

# Case History

## Bridge Deck Overlays

**Resin:** Vicast® Isophthalic Polyester

**Composite Application:** Polyester Concrete

**Location:** Bridges on I-80  
Between Truckee and  
Floriston, California

**Installed:** 2004

Polyester concrete overlays demonstrate that when it comes to bridge construction, polymer composite technology can start right at the top. When used as a bridge deck overlay, polyester concrete offers numerous cost and performance advantages over alternative materials such as conventional concrete, latex-modified concrete, methacrylate epoxy concrete, and asphalt.

Polyester concrete is a composite of dry aggregate in an unsaturated, or thermoset, polyester resin binder. When the liquid resin cures into a hardened, cross-linked state, a polyester concrete is formed to provide these primary features and resulting benefits:

- Ease of application for reduced production costs
- Quicker cure for shorter lane closure times
- Thinner overlays for greater live load capacity
- Higher elongation and tensile strength for improved dynamic performance
- A protective barrier against moisture and deicers for lower maintenance costs and longer service life
- Greater resistance to abrasion and impact for lower maintenance costs and longer service life.



The surface is cleaned and primed prior to application of the polyester concrete.



The Vicast® resin is stored on site in an ISO container.



The traffic lane can be re-opened for traffic within four hours of the polyester concrete application.



New polyester concrete deck overlays are being applied to multiple bridges on Interstate 80 between the California towns of Truckee and Floriston.

## **I-80 Truckee-Floriston Project**

Working over the years with contractors and material suppliers, engineers for the State of California Department of Transportation (Caltrans) have advanced the art and science of polyester concrete overlays. One of the most recent California projects for the material is for a scenic stretch of Interstate 80 in the Sierra Nevada Mountains. Atlas Construction Supply, Inc., San Diego, California, is working with Granite Construction, Sparks, Nevada, to overlay the decks on multiple I-80 bridges between the California towns of Truckee and Floriston.

When completed, the Truckee-Floriston Project will have consumed 700 cubic meters of polyester concrete material. Some 400,000 pounds of polyester resin have been delivered in ten batches of 40,000 pounds each to allow for on-site polyester concrete processing. Processing and application of the polyester concrete are performed in accordance with the Standard Special Provisions published by Caltrans.

Caltrans specifies that the resin binder for a polyester concrete overlay be “an unsaturated isophthalic polyester-styrene co-polymer.” For the Truckee-Floriston Project, Atlas Tech-Deck™ polyester concrete is composed of a Vicast® isopolyester resin engineered and manufactured by the Perris, California, facility of AOC, Collierville, Tennessee. Ryan Quinn, Product Manager, Atlas Construction Supply, points out how the role of the resin manufacturer goes beyond mere supply.

“The reaction chemistry for curing an unsaturated polyester is very dependent on environmental conditions, especially deck and ambient temperatures,” Quinn says. “When we’re placing polyester concrete overlay, environmental conditions in the field are constantly changing,” he continues. “We adapt to the conditions by adapting the reaction chemistry. To do that, we get technical

support from AOC. For example, with each resin batch that we receive, AOC Technical Service Manager Bill Longest ensures that we have the most efficient gel time [the point at which the resin sets up and is no longer workable].”

## **Vicast Resin Requirements**

The Vicast resin is supplied to Truckee-Floriston Project sites on a batch basis. Each batch is shipped in a standard ISO container, designed for transporting liquid chemicals in 20,000 to 25,000-liter capacities. While the shelf life of the Vicast isopolyester resin in an ISO container is generally at least nine months, it is common practice to use the resin within one week after delivery to the job site.

Each resin batch that leaves the Perris facility is tested to ensure that the resin meets or exceeds specifications set forth in the following table prepared by Caltrans:

POLYESTER RESIN BINDER		
PROPERTY	REQUIREMENT	TEST METHOD
* Viscosity	0.075 to 0.200 Pa·s (RVT, No. 1 Spindle, 20 RPM at 25°C)	ASTM D 2196
* Specific Gravity	1.05 to 1.10 at 25°C	ASTM D 1475
Elongation	35 percent, minimum Type I at 11.5 mm/min. Thickness= 6.5±1 mm	ASTM D 638
	Sample Conditioning: 18/25/50 + 5/70	ASTM D 618
Tensile Strength	17.5 MPa, minimum Type I at 11.5 mm/min. Thickness= 6.5±1 mm	ASTM D 638
	Sample Conditioning: 18/25/50 + 5/70	ASTM D 618
* Styrene Content	40 percent to 50 percent (by weight)	ASTM D 2369
Silane Coupler	1.0 percent, minimum (by mass of polyester styrene resin)	
PCC Saturated Surface-Dry Bond Strength	3.5 MPa, minimum at 24 hours and 21±1°C	California Test 551
* Static Volatile Emission	60 gram per square meter, loss, maximum	South Coast Air Quality Management District, Standard Method
* Test shall be performed prior to adding initiator.		

