PROJECT

Texas Replaces Washed-Out Cow Creek Bridge in 29 Days

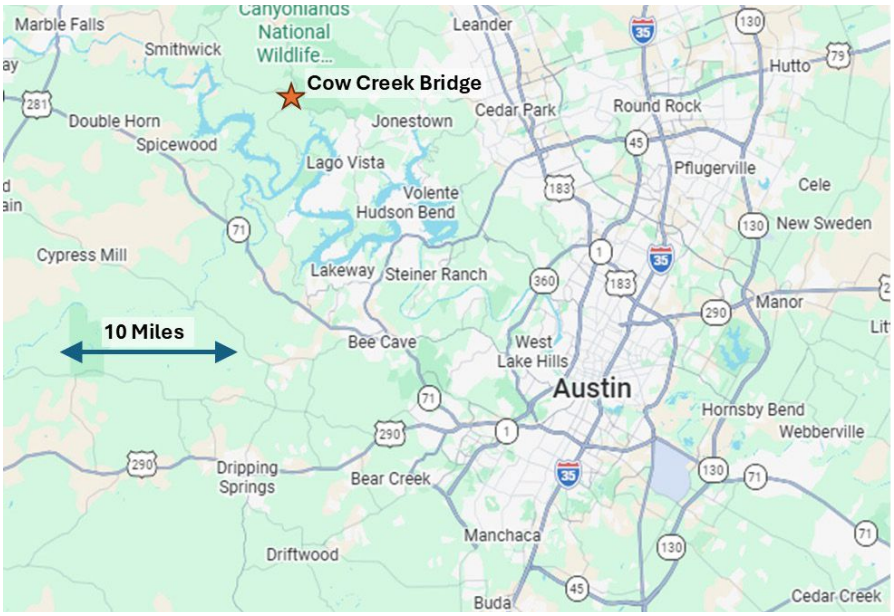
by Biniam Aregawi and Michael Hyzak, Texas Department of Transportation

On July 4, 2025, as the United States celebrated Independence Day, severe flooding swept through central Texas, causing widespread damage to infrastructure across the region. One of the hardest-hit areas was northwest Travis County, where the rapidly rising waters of Cow Creek posed an immediate and dangerous threat. In the early hours of July 5, the Ranch to Market Road (RM) 1431 bridge over Cow Creek—a 240-ft-long, six-span reinforced concrete girder bridge built in 1960—washed out under the force of the floodwaters. Despite being rated in satisfactory condition during its inspection in January 2025, the bridge was overwhelmed by the intensity of this extreme hydrologic event. Two people died in the collapse, and a vital link between the communities of Marble Falls and Lago Vista was severed, resulting in a 40-mile detour for the 3500 vehicles that used this route daily.

Historic Hydrologic Event

The Texas Hill Country is known as "flash flood alley" because it has one of the greatest risks for flash flooding in the United States. The region is prone to flash floods because of its steep terrain, shallow rocky soils, and unusual rainfall intensity. Bridge structures can become inundated during lower-probability events. Minor arterials and collectors such as RM 1431 typically are designed for a 4% annual exceedance probability or 25-year annual recurrence interval. Stormwater velocities can be up to 20 ft per second, and these stormwaters can carry substantial debris.

Cow Creek Bridge is 40 miles from Austin, Tex., and located on one of the few roads in the area, which had a 40-mile detour after the bridge washed out. Figure: Google maps.



