

South Dakota Department of Transportation



SD 28 Reconstruction & Resilience

Resilience Improvement Grant

FY22/FY23 Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving

Transportation (PROTECT) Program

Project Name	SD 28 Reconstruction & Resilience
Project Type	Resilience Improvement Grant
Future Eligible Project Costs	\$ 14.45 million
Future PROTECT Eligible Project Costs	\$ 14.45 million
PROTECT Funds Requested	\$ 2.9 million

Primary Contact:

Steven Gramm, PE, Planning Squad Leader
South Dakota Department of Transportation
700 E. Broadway Avenue
(605) 773-3281 | Steve.gramm@state.sd.us

Supporting Information can be found at:

<https://www.srfconsulting.com/sddot-sd28-protect/>

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Basic Project Information

1. Project Description

The South Dakota Department of Transportation (SDDOT) is requesting \$2.9 million in federal funding through the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) federal discretionary grant program. The funds are imperative to SDDOT's SD 28 Reconstruction & Resilience Project (Project) to immediately address and reconstruct 3.5 miles of South Dakota Highway 28 (SD 28) from 458th Avenue east of Lake Poinsett to 5.2 miles west of the City of Estelline. The Project will raise bridge deck elevations and lengthen bridge spans to address flood vulnerabilities which currently exist for structure 29-227-144 at the Lake Poinsett Outlet and structure 29-227-160 at the Big Sioux River. Both structures are in "Fair" condition. Originally constructed in 1952, with several rehabilitation projects since that time, SD 28 is now due for reconstruction. In addition to flooding vulnerabilities at bridges, SD 28 has other deficiencies, including culvert replacement, and addressing horizontal and vertical curves to meet a 70-mph design speed.

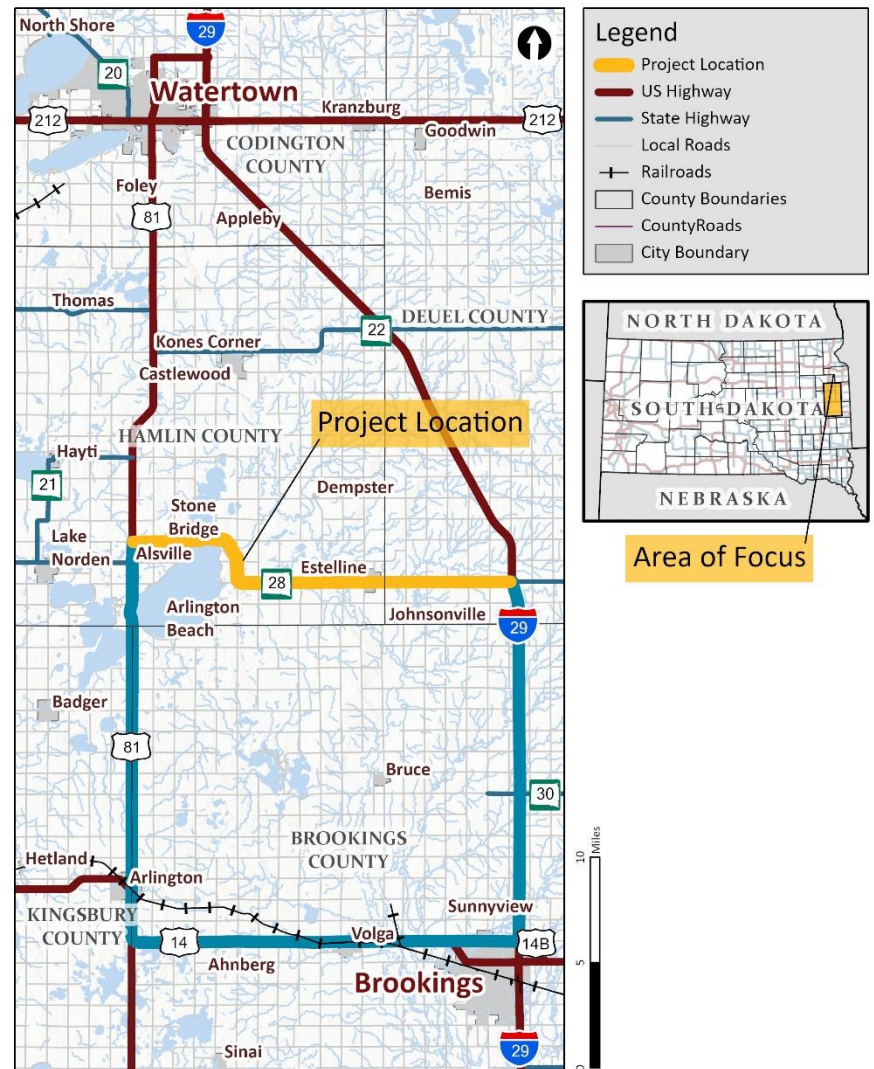
The SD 28 Project is of critical importance to South Dakotans because SD 28, a Rural Minor Arterial, is one of the only east-west highways serving a 46-mile area between Watertown (population 22,655) to the north and Brookings (population 23,377) to the south. SD 28 in the project area provides vital mobility between U.S. Highway 81 (US 81) to the west and Interstate 29 (I-29) to the east. This segment of SD 28 is in a rural area with severely limited east-west access to essentials, including groceries, fuel, and basic health care needs. The area is very dependent on the highway network for mobility. A map of the SD 28 Project location is shown in Figure 1.

