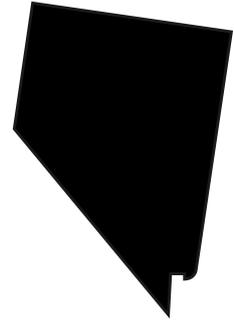


Nevada

by Jessen Mortensen, Nevada Department of Transportation



As the Nevada Department of Transportation (NDOT) approaches its 100-year anniversary, there is a continuing effort to explore more economical and innovative methods of maintaining and expanding the state's infrastructure while keeping the traveling public safe and connected.

Nevada is fortunate to have the lowest percentage of deficient bridges in the nation, as ranked by the American Road and Transportation Builders Association. However, like other states, many of Nevada's bridges were constructed as part of the interstate system and are quickly approaching the end of their original service lives. While the state has managed to reduce the number of deficient bridges in recent years, it will become more difficult to maintain this trend as approximately 38% of the state-owned bridges currently exceed 50 years of age.

Concrete Bridges in Nevada

Concrete bridges have always played a major role in Nevada's infrastructure and while it continues to utilize precast concrete and steel girders, cast-in-place (CIP), post-tensioned concrete box-girders are the most commonly constructed bridge type throughout the state, and have been since their first use in the early 1970s.

Widespread use of CIP post-tensioned concrete box-girder bridges may seem foreign in other parts of the country where precast concrete beams are a more economical option. However, a problem somewhat unique to Nevada is the lack of girder fabricators in the state. Historically, all steel and precast concrete beams have been supplied by out-of-state contractors in Utah, Arizona, or California. Shipping often contributes to the additional cost associated with these superstructure types. Cost analysis of many of our bridges has shown CIP concrete box girders to be the most economical, followed by precast concrete and steel.

In the past, precast concrete girders had limited use throughout the state. Records indicate the occasional construction of precast concrete box-beam and girder bridges dating back to the 1930s, with the highest concentration in the 1960s. Only in the last 10



US 50 Cave Rock Tunnel extension for rockfall protection. Photo: Nevada Department of Transportation.

years has there been a resurgence in the use of precast concrete structures, primarily in design-build jobs. Several factors have contributed to this increase.

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The larger design-build projects have included improvements to major arterials in urban areas where falsework is not feasible. In these locations, steel girders were the previously preferred alternative because of the price associated with precast concrete girders. However, with standardized shapes leading to quicker designs, increased speed of construction, and more competition amongst suppliers, precast concrete girder prices have become more competitive, and in some instances, more economical than steel girders in Nevada.

Segmental construction has been utilized only once in Nevada while building the Las Vegas

Spaghetti Bowl, a project that included several large flyover structures. Very few other projects in the state have had the size or number of structures to prove economical for this type of construction.

Although there has been more diversity in the recent construction of bridges in the state, CIP post-tensioned concrete box girders continue to be widely used because of the many benefits they offer. The bridges have proven to be low-maintenance, durable structures that exhibit excellent seismic performance. They are an economical option that local contractors are familiar with and know how to build, and the majority of the work is performed by local laborers, supporting the state's economy.

Current Trends

There is currently a substantial increase in the pace of construction of bridges in the state, primarily attributed to three large projects underway in the Las Vegas valley. Over the next few years, Project NEON and the two phases of the Boulder City Bypass will add nearly 50 bridges to the state's structural inventory of approximately 2000 bridges. More than 40 of these structures are precast or CIP concrete. While this may not seem significant to many



Interstate 80 Silver Zone Summit wildlife crossing. Photo: Nevada Department of Transportation.

of the states with larger construction programs, NDOT typically constructs fewer than a dozen bridges statewide per year.

Project NEON is the largest public works project in Nevada history, and includes operational improvements to the I-15 Las Vegas corridor from Sahara Avenue to the Spaghetti Bowl. Existing infrastructure and maintenance of traffic along this highly traveled section of road added complications to the proposed construction of 30 new bridges. The project reference design documents included a mix of CIP concrete, precast concrete, and steel structures to account for the geometric constraints at various locations. The design-build contractor chose to build all structures utilizing precast concrete girders and partial-depth precast concrete deck panels. All precast concrete elements will be manufactured in Phoenix, Ariz., and transported to the jobsite.