In the July 2025 storm, approximately 17 in. of rainfall occurred during a 24-hour period and 8.6 in. of rain fell in a 2-hour period in the vicinity of Cow Creek, which amounted to an estimated 200- to 300-year event. During the preceding winter, ice storms combined with ongoing drought resulted in significant amounts of woody debris. The original 1959 design of Cow Creek Bridge was developed using the rational method to calculate the peak hydraulic flow for a drainage area of 33,000 acres. Manning's equation for hydraulic analysis resulted in a 25-year design event with a peak flow of 28,050 ft^3/sec and 1.75 ft of available freeboard. These design methods do not meet the current requirements in Texas Department of Transportation (TxDOT) and Federal Highway Administration guidance for hydrologic and hydraulic calculations. Investigators for the National Oceanic and Atmospheric

profile

COW CREEK BRIDGE / NORTHWEST TRAVIS COUNTY, TEXAS

BRIDGE DESIGN ENGINEER: Austin District Bridge and Hydraulics Section, Texas Department of Transportation

PRIME CONTRACTOR: Hunter Industries Ltd., San Marcos, Tex.

CONCRETE SUPPLIER: Texas Materials Ready Mix, Austin, Tex.

PRECASTER: Bexar Concrete Works Ltd., San Antonio, Tex.

OTHER MATERIAL SUPPLIERS: Reinforcing steel: CMC Steel, Seguin, Tex.; bearing pads: Bearing LLC, Tyler, Tex.

The original bridge was overtopped by Cow Creek, and segments were displaced some distance away. All Photos: Texas Department of Transportation.

Administration (NOAA) Physical Sciences Laboratory conducted a more modern and refined analysis, based on a 2025 Travis County study, using LIDAR for drainage area delineation, NOAA Atlas 14[1] precipitation depths, US Army Corps of Engineers Hydrologic Engineering Center Hydrologic Modeling System data for losses and routing, and Hydrologic Engineering Center River Analysis System data for hydraulics. The analysis provided a more accurate 25,000-acre area and determined that the same 25-year event generated a flow of nearly 37,700 ft^3/sec, resulting in calculated overtopping of the existing bridge.[2]

Rapid Response Plan

As soon as the floodwaters receded on July 6, engineers from the TxDOT Austin District conducted a field assessment. They confirmed the total failure of the structure and discovered entire bridge spans scattered up to 100 yards from their original location.

A maintenance contract was used to allow a contractor to quickly clear the debris and prepare the site for reconstruction. Closure of the road provided the contractor with unimpeded access without facing traffic challenges through the work zone.

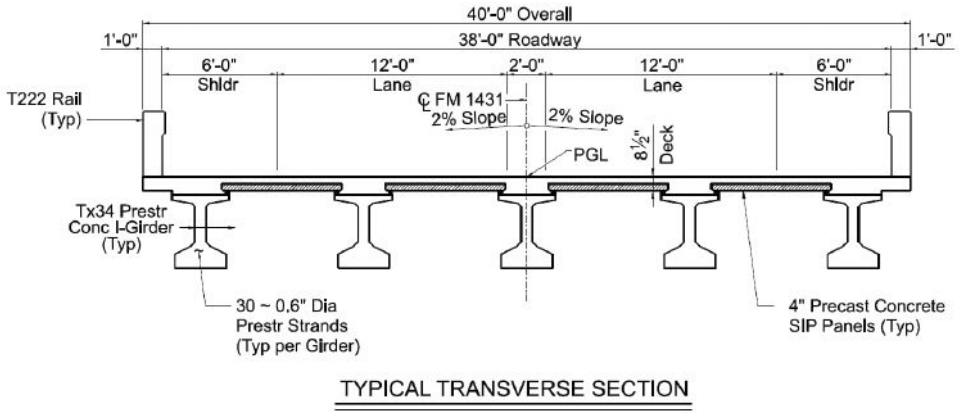
TxDOT administration set a goal of completing the reconstruction effort within an aggressive two-month time frame, as the community wanted to have the roadway open before the start of the new school year. The Austin District initiated design efforts on Monday, July 7, just two days after the bridge was washed away.

Daily TxDOT coordination meetings were held to guide the design process. The effort relied on an approach that is well established in Texas for emergency situations that need rapid implementation from event to finished product. Specifically, in such situations, TxDOT uses standardized designs that are common and familiar across the state, with readily available components from Texas fabricators and contractors. (For more information, see the State article on Texas in the Fall 2020 issue of *ASPIRE®*.) Through consistent collaboration and long workdays, the design team was able to deliver 90%-stage plans by Friday, July 11.