Other Infrastructure Investments

US Highway 81 (US 81)

SDDOT is strategically making infrastructure investments to increase flood resiliency in the region. For example, approximately twenty miles south of SD 28, SDDOT recently completed [US 81 improvements to increase flood resiliency](#). In 2019, US 81 flooded under [approximately one foot of water](#), requiring an emergency temporary grade raise. A permanent grade raise of US 81 was completed in 2022 to bring the roadway out of the 100-year floodplain

Figure 1. Project Location Map



and improve resiliency. SD 28 intersects US 81 approximately four miles west of the western Project termini. This was the fourth permanent grade raise SDDOT has performed on various portions of US 81 in eastern South Dakota over the past twelve months.

FY 22/FY 23 PROTECT Grant Applications

Interstate 90 (I-90)

SDDOT is also responding to flood vulnerabilities on the Interstate System in South Dakota. In 2019, the department suffered [\\$23 million of flood damage to interstates and highways](#). The impact had ripple effects through SDDOT's Statewide Transportation Improvement Program (STIP) as the department shuffled other projects to accommodate the fixes, pushing some projects back two or three years. SDDOT is also pursuing a FY 22/FY 23 PROTECT Resilience Improvement project to strengthen resiliency on 1.2 miles of I-90, approximately 70 miles south of the SD 28 project area.

Statewide Resiliency Plan

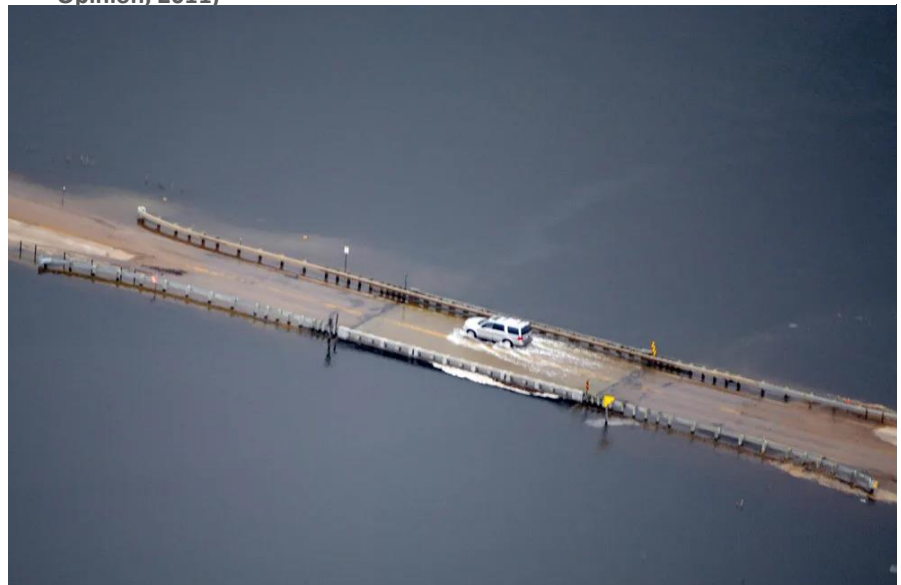
SDDOT is pursuing a FY 22/FY 23 PROTECT Planning grant to conduct a statewide resiliency and hazard mitigation plan. The plan would be the first of its kind for the State and would help SDDOT better understand the impacts of natural disasters, strategies to strengthen resiliency of the State's transportation system, and resources available to prevent or lessen these impacts. The plan would also support local and rural communities in their efforts across South Dakota to protect their citizen's and land including strategies to recover more quickly from natural disasters exacerbated by climate change.

Transportation Challenges

Resilience Challenges

Digital floodplain data is not available for the project area however, a [print Flood Insurance Rate Map \(FIRM\)](#) [LINK TO FIRM IMAGE FILE] identifies portions of the Project and SD 28 within Zone A Special Flood Hazard Areas (SFHA). Zone A SFHAs are areas with a one percent annual chance of flooding and a 26 percent chance of flooding over 30-years. Detailed analyses are not performed for such areas therefore, no depths or base flood elevations are shown for Zone A SFHAs. Zone A designated areas for SD 28 in the Project area are adjacent to the Lake Poinsett Outlet and Big Sioux River.

Figure 2. Floodwater over the Lake Poinsett Outlet Bridge (Watertown Public Opinion, 2011)



The National Oceanic and Atmospheric Administration (NOAA) has flood gauges at the [Lake Poinsett Outlet](#) and the [Big Sioux River](#) adjacent to the project area. Since 1935, the Lake Poinsett Outlet gauge has reached flood stage (elevation 1,654 feet) nine times. Sixty-seven percent of flood stage crests at Lake Poinsett have occurred since 2000¹. The Big Sioux River has also reached flood stage (elevation 1,644 feet) [five times](#) in the project area since 2018, the year in which the gauge was installed. Flood events are most common in the region during Spring (March

¹ https://water.weather.gov/ahps2/crests.php?wfo=abr&gage=pons2&crest_type=historic

– May), primarily caused by snowmelt and precipitation events. Significant precipitation events outside of the Spring season can also cause flooding.

During major flood events, structure 29-227-144 (part of this project) at the Lake Poinsett Outlet becomes inundated with floodwater. Observed floodwater has reached the bottom of the structure and in some cases has overtopped the bridge deck, flooding over SD 28. During flood events when the structure experiences floodwater, the bridge deck, railings, and trusses can be damaged. Furthermore, when

floodwater reaches or touches the bridge at the Lake Poinsett Outlet, the structure impedes the flow of water, which exacerbates flood impacts in the surrounding area.

Figure 3. Lake Poinsett Outlet Bridge Deck Flooding, Spring 2019 (Watertown Public Opinion)



Historically, SDDOT has observed flooding at both Lake Poinsett Outlet and Big Sioux River bridges. However, overtopping of the bridge deck has only been observed at the Lake Poinsett Outlet. Recent observations of bridge deck overtopping at the Lake Poinsett Outlet bridge occurred in 2011 and 2019. In 2011, SD 28 at the Lake Poinsett Outlet was closed to traffic as water remained over the bridge for several days. In 2019, bridge deck overtopping events did not close the bridge to traffic however, SD 28 was reduced to stop-and-go one lane traffic across the Lake Poinsett Bridge to limit the size and frequency of the wake created as vehicles went through the water.

