WINERY DESIGN

## ADELSHEIM VINEYARD

# TRADITIONAL CAVE DESIGN USING MODERN TECHNIQUES

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Photo above: View of north barrel room looking east, toward the tasting room alcove at base of tower.

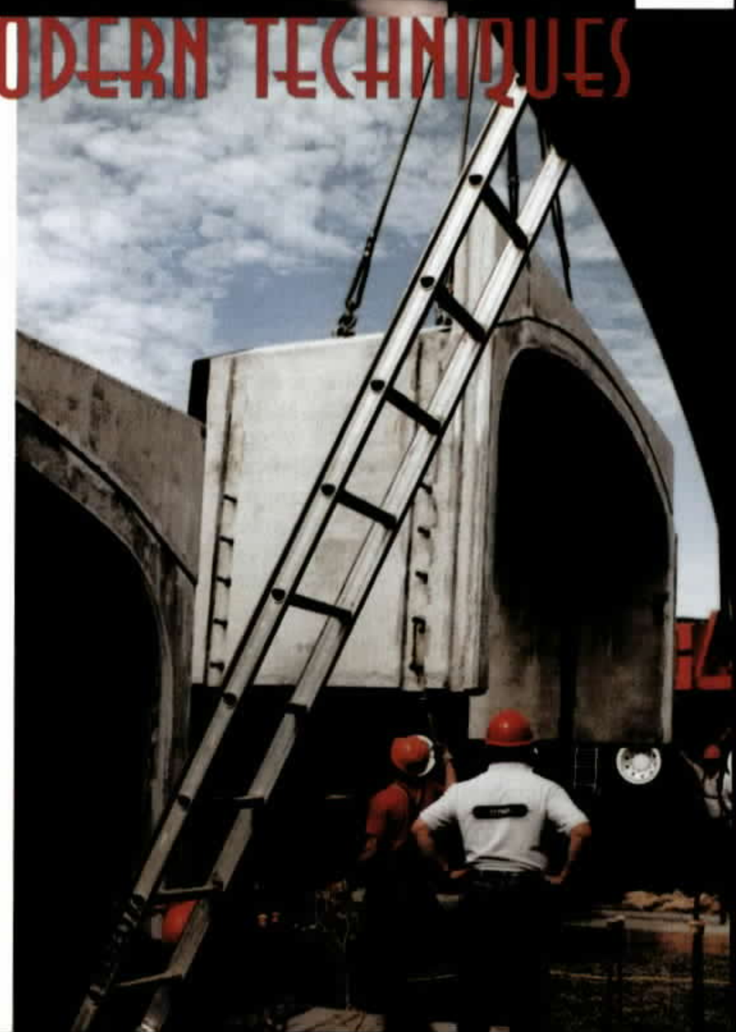

Photo right: Lowering a 20-ton pre-cast vault into place. Vertical keyways with reinforcing dowels are visible on the outside of the vault. These match up with similar keyways on the adjacent unit and were later pumped full of concrete grout.

Adelsheim Vineyard, near Newberg, is one of Oregon's pioneering Willamette Valley wineries, producing Pinot Noir, Pinot Gris, and Chardonnay. The winery's first commercial production of 1,300 cases in 1978 had climbed to 13,000 cases by 1987. As production increased, winemaking in the basement of the Adelsheims' home moved into an adjacent 4,500 sq. ft. structure, which was completed in 1984 and immediately filled to capacity.

In 1992, owners David and Ginny Adelsheim began planning for a new production facility to meet future growth. Expansion was planned in two phases, coinciding with development of new vineyards. Phase I was completed before the 1993 harvest; phase II was completed in 1997. The finished facility has an ultimate capacity of 30,000 cases.

An Oregon vintner who "cut his teeth" at the Lycée d'Agricole in Beaune, France, David Adelsheim has a natural affinity for Burgundian varieties and production techniques. During development of an overall plan for the facility, David, Don Kautzner (winemaker), and I explored design and construction of classic and contemporary wineries, visiting more than 40 facilities in Oregon, California, and Burgundy. Future needs of Adelsheim's winery were anticipated by incorporating and adapting many ideas from these winery visits.

The new 28,000 square foot facility, built into a hill to take advantage of gravity flow, incorporates four levels. The upper level affords access for filling and punch-down of 44 open top fermentors. The intermediate level, eleven feet below, houses the presses and provides access to unloading the fermentors. Three feet lower is the largest level containing barrel cellars, main tank room, lab, wine library, bottling, and case good storage. Truck access to loading docks is four feet lower.