Design Improvements

Compared with the bridge that washed away, the new bridge includes several structural improvements to enhance resistance to extreme flood events. The diameters of the round columns were increased from the typical 36 in. to 49 in., and the cross sections of the rectangular bents were also increased in size. Whereas the original bridge had six span lengths of 40 ft, the new structure's three spans are 80 ft to improve the hydraulic flow. Enhanced concrete shear keys were incorporated at the substructure-to-superstructure interface at all bents to enhance lateral and overturning force resistance.

Geometrically, the existing roadway followed the topography of the hilly



Cross sections of new Cow Creek Bridge. The new bridge was widened a nominal amount. Figure: Texas Department of Transportation.

TEXAS DEPARTMENT OF TRANSPORTATION, OWNER

BRIDGE DESCRIPTION: 240-ft-long, 40-ft-wide precast, prestressed concrete bulb-tee girder (TX girder) bridge

STRUCTURAL COMPONENTS: Fifteen TX34 bulb-tee girders; approximately 6240 ft^2 of 4-in.-thick precast concrete deck panels with a 4½-in.-thick cast-in-place concrete deck; two cast-in-place abutments; two cast-in-place bent caps; six 48-in.-diameter cast-in-place columns; eight 36-in.-diameter drilled shafts; six 48-in.-diameter drilled shafts

BRIDGE CONSTRUCTION COST: $4,884,423 for total project; $2,358,575 for bridge items ($245.68/ft^2). (Note: Bridge items costs do not include incentive bonus.)

terrain with a sag curve at the bridge location. In addition, a local road intersects RM 1431 near the east end of the bridge. Ideally, the proposed design would improve the hydraulics, provide a 45-mph design speed, and accommodate the intersecting local road. The geometric design was a balancing act of minimizing the scope (and time) of the reconstruction while improving the roadway and the hydraulic and structural designs. The original vertical profile of a single sag curve was changed to a pair of sag curves with a constant tangent grade section over the length of the bridge. The result was a 35-mph design speed (matching the existing design speed) with a 4.5-ft raise in vertical alignment to provide measurable freeboard for a 10-year flood and no overtopping for a 25-year flood. A design waiver was required for maintaining design speed, vertical profile, and reduced shoulder width. These design decisions avoided right-of-way acquisition, major utility adjustment, a potential need for retaining walls, and excessive impact to the intersecting local road, whose profile grade was affected slightly.

Accelerated Construction

While Texas has a robust precast, prestressed concrete industry, fabrication of components still takes months. Through an established network, the TxDOT Austin District reached out to fabricators and neighboring TxDOT districts to identify available beams and precast concrete subdeck panels. Fortunately, the Cow Creek project could use Texas bulb-tee girders (TX34 girders) and precast concrete subdeck panels that had already been fabricated for a project in the adjacent Yoakum District. Integrating these elements into the design significantly accelerated the construction timeline.

Through established emergency maintenance contract methods, the Austin District's preliminary plans were immediately distributed to a few preselected contractors for their review and feedback. Before bidding occurred, TxDOT held a meeting with the prequalified contractors on July 12 at the Cow Creek site to ensure that they fully understood the project scope. Final signed and sealed design plans were released on July 14, bids were received on July 16, and the project was awarded the very next day.

Installation of the 79.5-ft-long precast, prestressed concrete TX34 bulb-tee girders is complete on two of the three spans. The creek typically only carries a small amount of water, but with high-intensity rainfall events, the hydraulics can change immensely.

The project time estimate was set at a total of 60 working days and 50 days for substantial completion, based on a 7-day workweek. However, the contract had an incentive/disincentive of $50,000 per day for early substantial completion of a maximum of 20 working days. The contract award was for approximately $4 million, but the contractor would receive a $1 million bonus if work were substantially completed in 30 working days or sooner.