Regional Mobility & Quality of Life Challenges

Due to the rural context, SD 28 provides critical east-west mobility, with limited alternate routes available to travelers between US 81 to the west and I-29 to the east in the project area. Regionally, SD 28 provides rural mobility from US 281 to the west and the South Dakota-Minnesota border to the east (a distance of 91 miles). Depending upon flood events in the project area, SDDOT closes or partially closes SD 28. Closures result in significant traffic detours to alternate routes. The official detour used for SD 28 closure as shown in Figure 4, routes traffic to US 81, US 14, and I-29 adding about 55 miles and 52 minutes of travel time to the trip.

SD 28 provides mobility to and from rural areas and communities of Hamlin, Deuel, Clark, Beadle, and Spink Counties in eastern South Dakota. For example, SD 28 provides the [quickest route](#) between the City of Lake Norden (approximately eight miles west of the Project) and Sioux Falls. Sioux Falls (population 192,517), provides a regional hub for education including higher education, healthcare, social services, cultural and heritage events, and historical sites. Additionally, SD 28 provides a vital east-west connection to US 81 and I-29. Rural residents and freight traffic use SD 28 to travel between not only I-29 and Sioux Falls, but also to Watertown and Brookings. Watertown and Brookings also provide everyday amenities, goods, and services essential for rural residents in the region. SD 28 provides vital mobility for essential needs, everyday goods, healthcare, and movement of freight. Figure 4 illustrates the detour when SD 28 is closed due to flooding. The official detour reflects regional flood impacts often experienced in the project area because of the regional watershed. For example, if SD 28 is closed due to flooding, east-west county and township roads are also most likely impassible or too hazardous for traffic, especially trucks

or vehicles with trailers. Even SD 22, located approximately eleven miles to the north of the project area, is not a safe detour option as SD 22 often floods when SD 28 floods.

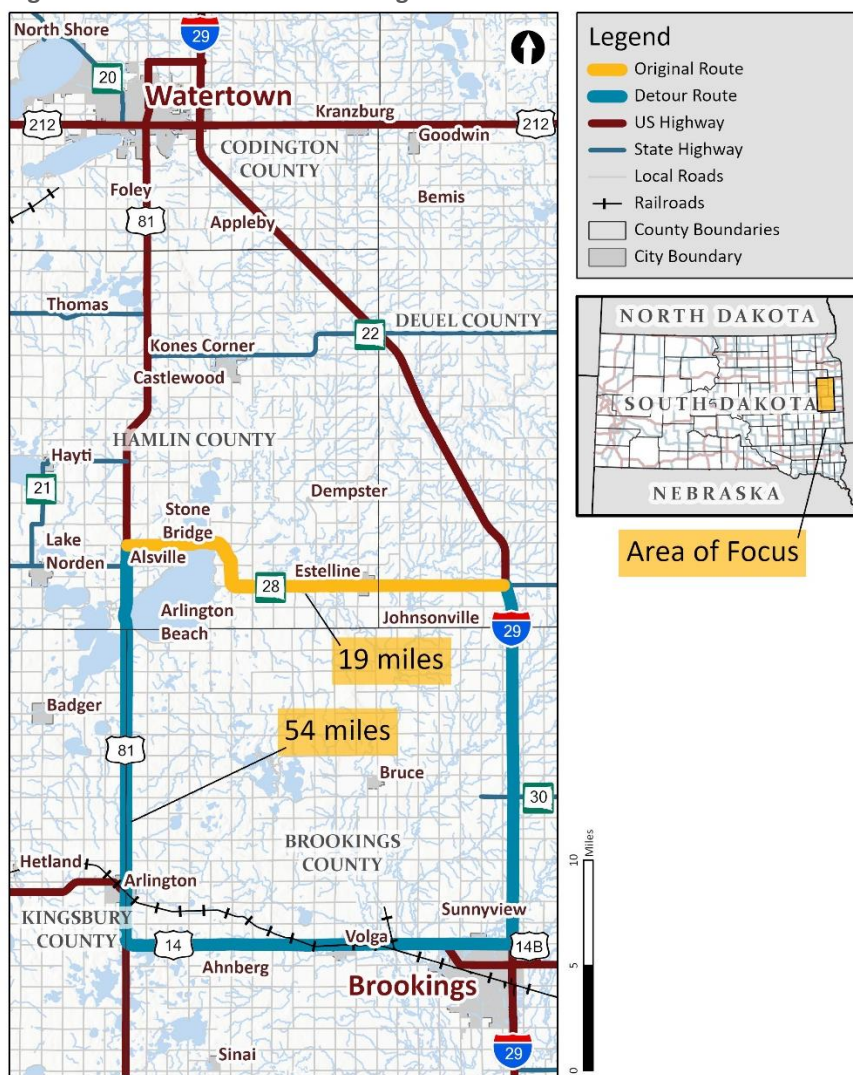
Pavement Condition Challenges

Although the pavement on SD 28 within the project area was last sealed in 2022, and the surface condition index is currently in good condition, the subsurface of SD 28 has deteriorated and after over 70 years, the roadway in its current state is reaching the end of its useful life. SDDOT has used Transportation Asset Management (TAM) principles to provide routine maintenance and address roadway surface. Within the project limits, SD 28 travels over water bodies including Lake Poinsett Outlet and the Big Sioux River. Historically, SD 28 has been covered with floodwater at the Lake Poinsett Outlet bridge. The inundation and saturation of the roadway at the Lake Poinsett Outlet bridge increases the risk of not only washout and erosion of SD 28 but impacts the structural integrity of the entire roadway infrastructure. A saturated base course for example, decreases load bearing capacity of SD 28 and can cause irreversible damage.

