

I-80 Verdi Bridge – Verdi, NV, USA

Project overview

MAPEI products were used for the structural repair of deteriorated concrete on the columns, ledger beams and pile caps of the Interstate 80 (I-80) Verdi Bridge over the environmentally protected Truckee River in Nevada.



Project information

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| Project category: | Infrastructure – Bridge |
| Period of construction: | 1995-1996 |
| Years of MAPEI involvement: | 2015-2016 |
| MAPEI coordinator: | Tom Lundgren |
| Project owner: | Nevada Department of Transportation (NDOT) |
| MAPEI distributor: | Titan Construction Supply |
| Original designer: | Nevada Department of Transportation engineers |
| General contractor: | Granite Construction Inc. |
| Concrete-restoration contractor: | Granite Construction Inc. |
| Project manager: | Donavin Greenwell |
| Photographer: | Tom Lundgren |
| Project size: | 1 mile (1,61 km) long x 100 feet (30,5 m) high |



MAPEI products used

- Planitop® XS
- Planitop 15
- Planiseal® WR 100



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Structural strengthening of scenic bridge on interstate highway

Interstate 80 (I-80) traverses the United States from San Francisco, California, to New Jersey, passing through the northern portion of the state of Nevada. The highway serves as a major artery between Sacramento, California, and the metropolitan areas of Reno-Sparks and Carson City, Nevada, as well as the famous recreational area of Lake Tahoe.

I-80 follows the routes of the Truckee River, the historical California Trail and the First Transcontinental Railroad, paralleling the transportation corridor that was used in the 1840s during the era of the California Gold Rush.

The mile-long, 100-foot (30,5-m) high Verdi Bridge lies a short distance from the California-Nevada border – just below the historically famous Donner Pass. The bridge carries I-80 traffic over the broad, craggy canyon that has been cut deep into the Sierra Nevada range foothills by the Truckee River over the millennia.

Over the years, the structural concrete of the columns, ledger beams and pile caps on the bridge had progressively decayed due to thermal stresses, freeze-thaw cycling, de-icing salts, deterioration of slab-bearing plates, impact, corrosion cells and more.

The structure was clearly at the pivotal point in its life cycle where repair was still feasible at a reasonable cost. If not thoroughly restored at this time, in another year or two the integrity of the structural elements would become severely compromised – a full-scale replacement of most of the pile caps and many of the ledger beams would be the only solution. Therefore, the Nevada Department of Transportation (NDOT) decided to address the bridge's issues at an early stage.

The repair division of Sparks, Nevada-based Granite Construction Inc. was awarded the contract by the NDOT in the summer of 2015. However, due to environmental issues related to wildlife habitat protection (e.g., a swallow nesting area under the bridge), work could not begin until fall of 2015.

Starting a project so late in the year in the foothills of the Sierra Nevada mountains presented major challenges. Donavin Greenwell, repair structures superintendent at Granite Construction, anticipated that his crewmen and repair materials would be pushed to their limits by the area's typical cold winter temperatures combined with heavy snowfall. Cold-temperature mitigation measures would be required.

Although the cutting, chipping and removal of deteriorated concrete can take place under cold temperatures, repair mortars cannot be installed

when substrate temperatures fall below 45°F (7°C). Consequently, tenting and heating became mandatory – not an easy feat on a 100-foot (30,5-m) high structure bridging a canyon that is exposed to high winds.

Scaffolding was erected around columns and beams and then thoroughly screened in to prevent debris – caused by chipping guns – from falling into the Truckee River. Plastic was then wrapped around the scaffolding to help create the recommended surface temperatures for applying repair mortars.

As repairs progressed, each area of work was brought up to the required installation temperature over several days by means of clean air that was transferred from diesel heating units via ductwork. A very detailed repair plan had to be mapped out ahead of time to control heating costs and ensure non-stop progress.

MAPEI products on the jobsite

Because 75% to 80% of the damaged areas were deep and involved the reinforcing steel, repairs were deemed to be structural. International Concrete Repair Institute (ICRI) guidelines regarding removal geometry and surface profile (concrete surface profile [CSP] #7 to #9) were followed. Given the size, depth and volume of the areas to be repaired, form-and-pour methods as specified in ICRI guidelines for structural repair mortar were employed.

To ensure effective load-sharing structural repairs, application methods and materials had to work hand in hand to avoid cold joints and create homogenous repair. The mortar needed to be fluid and self-priming – offering high bond strength, low coulombs and volume stability, as well as a modulus of elasticity comparable to the host concrete. Granite Construction turned to MAPEI for solutions.

In order to confirm selection of the optimal MAPEI mortar, a site visit with Greenwell and NDOT engineers was scheduled in early December. After the site visit, it was clear that **Planitop 15** form-and-pour concrete repair mortar with its high-flow, self-consolidating properties would be ideal.

Many areas to be repaired presented the additional challenge of congested reinforcing steel. Again, **Planitop 15** with its high-flow properties would ensure complete consolidation around the tightly spaced reinforcing steel. For small, superficial repairs, such as soffit edges and corners, **Planitop XS** fast-set, nonsag, trowel-grade repair mortar was the perfect choice for overhead hand placement.

These two repair mortars were submitted to Granite Construction by MAPEI distributor Titan Construction Supply of Reno, Nevada, along with product technical data sheets for NDOT review. After a joint meeting between the NDOT bridge engineer, Granite Construction and the MAPEI representative in early November, NDOT issued a formal approval for the use of **Planitop 15** and **Planitop XS** on the Verdi Bridge restoration project.

The project continued from November 2015 through the end of February 2016. The Granite Construction crew used approximately 2,000 bags of **Planitop 15** for the deep, structural-type repairs as well as for "jacketing" (enlarging) columns that were found to have insufficient concrete cover over the reinforcing steel.

The outstanding skill of the Granite Construction carpenters played a key role in the success of the form-and-pour repairs. The carpenters built strong, highly reinforced, leak-free forms – in many cases, elaborate in detail – in order to restore the planes and contours of the existing bridge elements.

When poured, **Planitop 15** flowed freely through the well-constructed forms, surrounding the congested reinforcing steel and filling the void between the inner surface of the forms and the saturated-surface-dry host concrete. A few taps on the forms with a hammer were all that were needed to ensure 100% consolidation and a well-bonded, homogenous repair.

For minor surface blemishes, Granite Construction employed **Planitop XS**. The Granite Construction crew hand-placed several hundred bags of **Planitop XS** to correct bug holes and surface profile issues.

After the structural repairs were completed, all of the pile caps and load-bearing pedestals were treated with **Planiseal WR 100** – a 100%-silane penetrating water repellent – to protect against chloride ion intrusion.

Both **Planitop 15** and **Planitop XS** repair mortars performed remarkably. Not only did the Granite Construction installation crew find them easy to mix and install, the results were excellent – meeting the aesthetic expectations and stringent functional requirements of NDOT quality-control inspectors and the Granite Construction project managers.

There were no call backs to correct defects or deficiencies. Greenwell praised the performance of the MAPEI mortars, as well as the service provided by the local MAPEI distributor and the on-site technical support provided by the MAPEI representative.