The contractor mobilized quickly, and construction operations began on Monday, July 21, with two crews working 12-hour shifts during various critical periods throughout the project. Two drilling rigs were mobilized to install four 36-in.-diameter drilled shafts at each of the two abutments and three 48-in.-diameter drilled shafts at each of the two interior bents. Foundations were completed by July 26, and then matching cast-in-place round columns with rectangular bent caps and spill-through abutments were constructed. The 15 precast, prestressed concrete bulb-tee girders, with lengths just under 80 ft, were erected on August 5.

A key to the efficiency of the bridge construction was using concrete mixture proportions that provided higher earlier strengths for the cast-in-place concrete. For this project, the 28-day specified strengths were 3600 psi for the substructure and 4000 psi for the bridge deck; there were no concerns about creep and shrinkage with such a quick placement because the girders were from another project and had sufficiently aged. TxDOT specifications place restrictions on concrete strength for formwork removal and next-sequence construction, so accelerating strength gain is vital to rapid replacement with cast-in-place concrete elements. TxDOT allowed the use of preapproved straight cement mixture designs that achieved full design strength for drilled shafts, columns, bent caps, and bridge deck within 48 to 72 hours. Concrete durability for the bridge components was maintained by ensuring adherence to TxDOT's curing requirements for method and duration. During construction, a nearby ready-mix concrete plant was solely dedicated to provide concrete on demand for this project.

After the girders were erected, the next critical phase was the bridge deck. Crews installed and adjusted partial-depth precast, prestressed concrete panels and overhang brackets, tied the deck's steel reinforcement, and placed the expansion joint assemblies. In the early morning hours of August 12, the bridge deck was ready for concrete placement. The contractor used two pump trucks to facilitate a speedy placement of the bridge deck concrete. A few days later, crews installed the concrete bridge rails using welded-wire reinforcement and concrete slip-forming technique. Each of these steps marked a key milestone in the accelerated construction timeline.

Throughout the construction process, design and construction personnel were available to respond quickly to any field change requests, avoiding the typical delays of a traditional change-order process. A ribbon-cutting ceremony was

The cast-in-place concrete deck is placed at at night to accommodate the project schedule. However, it is common to cast concrete decks at night during the summer months in Texas.

held on August 19, 2025, just 45 days after the collapse and 29 days after start of construction.

Conclusion

The new Cow Creek Bridge is a precast, prestressed concrete bulb-tee girder structure designed to meet current safety standards and enhance hydraulic capacity. Elevated and widened, the bridge consists of three 80-ft spans with a contiguous deck unit of typical Texas link slabs, totaling 240 ft in length. It features an overall width of 40 ft, including a 38-ft-wide roadway that accommodates two 12-ft travel lanes, a 2-ft striped median, and 6-ft shoulders on both sides. This configuration improves traffic flow and safety, while the larger and more robust substructure elements increase resilience against future flood events. From initial damage to full restoration, the entire reconstruction process took only 45 days, which is likely a record for TxDOT.

References

1. Perica, S., S. Pavlovic, M. St. Laurent, C. Trypaluk, D. Unruh, and O. Wilhite. 2018. *National Oceanic and Atmospheric Administration NOAA Atlas 14. Precipitation-Frequency Atlas of the United States.* Vol. 11 Version 2.0, *Texas*. https://www.weather.gov/media/owp/oh/hdsc/docs/Atlas14_Volume11.pdf.
2. Hoell, A., K. Mahoney, M. Abel, J. Bytheway, W. Currier, A. Thompson, E. Towler, J Gerlich, and J. Lisonbee. 2025. "Weather Whiplash in Texas: Drought to Flood" (news article). National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Laboratory. Published August 11, 2025. https://www.psl.noaa.gov/news/2025/texasfloods.html.