Bridge Condition Challenges

SD 28 structures in the project area were constructed in 1951. South Dakota has 595 bridges that were constructed between 1950-1959 on the National Bridge Inventory (NBI). Of the 595 still in operation from the fifties, 523 (88 percent) are in “fair” or “poor” condition and will need replacement soon. Condition of the two structures part of this SD 28 Project are listed below in Table 2. As you can see, Structure 29-227-144, and Structure 29-227-160 are rated a “5” denoting “fair” condition. All primary structural elements are sound but may have minor section loss, cracking, spalling, or scour². Since NBI ratings are determined based on the lowest number of each of the sub categories (deck, superstructure, substructure and channel rating), it is expected that these two structures will fall into the “poor” rating at the next bridge inventory date. A rating of four (4) or poor condition would result from advanced section loss, deterioration, spalling, or scour and is expected to occur by year 2025.

Figure 4. SD 28 Detour Route During Flood Events



² FHWA. (1995) Recording and Coding Guide for the Structural Inventory and Appraisal of the Nation's Bridges. FHWA-PD-96-001

In the Department's Transportation Asset Management Plan, a service life of 50 to 75 years is anticipated for structures³. Considering a 50-year service life, the bridges would have met their useful life in 2001 and considering a 75-year service life, the bridges will meet their service life approximately in year 2025 (the Project's anticipated construction start date). Existing bridge condition, however, indicates that SDDOT has performed well to maintain the structures in a state of good repair.

Table 1. SD 28 Project Area Structures and NBI Ratings

Inspection Date	Structure	Location	Deck	Superstructure	Substructure	Channel
9/21/2021	29-227-144	Lake Poinsett Outlet	5	5	6	6
8/9/2021	29-227-160	Big Sioux River	5	5	5	6

Safety Challenges

Flood events, when the bridge deck is overtopped at the Lake Poinsett Outlet bridge structure, increase the risk for bridge washout or failure and hazards posed by vehicles driving through floodwaters. The Federal Emergency Management Agency (FEMA) [advises not to drive in floodwaters](#). Risks associated with driving through [even shallow floodwaters](#) include vehicular damage, stalling, hydroplaning or loss of control, and even the vehicle being swept off the roadway by floodwaters.

Even if water on the roadway looks shallow and harmless, it doesn't take much to sweep your car away. According to the National Weather Service, a small car can be swept away by water that's only 12 inches deep, and 2 feet of flowing water can dislodge and carry most vehicles, including larger ones.

In the five years from 2018 to 2022, 19 crashes occurred on SD 28 within 100-feet of the project limits. Of these, 16 crashes were animal hits, two were run off road crashes, and one was a cross-centerline sideswipe. No injuries were reported during the five-year period of crash data analyzed. Despite a lack of serious injury crashes, the reported crash rate on SD 28 in the project area is 2.06 crashes per one million vehicle miles traveled (VMT). This is higher than the statewide weighted crash rate of 1.73 for rural arterial roadways. The existing alignment of the roadway is a contributing factor to higher crash rates in the project area.

Horizontal and Vertical Curve Challenges

SD 28 within the project area has horizontal curve warning signs with a posted advisory speed limit of 55 mph. Horizontal curves change the alignment or direction of SD 28 to traverse around Lake Poinsett and Dry Lake. Horizontal curves pose a safety risk as drivers are required to navigate along the road as it curves to change direction. The design speed of the horizontal curves is associated with the posted advisory 55 mph horizontal curve signs, different than the vast majority of SD 28 which is posted for 65 mph. Nationally, more than [25 percent of fatal crashes](#) are associated with a horizontal curve, with a majority of crashes stemming from roadway departure accidents. The average crash rate for horizontal curves is approximately [three-times greater](#) than other types of highway segments.

³ [SDDOT. \(2022\) Transportation Asset Management Plan. Pg. 33.](#)

Vertical curves are also deficient on SD 28, decreasing sight lines for drivers, creating hazardous perception reaction times, and impeding stopping sight distances.

