

TEMPORARY GRAIN STORAGE

GROUND PILES

MR. DANIEL WAMBEKE, PE. TAKES US ON A TOUR
OF THE HISTORY OF GROUND PILE STORAGE



Preferably, everyone would like to store grain in bins. Steel bins, concrete silos, steel or concrete warehouses, or other satisfactory vessels. However, based on the size of various crops, it is not always possible to find the necessary storage for new crop grains. So, warehouse managers have turned to various forms of temporary storage.

Grain has been stored on the ground for thousands of years. Four thousand years ago, the Hittites stored wheat on the ground in central Anatolia (present day central Turkey). They smoothed some land about six meters wide (20'), placed straw on it and stored wheat in long triangular shaped piles. Once the piles were filled, they covered the grain with straw and covered the piles with earth to keep the weather from reaching the stored grain. This created an anaerobic storage vessel which allowed the tribes to keep grain over the winter – sometimes for a few years.

Visits to Turkey in the 1980's saw vast fields of these open bulk storages all over the country. They were a little more modern than used by the Hittites – modern day Turks placed plastic sheets on top the straw base, poured the grain (mostly wheat) on top the plastic and covered the piles with white polyethylene sheets. Finally, they shoveled earth on top the piles to hold the polyethylene covers down. Visiting in the spring when they began the unloading process the odor of spoiled grain was in the air and many tons of wheat were lost to birds, grain spills. Manpower needs were large and hundreds of trucks were employed to convey the grain to the flour mills where the wheat was processed.

Wheat has been stored on the ground in the Pacific Northwest for decades – put down during July and August harvest periods – exposed to the weather, birds and rodents. When it rained on the grain, the top surface formed a sort of a crust which protected the grain underneath the surface. Piles were picked up by late November in accordance with USDA requirements and placed in bins or shipped to Northwest ports for export.

In the late 1980's SCAFCO introduced more sophisticated open bulk storage to Turkey and exported enough structures and equipment to them to store around 900,000 metric tons of wheat (around 33 million bushels). These open bulk storage systems had low steel walls, aeration systems, temperature monitoring systems and were covered by pre-manufactured PVC covers. After a year or two of use, TMO (Toprak Mahsulleri Ofisi) added paving inside the walls to reduce spoilage in the bottom layers. TMO was in charge of purchasing and selling all wheat in Turkey.

They constructed oval and circular open bulk storages with capacities of 2,500 tons, 5,000 tons and 10,000 tons (90,000 bushels, 180,000 bushels and 360,000 bushels). The circular storages were filled from receiving concrete pits with belt conveyors. The oval units were filled from trucks with portable augers and portable grain throwers.

In the early 1980's overproduction produced a huge glut of grain all over the U. S. Warehouses started storing grain in piles all over the country in order to find a home for all the produced grain. These temporary storages were usually filled at harvest time with new crop (corn and wheat), or occasionally emptied bins from the previous season crop. These storages were occasionally placed on pavement, but often the grain was stored on the ground. Piles containing a million bushels of corn or wheat were seen in the Pacific Northwest and throughout the Midwest.

Temporary storages were equipped with low walls – either steel, wood or concrete ecology blocks. They were round, oval or rectangular. The round storages were filled with temporary or permanent belt conveyors. Most storages were equipped with aeration systems (negative pressure fans connected to perforated corrugated galvanized steel aeration pipe were required to hold the top covers down during wind events and they helped cool the grain). The top covers





were pre-manufactured to fit the shape of the storage. Usually in the spring time the pile walls were breached and large loaders entered the storage area to fill trucks, taking the grain to feed mills, rail loading facilities, country elevators and export storages.

SCAFCO Grain Systems participated in this explosion of temporary storage by shipping perforated wall panels, aeration pipe and occasionally aeration fans all over the country for use by contractors building temporary grain storages. In 1986, with changes in USDA programs and bad weather, the grain surplus ended and temporary storages all but disappeared from the countryside.

On the other side of the world, a different kind of on the ground grain storage was being practiced in the arid climate of Australia. Australian engineers developed “bunker storage” to store millions of tons of wheat. The storages had one-meter high poured concrete walls (about 39”) surrounding rectangular storages on flat land with concrete floors. These storages were filled from one side by sophisticated bunker filling machines. These portable machines moved along one side of the bunker and are equipped with a low-profile drive-over truck pit and inclined belt conveyor.

Once the bunker was filled it was covered with white polyethylene sheets and sealed to be airtight. Grain respiration soon consumed all the oxygen in the storage and the bunkers became anaerobic. Because there was no oxygen, stored grain insects could not survive. Emptying the bunkers required large

loaders, many trucks and manpower, but grain spoilage was minimal. These bunkers, plus farm storage primarily resulted in a minimal commercial grain storage industry in Australia.

Pakistan, where large quantities of wheat are produced in the Punjab region, tried several of these bunker storages in the mid 1980's. It was never known if these were successful for PASSCO (Pakistan's government grain storage company). A few of these grain bunkers were tried in the U.S., but they were generally not successful. They did not keep grain storage insects from the stored grain and there was some grain spoilage.

Demand for temporary grain storage continued in the 21st century due to improved farming techniques and constantly improving grain yields. Country elevators could not keep up with the volumes to grain to be handled by their organizations and there was never enough capital to build the more and more silos required for grain storage. Today's modern open bulk storages are asphalt paved units with concrete or steel walls of various configurations. Sizes are larger – approaching 1.5 million to 2.0 million bushels capacity (40,000 to 55,000 metric tons).

These storages are being constructed with years of use in mind. They have permanent truck receiving pits and permanent belt conveyors for filling. Storages are equipped with aeration systems and negative pressure fans for grain cooling and holding the top covers down.

Metal walls in various forms have been developed by the grain storage bin manufactures to form the perimeter of these storages. Walls can be as low as 3'6" (1.07 m) to as high as 10'0" (3.05 m). Some walls are vertical and some walls are sloped. Shapes of the storages can be square, rectangular, oval or circular. Generally, after the temporary storages are filled with grain, specialized companies cover them with white polyethylene sheets.

Unloading the storages are still manpower intensive as the walls have to be breached at some point so large loaders can enter the storage to load trucks.

Temporary grain storage systems provide low cost storage in large volumes. Unfortunately, they are manpower intensive to empty. They require emptying over a period of a few days and there are always some storage losses. They are practical in an arid or semi-arid climates but they do not lend themselves to tropical environments or operations where some grain needs to be taken from the storage daily for processing. ♦



This article was written by Mr. Daniel Wambeke, PE, who recently retired from SCAFCO Grain Systems after over forty years of service. Dan continues to consult for SCAFCO in Spokane, Washington State, USA.



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