Photo above: Crane lifts vaults into place. Approximately one-half of the vaults have been installed in this photo. Black stripes are sealant used where units come together. Phase I building is at left.

### *Master plan*

The overall plan for the winery (fig. 1) called for a U-shaped building enclosing an entry courtyard. The northern side of the "U" houses the red fermentation room and the press room. The southern side contains the bottling line, loading docks, glass and case goods storage. The base of the "U" is the main tank room. In the center of the "U," below the entry courtyard, are four barrel rooms.

The courtyard is a staging area during harvest. Grapes arriving by truck are off-loaded in the courtyard by forklift. Whole clusters of white grapes are loaded directly into a 80hl membrane press through a large door opening from the courtyard. Red grapes can be staged out of the rain in an unheated vestibule at the west end of the fermentation room.

The red fermentation room has two wide concrete catwalks, each with a row of open-top red fermentors along each side. Fermentors vary in capacity from three to eight tons. On the upper catwalk level, red grapes are dumped onto a sorting table, built by BEI Inc. of South Haven, MI, which is equipped with a variable-speed, open-mesh conveyor belt and a high-speed blower to remove excess water. The conveyor (15 feet long and 30 inches wide) feeds directly into the destemmer which, in turn, drops destemmed grapes into a fermentor. Each step was planned within tight tolerances to minimize vertical (falling) distance and ensure the gentlest grape handling.

On the lower level, after fermentation, the wine is drained from the fermentors through a strainer, and the remaining pomace is shoveled into bins and transferred to the presses. The press room is directly adjacent to the main tank room to minimize pumping requirements. There are three presses: the 80hl press for white grapes and two smaller presses (15hl and 22hl) used primarily for red wine. When necessary, the smaller presses can serve as white presses conveniently accessed from the courtyard level by removable chutes.

On the upper level, between the tank room and press room, the winery offices and a dining room flank a garden terrace with views of the vineyards. A small tower marks the public entrance. Glass block flooring in the tower allows filtered light into the tasting area below. This intimate space opens directly to the barrel rooms. Design inspiration was the exquisite tasting alcove of Domaine des Comtes Lafon in Meursault.

Phase I of the expansion included the central tank room, laboratory, and wash rooms for the harvest crew. For three years, until Phase II was completed, this structure also contained the winery's entire white wine production.

Seven openings, each five feet wide and eight feet tall, were incorporated into this tank room, ready to connect to barrel rooms planned in Phase II. Excavation for the barrel rooms began in fall 1996, as 18 newly planted acres came into production.

### *The model*

Prior to refining the design of Phase II, the final, larger phase of the winery, Adelsheim decided we should revisit Burgundy, "to make sure we don't repeat the latest mistakes." An Italian side trip was included to Friuli, Trentino, and Alto Adige where white wines are produced, including the Oregon varietals: Pinot Gris (Pinot Grigio), Pinot Blanc (Pinot Bianco), and Chardonnay.

The goal in designing the Adelsheim cellar was to provide a spatial experience similar to the traditional Burgundian cellars, using cost-effective means. Traditional Burgundian caves are low, elegantly vaulted spaces constructed of stone and mortar, typically located directly under the fermentation or bottling area. Barrels are arranged in rows and stacked by hand, only two or three high.

Earthen floors, covered with gravel, help maintain humidity. Walkways between barrel rows are paved with flagstone or concrete. Since French cellars usually accommodate bottled wine and barrel storage, tasting rooms are often part of, or located adjacent to, these cellar spaces.

We were impressed with the many natural advantages of a traditional cellar. Although technology now permits precise control of temperature and humidity regardless of the enclosure, artificial climate control can be costly. Energy consumption is just one issue. Mechanical refrigeration circulates and dehumidifies air, causing evaporation of wine from barrels and requiring frequent topping.

In addition, wineries are notoriously corrosive environments. Maintenance is a constant concern, and the life span of mechanical equipment is limited. The passive, natural control of humidity, temperature, and evaporation is a strong, cost-effective argument in favor of classic cellar designs.

Drilled caves were ruled out early in the research and planning at Adelsheim because of inappropriate sub-surface rock, the expense of dealing with Oregon's high winter water table, and lack of a significantly sloped site. Several other construction techniques were considered, ranging from a Swiss tunneling system to flat pre-cast ceiling planks "dressed up" with arch-shaped room dividers.