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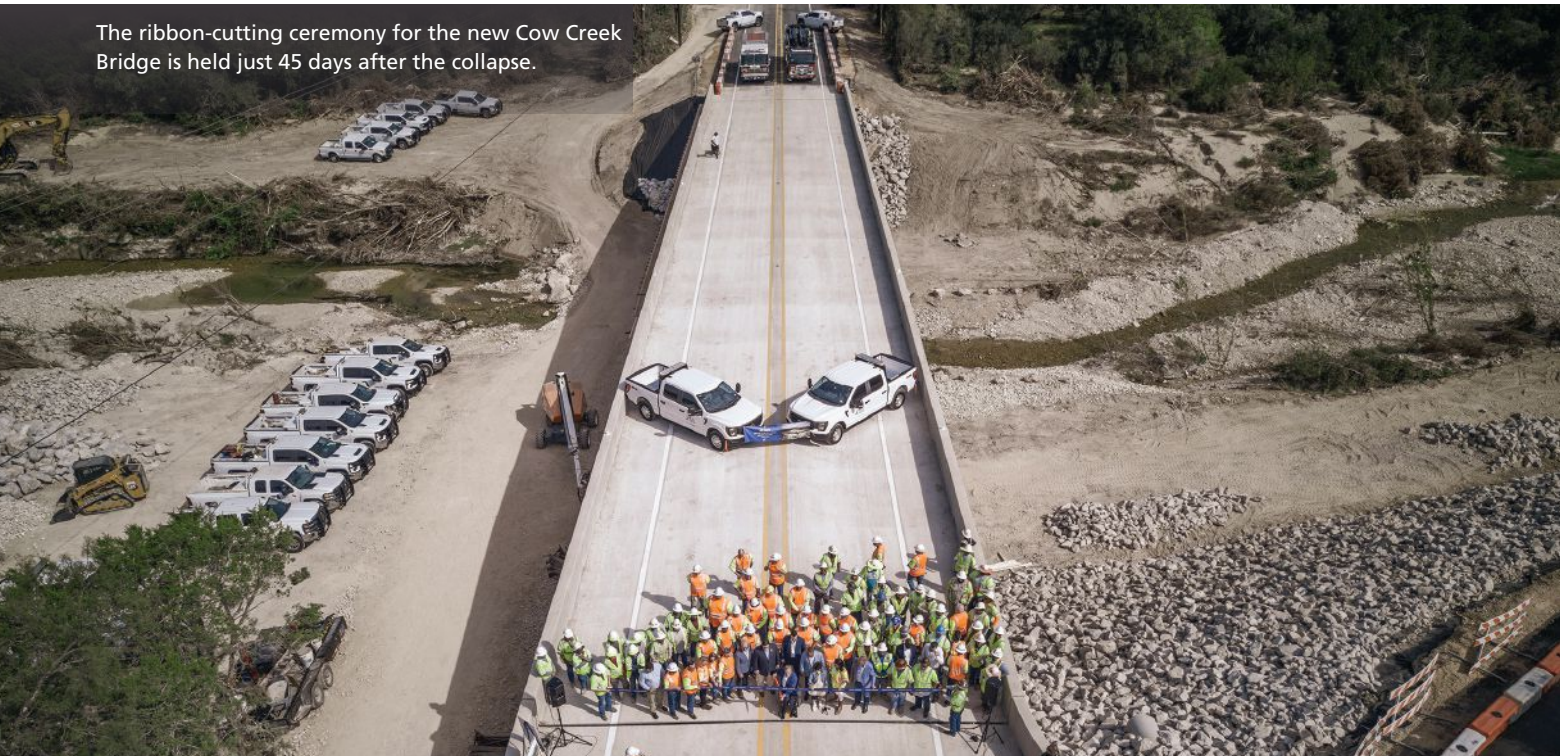

The ribbon-cutting ceremony for the new Cow Creek Bridge is held just 45 days after the collapse.