NDOT and the Regional Transportation Commission of Southern Nevada are simultaneously constructing both phases of the Boulder City Bypass. Nearly 15 miles of new highway are being built as part of Interstate 11 extending from Henderson to US 95 (Phase 1) and continuing to US 93 near the Hoover Dam Bypass Bridge (Phase 2). The roadway corridor includes mixed terrain as it travels through the valley and continues past an extremely rugged mountainous section. A variety of structures are

being built including CIP post-tension concrete box girders, precast concrete arches, steel girders, and conventionally reinforced concrete bridges to accommodate the safe passage of both the traveling public and wildlife in the area.

Highlighted Projects

The following projects highlight more unique structural applications that have been used recently throughout the state. While not all were large in scale, each had concrete elements that contributed to a more economical and innovative design.

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This fall, NDOT completed the extension of the US 50 Cave Rock tunnel in the Lake Tahoe basin. The original tunnel, constructed in 1931, was a CIP concrete liner built through a large rock outcropping at the lake's edge. In response to frequent rock falls in the area,

NDOT installed temporary netting on the slopes above the structure and chose to lengthen the tunnel to provide additional protection for the traveling public. A context sensitive design was developed to satisfy stakeholder concerns that included architectural treatments to minimize the environmental and cultural impacts of the construction and a simplified design to reduce construction duration. Sculpted shotcrete was applied to the exterior surfaces to blend the tunnel with the surrounding landscape and a deep layer of sand was placed on top of the structure to reduce the impact of large rocks.

In an effort to further reduce the construction window, the contractor proposed the substitution of precast concrete beams for the CIP rectangular sections detailed in the plans. NDOT worked closely with the contractor to successfully modify the design and complete construction ahead of schedule.

In recent years, NDOT has utilized precast concrete arches in a variety of applications. Because of cost, aesthetics, and speed of design and construction, arches have become an appealing option for water crossings, animal safety crossings, and grade separations.

NDOT has used precast concrete arches on several wildlife overcrossings with great success. Camera monitoring of the structures has confirmed frequent use on several critical migratory routes in the northeast corner of the state. The structures blend well with the environment and are ideal for the placement of topsoil and landscaping to provide the comfort level necessary to encourage animals to cross, thereby helping to reduce potential vehicle-animal collisions. The Silver Zone Summit crossing near Wendover is regarded as one of the largest crossings in the country and spans both directions of Interstate 80.

The newly constructed Interstate 15 Mesquite interchange is another notable example of the use of precast concrete arches. The city of Mesquite, Nev., and NDOT worked together



Interstate 15 Mesquite interchange constructed using precast concrete arches. Photo: Horrocks Engineers.



Flyover constructed using post-tensioned, cast-in-place concrete box girders as part of the Centennial Bowl in Las Vegas, Nev. Photo: Nevada Department of Transportation.

to develop and administer the design-build contract to construct the new interchange. Original concepts included a steel structure that sloped significantly to match the grade and extensive mechanically stabilized earth walls along the alignment. The contractor proposed

an alternative technical concept that included the use of precast concrete arches. The resulting structure was an economical option that blended well with the surrounding topography and provided an attractive entrance to the city.

The versatility of post-tensioned, cast-in-

place concrete bridges is displayed with the construction of the Centennial Bowl flyover in Las Vegas. The 11-span structure is nearly 1/2-mile long with maximum spans of 250 ft. At its greatest height, it stands 70 ft tall and curves along an 847-ft radius. Four superstructure types were evaluated during design, including steel plate girder, precast concrete I-girder, and precast concrete U-girder. A number of factors were considered in determining the appropriate superstructure type including cost, aesthetics, geometry, constructability and long-term maintenance. The CIP, post-tensioned concrete box-girder was ultimately chosen for its suitability to the site. Future phases of the Centennial Bowl include two other structures of similar size and type.

NDOT will continue to be challenged in the future with maintaining the health of our structural inventory. In an effort to further extend budgets, economical construction methods must be utilized, and concrete structures will likely remain the mainstay of the NDOT bridge program. 

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