parts exhibit rust and corrosion. Twisted and bent metal parts on the machine indicate they were likely displaced from their original location and deposited near their present location during construction of the golf course in the early 1990s.

The Adobe Block Manufacturing Company first operated a Caladobe mixing machine acquired from the Foster and Kleiser Company (San Diego Union 1 May 1949) which appears in historic images of the site (Figure 7). It was small enough to be easily moved, and it used a belt drive and flywheel to turn the mixing paddles. By 1959, the company had replaced the original mixer with a mobile mixer mounted on a wheeled chassis that used gears to turn the paddles.

The process for manufacturing adobe using a mobile mechanical mixing plant was described in literature issued by the *Minerals Information Service* in 1959, and is consistent with the machinery present at Locus A. Although the report described the process at Fresno, the Adobe Brick Manufacturing Company plant at Escondido mirrored the Fresno process:

A specially designed mixing machine, mounted on a large trailer, is used. Soil is fed into a simple crusher by a belt conveyor system, and passes through a 1-inch screen from which it is conveyed to one end of a 12-foot trough. Two shafts, studded with short paddles, rotate in the trough, and an operator controls the feed of soil, water, and asphalt emulsion. The materials are pushed along the trough as they are mixed, the process being continuous, and the mud is withdrawn from the opposite end into small vehicles specially fitted with hoppers [Minerals Information Service 1959:4-5].



Figure 4. Image of the mixing bucket with paddlewheels.



Figure 5. Conveyor belt remnants at Feature 1. Inset shows rollers attached to the metal frame.



Figure 6. Image shows the wood deck and metal grate at Feature 1. Note soil remnants inside the grate.



Figure 7. Upper image shows the original Foster and Klieser mixer, lower image shows remnants of mixer mounted on a vehicle chassis at Feature 1.



Figure 8. Aerial image of machinery remnants at Feature 2.

Feature 2 is located 60 ft north of Feature 1. It consists of a partly buried metal frame with attached parts, including sheet metal sides, and cross beams set on the frame (Figure 8). Most of the machine is buried, and only a portion of the metal frame is exposed in a 16-x-11-ft area. Pieces of machinery are present on the surface nearby to the east and south. An exposed end of one I beam has a small chain attached. This device may have been used with the conveyor belt and meat frame at Feature 1. Modern day adobe maker John Morris, owner of the San Tan Adobe Company, Queen Creek Arizona, claims this device was placed into a pit, and the metal frame and grate from Feature 1 were placed on top. The soil was passed through the grate, and into the pit, where the conveyor belt carried the soil to the mixing bucket.

Locus B

Features within Locus B include a linear concentration of adobe brick fragments, and other small areas that contain concentrations of adobe brick fragments (Figure 9). The linear concentration is 150 ft long and 3 ft wide, with more than one course visible in some areas. Smaller nonlinear clusters of adobe brick fragments in the area include small 3-ft-diameter clusters and others that are 20 to 30 ft in diameter. These whole bricks and brick fragment concentrations are 1 to 3 ft high.



Figure 9. Linear deposit of adobe brick fragments at Locus B.

The adobe bricks and brick fragments at Locus B represent debris from the large drying and curing area that was present across much of the site (Figure 10). Long rows of adobe bricks are visible in a 1968 aerial photograph, as well as in images of the older site near Kit Carson Park. These images are consistent with the historical records describing the drying and curing processes involving linear formations. Green's company used a Sumpft lay down machine to form and set the bricks, resulting in the linear concentrations seen in the aerial imagery as well as archaeologically. The Minerals Information Service described how the bricks were set and dried in 1959:

The bricks are molded in a large field adjacent to the plant. This operator [Hans Sumpft] has developed a special mold in-machine, mounted on wheels, which molds 35 4" x 7-z" x 16" bricks at one time. It consists of a steel mold mounted so that it can be raised and lowered, and a moveable hopper to feed mud into the compartments of the mold. Two men operate the machine, which moves in straight lines over the smoothly scraped surface of the drying field. A strip of paper unrolls on the ground beneath the machine, the bottomless mold is lowered onto the paper, and the adobe mix is fed into the mold from the hopper. The scrapers level the top of the mud, and the mold is immediately raised, leaving the bricks on the paper. Then the whole machine is moved forward, the mold washed with a water spray, and lowered for the next filling. The hopper 'trucks' shuttle between mixer and molding machine as the bricks are laid out in long rows. Different molds for the various sizes and shapes of bricks can be mounted in the molding machine. This operator holds a patent on these machines and has several which he makes available on a rental basis [Minerals Information Service 1959:4-5].