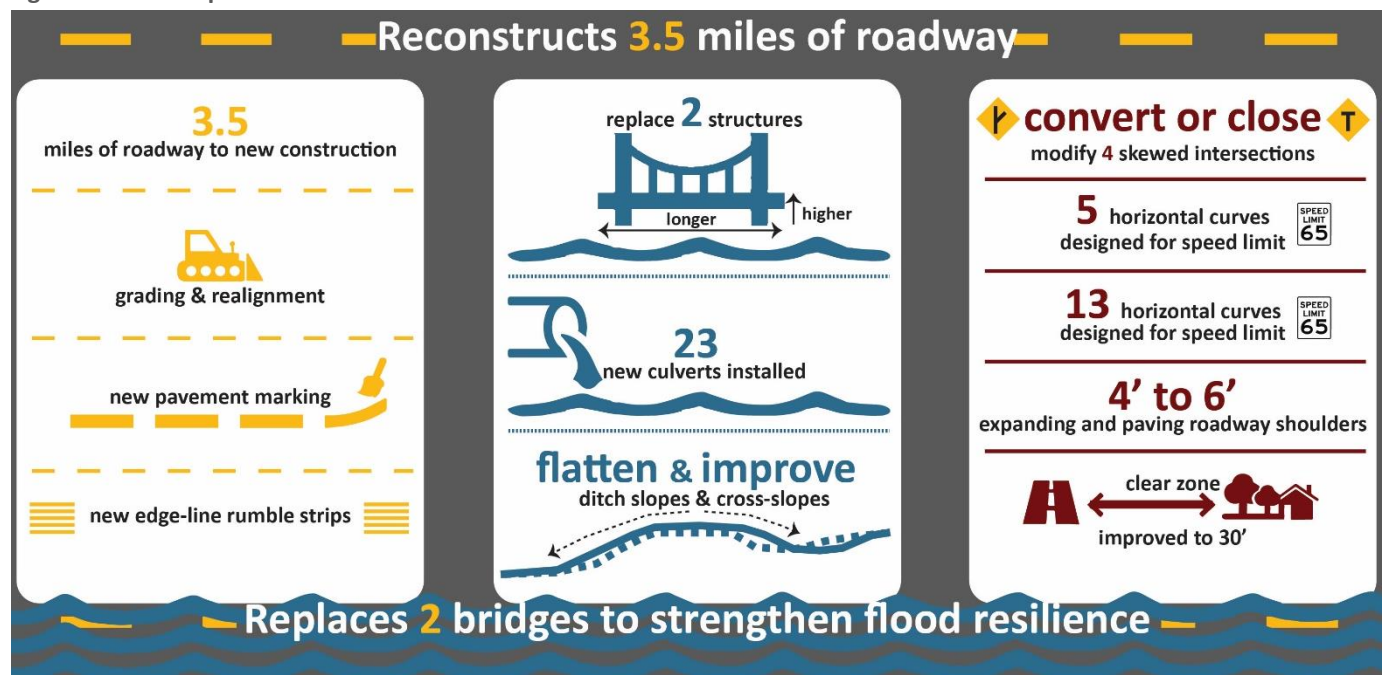
Skewed Intersection Challenges

Skewed intersections exist between SD 28 and County Roads within the project area. Skewed intersections are more dangerous for users of SD 28 for several reasons including⁴:

- Vehicles may have a longer distance to traverse when crossing or turning onto SD 28, increasing personal exposure to traffic on SD 28
- Older drivers and those with physical impairments may find it more difficult to turn their heads, necks, or upper bodies as necessary for a line of sight down an acute-angle approach
- The driver's sight angle to notice opposing traffic is decreased
- Drivers may have more difficulty aligning their vehicles as they enter the cross street to make a right or left turn
- Drivers making right turns around acute angles may encroach on lanes intended for oncoming traffic from the right
- Larger resulting intersections may confuse drivers and cause deviation from the intended path of travel
- Motorists on SD 28 making left turns across an obtuse angle may maintain higher than normal turning speed, cutting across the oncoming traffic lane of the intersecting roadway
- The vehicle body may obstruct the line of sight for drivers with an acute-angle approach to their right

Proposed Improvements

Figure 5. SD 28 Improvements At-A-Glance



Resilience Improvements

The Project will replace structure 29-227-144 at the Lake Poinsett outlet and structure 29-277-160 at the Big Sioux River. To mitigate flood impacts⁵, each bridge will be raised (structure 29-227-144 by 5-6 feet and structure 29-227-160 by approximately six-inches) to accommodate floodwaters that have started to impact bridge conditions and

⁴ FHWA. (2011) *Intersection Safety: A Manual for Local Rural Road Owners*. FHWA-SA-11-08.

⁵ FEMA. (2022) *Hurricane and Flood Mitigation for Public Facilities, Fact Sheet 1.4: Bridges*. Pg 1-56.

exacerbate flooding in the area. The increased elevation of the structures will improve resiliency of SD 28 as floodwaters will no longer impact the bridge and overtop the roadway/deck, as they do during major flood events at each structure's current elevation. In addition, each bridge span or length will also be increased (structure 29-227-144 by 138-feet and structure 29-227-160 by 108-feet). The increased bridge elevations and lengths will provide further separation between floodwater crests and improve flow beneath the structures during flood

events, strengthening SD 28's resilience to flooding. Grading and approach slabs will be reconstructed to accommodate raising the bridges. By replacing the structures at a higher elevation, SDDOT will be able to keep traffic on SD 28 above the flood hazards near the river crossings where historic flooding events have caused the Department to close or significantly reduce speeds (5 mph no wake) on SD 28.

The Project will also grade a more resilient SD 28 cross section, flattening steep slopes that contribute to stormwater runoff and erosion of inslopes or ditches. The elevated cross section provides improved drainage and decreases the probability of SD 28 becoming inundated with floodwaters near the Lake Poinsett Outlet and Big Sioux River bridges.