As indicated, certain tests are to be performed before the addition of the “initiator,” a chemical that is added to an unsaturated polyester formulation to start the reaction that leads to resin cure. The most commonly used initiator is methyl ethyl ketone peroxide (MEKP). For polyester concrete, the initiator is added to the resin just prior to when resin and aggregate are mixed together.

### Overlay Processing and Application

For the I-80 Truckee-Floriston Project, the need for new overlay is evident as existing overlays show signs of disrepair. After the old overlay is removed, the concrete deck surface is cleaned and then primed with a wax-free, low odor, high

molecular weight methacrylate primer. The prime coat is designed to improve the adhesion of the polyester concrete to the concrete deck surface.

The polyester concrete is made by first drawing the Vicast isopolyester resin from the ISO container and adding initiator. The initiated resin is mechanically mixed with coarse and fine aggregate in a cement mixer. Caltrans specifies that the resin content should be approximately 12% of the mass of the aggregate. After mixing for approximately two minutes, the polyester concrete is discharged into a front end loader. The material is then applied from the loader to the primed deck surface.

After the polyester concrete is struck off and before the resin gels, the overlay surface is tined and textured with a uniform application of sand to provide excellent skid resistance. The minimum coverage for the texturing sand is 0.4-kilogram per square meter. The surface texture must have a coefficient of friction of not less than 0.35 as measured by California Test 342. After the resin cures, expansion joints are cut and filled with appropriate joint filler materials.

### **Polyester Concrete Overlay Benefits**

**Rapid Cure.** By adjusting the chemical formulation, the Vicast isopolyester has the ability to cure over a 50° to 123°F range. The speed at which the resin cures provides one of polyester concrete's most noteworthy advantages. With polyester concrete, cure is sufficient enough to reopen the work area to traffic within four hours after application. With alternative overlay materials, traffic is disrupted for at least twice as long and often more.

**Increased Live Load.** Depending on specific site requirements, a polyester concrete overlay can be built up in layers to a thickness as great as 5.5 inches. But for the majority of the Truckee-Floriston Project, the nominal overlay thickness is only 0.75 inch. Compared to alternative overlay materials, this represents a significant reduction in thickness – and thus mass – with no reduction in performance requirements. The net result is an increase in the bridge's live load capacity and projected service life.

**Flexibility and Abrasion Resistance.** The Vicast isopolyester's elongation of 50% (per ASTM D 638) exceeds the Caltrans specification. The higher elongation enhances the overlay's ability to flex under load and to accommodate the extreme freeze-thaw cycles of the Sierra Nevada environment. The Vicast isopolyester also has excellent abrasion resistance. This feature offers added protection against damage caused by tire chains used during extreme winter weather.

**Corrosion Resistance.** "For thousands of applications around the world, AOC isopolyesters have

demonstrated their ability to resist the corrosive effects of moisture and chemicals," states AOC Business Manager Emilio Oramas. "For polyester concrete overlays, this proven performance establishes a protective barrier against rain, snow, ice and road salts. The isopolyester helps reduce concrete spalling and steel rebar corrosion, and that reduces the maintenance costs and extends the service life of the bridge structure."

### **About Atlas Construction Supply**

Atlas Construction Supply Inc. is a customer-oriented company specializing in concrete construction chemicals and restoration products as well as the design, fabrication and supply of concrete forming and shoring systems.

In addition to company headquarters in San Diego, California, Atlas Construction Supply has branches in Las Vegas, Nevada; Phoenix, Arizona; and Los Angeles, California. For more information about Atlas Construction's polyester concrete capabilities, contact Ryan Quinn. Phone (858) 277-2100; fax (858) 277-0585; e-mail [ryanquinn@atlasform.com](mailto:ryanquinn@atlasform.com).

### **About AOC**

Headquartered in Collierville, Tennessee, AOC is a leading global supplier of resins, gel coats, colorants and additives for composites and cast polymers. By listening to customers then delivering the technology and service they need, AOC has become the new leader in corrosion-resistant resins. For more information about AOC and Vicast resin technology, phone Steve Martin at (901) 854-2847 or e-mail [smartin@aoc-resins.com](mailto:smartin@aoc-resins.com).

