

California Wine Caves Showcase Wet-Mix Shotcrete

By Oscar Duckworth

There has never been a use for shotcrete that promotes tourism more than the California wine cave. Each year, people from across the globe come to experience California's famous wine region. Visitors compare pinots, merlots, and cabernets within the beautiful underground wine caves of the region's famous vineyards.

While many believe wine caves may not be the primary draw to California wine country, it is hard to imagine this region without these spectacular structures. Although originally built to provide ideal fermenting and storage conditions for freshly crushed grapes, California wine caves are now a staple of the region's immense tourism draw. No wine tasting outing would be complete without a look into the complex, underground world of the winemaking industry.

Stepping into a chilly wine cave begins a sensory overload of sights, smells, colors, and textures. Narrow underground passageways can open into grand subterranean ballrooms. Vaults full with neatly cradled barrels sit aging to perfection under nature's optimum temperature and moisture conditions deep within the earth. Gala benefits, dinner parties, and even weddings are frequently held within these spectacular shotcrete caves.

Shotcrete Technology Revolutionizes the Wine Industry

With the exception of a handful of hand-dug wine storage caves created by early vineyard settlers, few wine caves existed prior to the initial

use of shotcrete. In the 1980s, wet-mix shotcrete revolutionized the California wine cave industry. Wine cave pioneers, such as Alf Burtleson and others, promoted methods using wet-mix shotcrete to excavate and stabilize large caves within the volcanic tuff formations common to the wine country. The use of wine storage caves not only greatly improved the region's wine quality, but also became an unintended tourism magnet. It appeared that everyone wanted to experience a tour through these amazing subterranean structures. Soon no prominent vineyard was without its own ever more dramatic wine cave. Today, wine caves can vary from simply utilitarian to unimaginably elaborate; however, the primary goal is to provide the California wine country an optimum underground environment to make, age, and showcase the region's world-class wines.

Client Expectations Have Changed

Sash Williams, Senior Engineer, Williams and Associates, Santa Rosa, CA, oversees the engineering, design, and construction of many of the region's wine caves. Williams sees the current trend of caves that are primarily designed for barrel storage moving to a much more diverse purpose. "Client expectations have changed. It is not uncommon now for the caves to include everything from full underground wine production facilities to art galleries. We are seeing a wider selection of cross-sectional shapes including round, compound curves, high arches,





and vertical walls. There is a trend away from the rougher, free-form shapes of the past to sharp, crisp shapes with finishing tolerances closer to conventional concrete construction.” Williams claims that a more recent consideration is moisture and water within the cave. “Where leaks, moisture, and mold may have been tolerated in years past, the use of caves for much more than just barrel storage has changed client expectations. While a select few may still allow for visible moisture intrusion, the overwhelming majority seem to desire conditions closer to a conventional building. Water mitigation, as the preferred terminology may reflect, can be challenging or risky, depending on the amount of moisture. In the cave industry, it is not uncommon for the actual approach to water control to be treated as a design-build item by the cave contractor, with each contractor typically having a preferred approach, material, or methodology.”

Rick Shone, PE, President of Nordby Wine Caves, Healdsburg, CA, has built many wine caves for a diverse group of clients. “While some wine caves carry strict budget guidelines, many ‘lifestyle’ vineyard owners are interested in creating truly exceptional caves.” Immense subterranean rooms featuring tall ceilings, special surface textures, and spectacular lighting adorn his company’s photo album of recently completed work. “California wine caves continue to carry

strong market appeal. I see caves requiring larger, more elaborate, complex shapes to accommodate forklifts and winemaking equipment while providing room for wine tasting, ballrooms, or dining areas.”

Changes to the Cave Industry

Shone also sees changes in the region’s cave industry. “Wet-mix has almost completely replaced dry-mix placement. We only use the dry to occasionally pick up strength quickly in poor rock conditions. More and larger reinforcement patterns are commonly specified along with modern shotcrete mixture designs that improve in-place quality. Our shotcrete placement crew continuously uses the blow pipe to assure lenses of loose rebound material cannot accumulate and form moisture paths through the completed work. These steps, in conjunction with current water mitigation technology, have made wine caves much stronger and more watertight than earlier cave construction methods could have provided.”

The California wine cave industry has evolved conventional shotcrete placement and tunneling techniques to produce a unique, architecturally significant product that is specific to this region. Their prominence contributes immeasurably to the character of this global tourist destination. The shotcrete process has forever changed how the region’s wine industry



creates, ages, and showcases its product. While California wine caves are certainly the most visited of all shotcrete structures, it is the combination of utility and unexpected elegance created within their interior spaces that makes them truly special. The artistic implementation of structural shotcrete within the California wine country's spectacular wine caves may be shotcrete's most majestic use.

All photos courtesy of Sash Williams and Rick Shone.



*ACI Certified Nozzleman **Oscar Duckworth** is an ASA and ACI member with over 15,000 hours of nozzle time. He has worked as a nozzleman on over 2000 projects. Duckworth is currently an ACI Examiner for the wet- and dry-mix process. He continues to work as a shotcrete consultant and a certified nozzleman.*