Figure 10. The lay down machine would roll across the site as it formed and set the adobe bricks.

During the drying process, some bricks may have cracked or developed other imperfections. Many fragments and imperfect bricks would have been left behind when the bricks were gathered after drying. After the site was abandoned in the early 1970s, the adobe brick debris were left on the surface. Small mounds of adobe brick fragments that are present may represent grading activity that occurred during construction of the golf course, as adobe debris would make a poor surface for that activity.



Figure 11. Aerial image of Locus C.

Locus C

Features at Locus C consist of a wooden power pole, a concrete water well, and water tanks (Figure 11). The wood power pole is 6 1/2 in. in diameter, and has been treated with coal oil creosote. Three date nails are affixed to the pole. Nail heads exhibit marks indicating the years 1941, 1945, and 1956. A circular concrete well head with a galvanized metal vent is present near the power pole, with a large 8 x 8 ft metal water storage tank located on the north. The large tank is set within a wood frame filled with gravel. A second smaller tank measuring 11 ft high and 4 ft in diameter is also present. A small wooden pump house measuring 3 ft and 8 in high with a corrugated metal roof is also located near the well. Electric motor and pump remnants are also present near the well. The concrete well is capped with a concrete lid made of modern concrete. The circular well is made of older concrete that contains larger sand grains and small rounded rock aggregate.

Locus C is near a well that was already in place when the company first occupied the site in 1968. The well was developed during the 1940s, and may have supported earlier agricultural activity that took place on the site, as it is shown on a 1947 aerial photograph. A later aerial photograph shows that the well was improved with a concrete structure by 1964, before the site was occupied by the Adobe Block Company. The pump house is easy to move, and has been relocated at least once.

Although water was an important ingredient for the production of adobe, only a modest amount of water was needed to make the bricks. Some of the features recorded at Locus C may be remnants of equipment that supplied water for the operation. The water supply system was typical of small systems that were used after electric power became available in the area. Electricity was used to operate a pump that took water from a concrete well and pumped it into a small metal storage tank. A wood power pole supplied power for the electric pump. The smaller tank may have been brought to the site when the manufacturing facilities were moved from the first production site located near Kit Carson Park in 1968. A metal nomenclature tag affixed to the smaller tank indicates it was built by the Los Angeles Boiler Works in 1954. The larger tank may be of more recent origin and is not present in aerial photographs of the site until after construction of the golf course. The small pump house that was used to protect the electric pump from the elements may also be of recent origin.

CONCLUSION

Lawrence R. Green and the Adobe Block Manufacturing Company utilized machinery and a modern petroleum additive to produce their adobe bricks. Machines with gears and wheels replaced the bare feet and hand tools that had been used for thousands of years. The advent of an effective commercial additive and mechanized mixing processes that began in 1927 revolutionized the manufacture of adobe bricks. Green and the Adobe Brick Manufacturing Company began production in 1949, utilizing the latest technology to grow their industry in San Diego County. By 1967, the company was heavily producing adobe bricks using a highly mobile mixer mounted onto a vehicle chassis. The use of adobe remained prevalent in Escondido and elsewhere in the San Diego County area during the 1950s and 1960s, due in part to the presence of Green and his company.

The demise of the adobe industry can be attributed to a number of factors. When Green died in 1971, the company lacked a figure to provide adequate leadership. In addition, the Uniform Building Code and other legislation in California became more strict as a result of concerns of earthquake safety, making it difficult and expensive to construct adobe buildings. Less expensive building materials such as wood and fired brick increased in popularity, discouraging the use of adobe and the associated extensive labor costs and planning.

Evidence of this adobe brick manufacturing operation has survived modern development, and the remains provide a record of post-Second World War adobe production methods. The archaeological remains of the adobe manufacturing site serve as a reminder of the hard work and innovation that contributed to the architectural history of Escondido's historic adobe buildings. Adobe construction has continued in California into recent times, with some modern homeowners finding charm and allure in the appearance and feel of adobe bricks. Though adobe is no longer commercially manufactured in California, it can be sourced from other states; thus the use of adobe will likely persist in California and elsewhere for many years to come.

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