Finally, when thumbing through a landscape architecture trade magazine, I spotted an advertisement for a pre-cast concrete bridge system capable of spanning from 12- to 42-feet with up to a 15-foot rise. This looked like just the vaulted form needed for Adelsheim. I contacted the Ohio-based CON/SPAN Bridge Systems, which has a pre-cast plant licensed to manufacture its units within 20 miles of Adelsheim's winery site. CON/SPAN has provided units for Afton Mountain Vineyards in Virginia, for El Molino Winery near St. Helena, CA, and for an underground barrel storage entry tunnel at the E&J Gallo facility in Healdsburg, CA.

Initial cost estimating by the local distributor, CSR Associated of Tualatin, OR, compared favorably with the least expensive pre-cast or cast-in-place concrete structural system under consideration ($27/sq.ft. for the vaults FOB job site).

Aesthetics aside, two main advantages of the system were immediately apparent. The vaults are impressive in their strength and have been used as airport taxiway overpasses supporting 747s. The weight of grape trucks, forklifts, and tractors would be insignificant by comparison. More important, because winery projects invariably face the "beat-the-clock to harvest" syndrome, the fact that the vaults are fabricated entirely off-site was a real plus. Site preparation, excavation, utility, and foundation work could proceed without interfering with winery activities.

### Cellar design

The final cellar layout utilizes 40 of these pre-cast vaults, four rows of 10 each. Each of the four rooms accommodates 285 barrels in four rows: a double stack along each wall and two rows, three-high, down the center. In addition, each room has a 500-liter topping tank.

The pre-cast units have a 20-foot clear span; they are 10-feet high and 8-feet deep. The height allows just enough room to get a Bulldog Pup into the highest barrels.

Since these vaults are typically used for bridges and culverts and not buildings, it soon became apparent that the myriad openings needed for doors, duct work, plumbing, and electrical piping to interconnect the barrel rooms would eliminate some of the cost advantage.

In addition, the question arose of how to thermally isolate portions of the barrel rooms, when the temperature needed boosting to encourage malolactic fermentation. An ideal roll-up thermal curtain was discovered at Pojer & Sandri Winery in Italy, but the curtain amounted to an oversized window shade and would not have adequately sealed the arched opening.

The solution to both of these problems — the need for openings and for thermal isolation — was one cast-in-place flat-roofed, center cross-aisle, cutting across the middles of the four barrel rooms. The vaults on either side of this center section were designed with head walls, making the ceiling height in this section slightly higher. A roll-up thermal curtain was mounted on the side wall to isolate one-half of the cellar. In addition, this site-built portion accommodates all the miscellaneous penetrations required.

The cast-in-place center section also makes sense from a construction viewpoint. The vaults could be set from the existing building toward the center and from the end retaining wall toward the center. Any accumulated tolerances could be accommodated by adjusting the width of the cast-in-place center aisle.

The center section also conveniently contains barrel-washing facilities for each room. Winemaker Kautzner has planned an efficient routine in which each barrel is taken from its stack after racking and rolled onto a lees bucket that is set into one of two floor wells. After emptying, it is rolled onto a barrel washer set into the second well, exactly one barrel circumference away.

After washing, barrels are rolled back to their place to be re-stacked. The wells are interchangeable for either lees bucket or washer. This way, one cellar worker can continue racking while the other washes and replaces barrels. In a winery where barrels are moved by hand, this means each barrel is handled only once. The wells are covered with high-strength nylon grates when not in use.

### Breaking ground

The contractor, OTKM Inc., began earth moving for the project before the rainy season in fall of 1996. Once the site was excavated to a depth of 14 feet and covered with a 12-inch layer of gravel, the design was refined. CON/SPAN engineers and local CSR pre-cast personnel worked closely with us to develop an initial prototype form. This included specific designs for lighting recesses, concealed (cast-in) conduits, and block-outs for junction box access. After the prototype was approved, CSR was able to produce one vault per day, six per week, in order to meet a tight construction schedule.

The interface between the pre-cast units and the rest of the building was coordinated with the structural engineers, Berry/Nordling Engineers Inc. To ensure that the structure would meet seismic criteria, steel plates were embedded in the retaining wall that closed the west end of the vaults and in the top of each vault. Steel angles were welded to both of these plates after the units were set, to tie the whole system together.