Figure 6. Improvement Locations

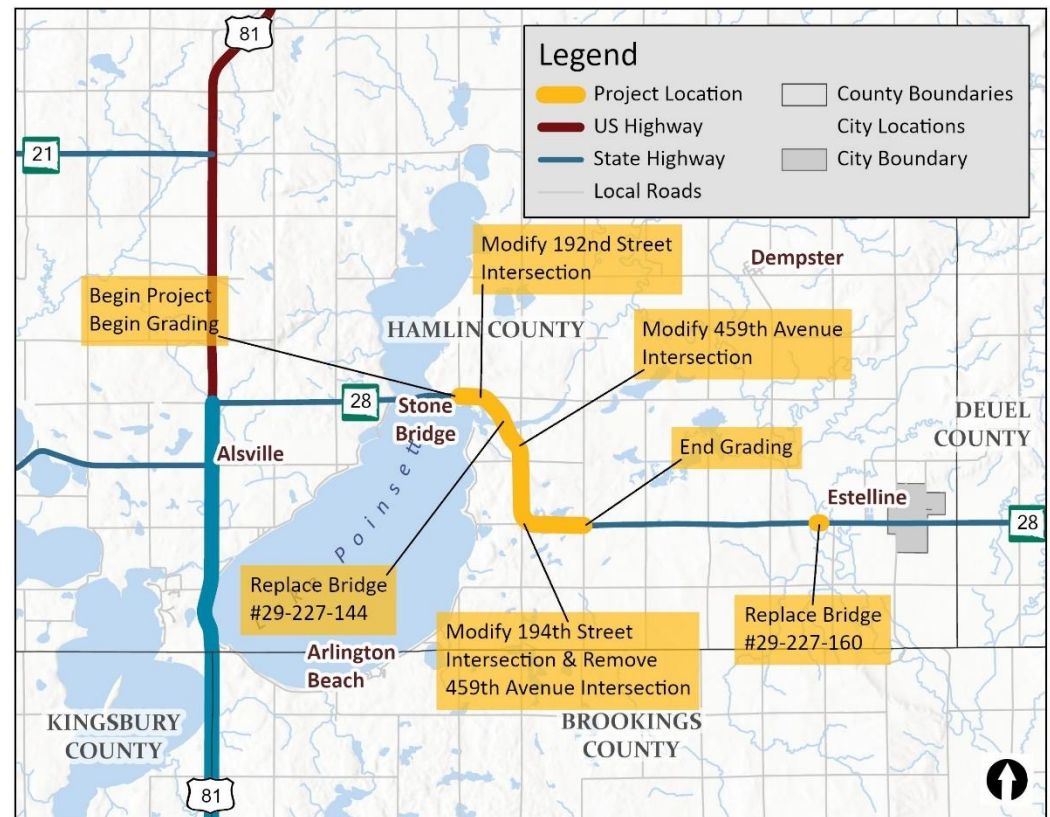
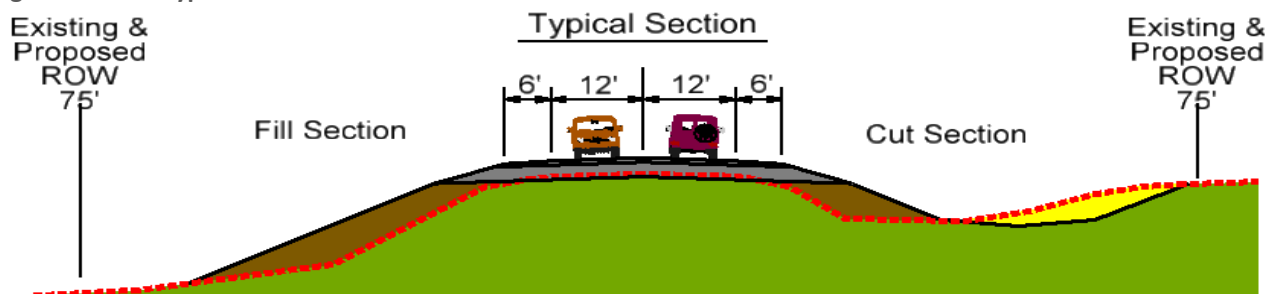


Figure 7. SD 28 Typical Section



Where the SD 28 alignment abuts water, riprap will be added. Additional and new riprap, as applicable, will prevent erosion of the water body's banks including erosion or potential washout of SD 28.

Pipe culverts will be replaced in the Project area to increase stormwater capacity, improving floodwater flows through the project area. Replacement culverts will also meet the 30-foot clear zone. The pipe culvert capacity improvements increase the resiliency of SD 28, by allowing storm and floodwater to flow through the area and not be impeded by the corridor, which exacerbates flood impacts including length of flood.

SDDOT resilience improvements on SD 28 are guided by the State's [Hazard Mitigation Plan](#). Hazards and vulnerabilities of the State are well understood by SDDOT, and flood mitigation efforts on SD 28 are a direct prioritization guided by the Hazard Mitigation Plan. The mission statement from the 2019 plan is as follows:

To reduce the impacts to life and property from hazards through a long term sustainable statewide mitigation strategy while maintaining economic vitality.

Regional Mobility

The Project will strengthen regional mobility of SD 28 by eliminating road closures associated with flooding. The enhanced mobility and reliability of SD 28 during flood events will increase the quality of life in the project area by providing access to economic opportunities, historical and cultural events or sites, education including higher education, healthcare, social services, and other essential goods and services. The Project will improve the reliability of access to social services, emergency service response times, and school bus routes to and from rural communities near the project area.

Pavement Condition

SD 28 pavement will be constructed to a new condition, resetting the clock to zero and minimizing maintenance costs along this stretch of roadway. Pavement conditions are expected to remain in excellent or good condition for years to come. Reconstruction of SD 28 also contributes to the overall statewide pavement condition, as the new roadway cross section will be more resilient to stormwater impacts, flood impacts, and resultant degradation of pavement condition.

Reconstruction and Resurfacing the Roadway

This Project will reconstruct and resurface SD 28. The reconstruction and new surfacing will enhance the safety of the roadway by providing:

- A smoother driving surface and better friction/traction for all users, including heavy trucks, motor vehicles, bicyclists, and pedestrians
- More paved roadway surfaces due to the installation of wider shoulders
- Improved stormwater runoff and roadway drainage reducing the likelihood of hydroplaning
- A reduction of debris accumulating on the highway surface
- New shoulder rumble strips, a [proven safety countermeasure](#) shown to reduce single vehicle, run-off-road, fatal and injury crashes by 13 to 51 percent on two-lane rural roads such as SD 28
- New pavement markings that are more visible and reflective during adverse driving conditions

Bridge Condition

The Project will replace structure 29-227-144 at the Lake Poinsett Outlet and structure 29-227-160 at the Big Sioux River in the project area, which are at risk of falling into poor condition. These structures in their current state continue to deteriorate and are currently at the end of their useful life. The Project will replace structures to a new condition rating, and investments are expected to last another 75 years, just as these bridges performed from 1951-2025. Design enhancements include raising bridge decks and lengthening bridge spans, which will strengthen resilience to flooding and resultant negative impacts to bridge condition.

Safety Improvements

By replacing the structures along SD 28 with higher and longer bridges, occurrences of vehicles driving through floodwaters will be eliminated. The Project reduces the [risks associated](#) with driving across floodwaters at the Lake Poinsett Outlet bridge.

The Project's grading and realignment of SD 28 improves the roadway's horizontal and vertical curves. The new design speed will match that of other rural sections of SD 28 and driver expectations of travel speed through the project area. The Project will provide more control to vehicles navigating curves, increase sight lines, enhance perception-reaction times, and improve stopping sight distance⁶.

The Project will also flatten steep inslopes or ditch slopes where applicable, improving safety and reducing the severity of crashes involving road departure⁷. Flattening inslopes or ditch slopes is a [proven safety countermeasure](#) that will reduce single-vehicle crashes by up to 12 percent.

Access Management Improvements

The Project will improve access management related safety and operational issues on SD 28 by altering and eliminating skewed intersections with several Hamlin County Roads. Similar to how the skewed intersection is improved in Figure 8, the following intersections will be altered to provide for a near 90-degree intersection with SD 28:

Figure 8. SD 28 "T" Intersection



- 192nd Street – "T" intersection
- 459th Avenue (on north side of SD 28) – "T" intersection
- 194th Street – "T" intersection

The following intersections will be eliminated:

- 459th Avenue (on south side of SD 28) – will become a dead-end road

At the 194th Street and SD 28 intersection, the Project will add a warranted left turn lane for SD 28 westbound traffic, and an unwarranted right turn lane for SD 28 eastbound traffic.

Realigning skewed intersections with SD 28 at 192nd Street, 459th Avenue, and 194th Avenue [will reduce intersection-related crashes](#). Additionally, dedicated turn lanes on SD 28 at the 194th Street intersection are additional proven safety countermeasures that will [reduce total crashes](#) at said intersection by up to 48 percent.

Widening Shoulders

The proposed improvements will widen and pave shoulder widths from four to six-feet for the entire corridor. Single vehicle run-off-road crashes are the largest type of fatal vehicle crash in the United States. The safety effects of widening and paving roadway shoulders to six feet are a time-tested way to effectively mitigate crashes and improve facilities for non-motorized users such as pedestrians and bicyclists. The Federal Highway Administration (FHWA) specifies guidelines for shoulder widths. According to FHWA, safety and efficient traffic operations can be

⁶ https://safety.fhwa.dot.gov/older_users/handbook/ch4.cfm#ss2

⁷ https://safety.fhwa.dot.gov/roadway_dept/countermeasures/horcurves/fhwasa15084/ch6.cfm

adversely affected as shoulder widths narrow. Wider shoulders lessen the likelihood of rear-end crashes with parked or disabled vehicles, particularly high-speed, two-lane roadways. A Transportation Research Board Record 1195 paper titled [“Safety Effects of Cross-Section Design for Two-Lane Roads”](#) determined that crashes will be reduced when wider roadway shoulders are present. In the event a vehicle departs the roadway, the six-foot shoulders give drivers more recovery area to regain control⁸. Implementation of wider shoulders along this segment will also help to protect pedestrians and cyclists who need to use SD 28 to travel to their jobs and other destinations. Paved shoulders are a proven safety countermeasure, [reducing crashes involving pedestrians](#) walking along roadways by 71 percent.

History

SD 28 was originally constructed in 1952 and was resurfaced in 1954, 1972, 1998, and 2019. With construction programmed to start in 2025, the 73-year-old infrastructure has reached the end of its useful life, including the roadway, bridge, and culverts. Table 3 shows SD 28 Maintenance Activities.

Table 2 SD 28 Maintenance Activities

Activity [^]	Year	Age of SD 28 (years)
Grading	1952	0
Asphalt Surfacing	1954	2
Asphalt Resurfacing	1972	20
Asphalt Resurfacing	1998	46
Asphalt Resurfacing	2019	67
SD Reconstruction & Resilience Project	2025	73

[^] Spot location treatments, such as the 1997 Emergency Relief Program grade raise project are not included in this list. These are corridor-wide SD 28 activities which occurred through the Project limits.

SD 28 has experienced numerous and re-occurring flood events. In more recent major flood events, floodwater has overtopped the roadway just east of the intersection of 194th Street and structure 29-227-144 at the Lake Poinsett Outlet. Structure No. 29-227-144’s bridge deck was overtopped in 2011 and 2019 with a depth of 12-inches and 5-inches, respectively. The SDDOT Region Bridge Engineer recommends [raising the bottom of the deck](#) a minimum of three-feet⁹. To accommodate this recommendation, the design raises the structure by five to six feet.

In 1995, riprap was placed along the inslope or ditch slope of SD 28 starting just east of 194th Street and extending approximately one mile east, to protect the roadway in the Project area from erosion due to adjacent highwater and flooding concerns. Subsequently in 1997, portions of SD 28 flooded, were overtopped, and then remained underwater. In response, a grade raise was completed using Emergency Relief Program funding and state maintenance forces to place riprap and a gravel base course on the existing grade. The impacted portion of SD 28 just west of 194th Street was then surfaced with asphalt.

Since the top of the existing riprap placed on the inslope or ditch slope east of 194th Street is at or near the centerline grade elevation and this elevation for the riprap is required for bank protection, the roadway cross section through this segment will require another grade raise and widening. The cross section for the roadway widening shall be designed as per [Table 7.1 of the SDDOT Roadway Design Manual](#); whereas the roadway lane and shoulder width shall be 12-feet. and 6-feet respectively. The cross section shall also be designed to provide a 30 ft. clear zone. Also, the preliminary surfacing recommendation is to provide a section that includes 12-inches of base course and 5-inches of asphaltic concrete.