At the site, work proceeded on foundations. The legs of two vaults rest upon a common footing, approximately seven feet wide and 15 inches deep. A wide slot or keyway runs down the middle of each footing. Plastic shims were used to set the vaults plumb and level in this keyway, then cement grout was poured to permanently set them in place. The top portion of footings, which protrude up into the barrel room gravel floor, was sloped to assure drainage. The first vault arrived by truck at 7AM on a Monday morning. By noon the following day, all 40 vaults had been set in place with their joints sealed.

Concrete grout was required between parallel units to increase the resistance to earthquake forces. Understandably, the contractor attempted to pour both keyway and wall grout at the same time but soon discovered that the vibrator used to distribute the grout was capable of moving the 20-ton vault several inches out of position. The foundation keyway had to be grouted first, before the upper vertical gap between the cells.

## SPECIFIC DESIGN ISSUES

### Structural

In a typical bridge or tunnel installation, the outside legs of the units are restrained by soil as they are buried along their entire length. But the goal at Adelsheim was to make the outer legs of the vaults do double duty, serving as the lower wall of the adjacent fermentation and case-good spaces.

The engineers were further challenged to design the upper walls of the two major spaces to bear directly on the outer legs of the vaults. Extra reinforcing steel was needed, but this was a less expensive and more efficient solution than building a separate two-story wall for each space. Special attention to the connection was required where the upper level wall actually rests on the vaults. CSR fabricated the outside vaults with special keyways to accept the upper portion of wall. Threaded dowels were also employed to help transfer the lateral (seismic) loading.

### Drainage

Because rows of vaults were installed side-by-side, drainage of the valleys between rows became a critical design issue. The solution was to pour lightweight concrete "crickets," sloped to direct the water to drains and then pipe it down a five-inch gap between cells. Courtyard drainage was directed to catch-basins and piped between vaults and through footings to the storm water detention pond.

The plumbing contractor had all of the pipes stubbed out above the final ground level. When the vaults arrived, they were simply set around the vertical pipes, which were later trimmed to the appropriate height.

To facilitate drainage of groundwater, spilled wine, or wash water, the design called for sloping the sub-soil beneath each barrel room and funneling runoff to a central drain. In reality, the "mudstone" beneath the site could not be adequately shaped. The alternative devised with the soils engineer was to line the excavation with filter fabric extending right up to the footings and then to compact crushed rock into the same funnel shape.

### Mechanical Systems

Cellar floors are gravel in a typical Burgundian cave. From the early conceptual stage of this project, the use of in-slab heating in the concrete walkways was considered to minimize air circulation and evaporation.

The architect for the new Hospice de Beaune cellars in Burgundy suggested that Adelsheim cool the cellar by connecting the in-floor heating tubes to the process cold water system. Although cooling from the ground up is not fast or efficient, in the cellar, quick temperature changes are not important or desirable. The system is supplied by the same chiller as the process heating and cooling.

Since fermentors are typically used only four to six weeks each year, the chiller could be put to use when it's normally not in service. All of the exterior piping was insulated, and a small space heater was installed in the chiller equipment room to avoid frozen pipes.

Condensation was also a concern in this carefully controlled, humid area. To prevent moisture dripping from the ceiling, two layers of rigid insulation were placed above the cellar and below the soil. The insulation conformed to the curved surface of the vaults. A special high-density layer was used over the center, flat-roof section where there was less soil cover to distribute the weight of vehicles above.

### Final touches

Because the vaults were produced in the controlled environment of a pre-cast plant, their interior surface is quite consistent. However, to smooth patches over lift holes and help unify the pre-cast vaults with the cast-in-place sections, a surface polymer coating was applied by spray gun when all concrete work was completed.

Finally, considerable attention was given to lighting; several visits were made to the pre-cast yard to try out mock-ups. Adequate lighting was desired for cellar work and appropriate mood lighting for barrel tasting with clients. The solution was inexpensive, high-output, industrial spotlights, U.L. listed for wet locations. These are positioned high to wash the arched ceiling with light and are covered with custom terra cotta sconces designed and built by Ginny Adelsheim and her sister, Corinna Campbell of Fondo Terra Cotta. The lighting is controlled with dimmer switches.

### Architect's postscript

As a designer, my intent from start to finish with this project was to address practical and aesthetic issues for a structure that enhanced the art of winemaking for David Adelsheim, his winemaker, and cellar staff. I rediscovered that classic solutions are simply that — those that have withstood the test of time. As a team, we were able to see how adaptations of these forms, techniques, and materials can work well for a modern winery. ■

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