⁸ FHWA. (2021) [Roadside Design Improvements at Curves. FHWA-SA-21-029](#).

⁹ SDDOT. (2023) [PCN 06NG Approved Scope. Pg. 18](#).

Previously Incurred Costs

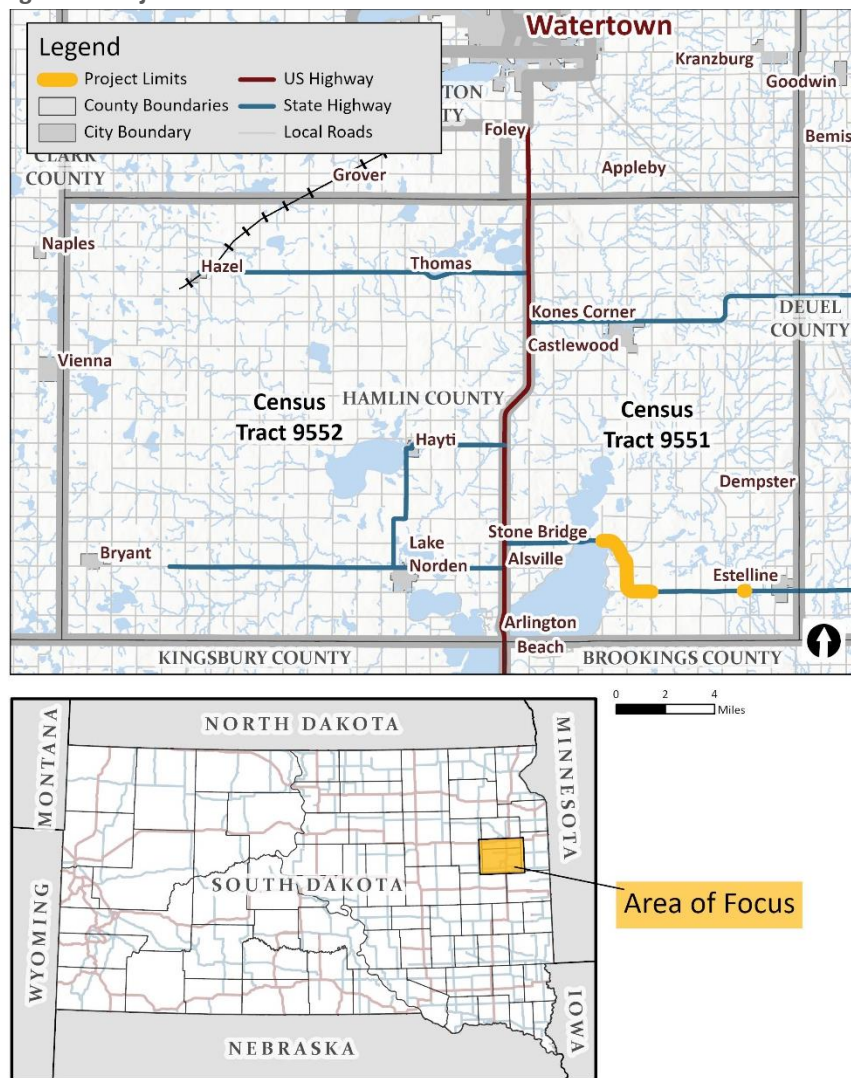
SDDOT has incurred costs of \$349,594 for the Project to perform preliminary engineering (PE) and right-of-way acquisition (ROW) work.

Table 3. Previously Incurred Costs

Activity's Incurred Costs	Participating	Non-Participating
Preliminary Engineering	\$0.00	\$345,073.82
ROW	\$0.00	\$4,520.16
Total Incurred Costs	\$0.00	\$349,593.98
PE Cost Breakdown		
PE Contracts	\$0.00	\$53,653.27
PE DOT Forces	\$0.00	\$291,420.55

2. Project Location

Figure 9. Project Location Context



The Project is located on SD 28, entirely within Hamlin County Census Tract 9551 in the eastern part of South Dakota. In the project area, SD 28 provides east-west mobility between US 81 on the west to I-29 on the east. By eliminating flood impacts at the Lake Poinsett Outlet and Big Sioux River bridges, the Project positively impacts regional mobility and access of rural residents and users of SD 28 including commodity movement via freight (see Merit Criteria #2). The Project limits extend from mileage reference marker (MRM) 346.00 + 0.000 on the west to MRM 349.00 + 0.300 on the east, approximately one mile west of the City of Estelline. The Project comprises approximately 3.5 miles of SD 28 including bridge replacements at the Lake Poinsett Outlet (MRM 346.94) and at the Big Sioux River (MRM 353.53). The Project is entirely rural and is not part of a census-designated urban area. The Project's geospatial location is 44.602447°N, 97.047442°W to the west and 44.572806°N, 96.927569°W to the east. Figure 9 shows the location of the

Project. Portions of the Project are located in [100-year floodplain \(Zone A\)](#) of the Lake Poinsett Outlet (structure 29-227-144) and Big Sioux River (structure 29-227-160).

3. Parties Involved

South Dakota Department of Transportation (SDDOT) is the sole applicant for FY 2022-2023 PROTECT funding. The Project has documented support from the state of South Dakota, Hamlin County, the City of Estelline, as well as two US Senators and South Dakota's lone member of the US House of Representatives.

SDDOT is very experienced with receiving and expending Federal-aid highway program funds and has a dependable record for completing project milestones on schedule. Every year since recordkeeping began in 1986, SDDOT has received the additional federal highway funds redistributed in August to grant recipients that met all that year's obligation deadlines. Further, SDDOT has full-time dedicated grant management staff who have managed grant agreements required documentation and reporting of federal discretionary grants.

Grant Funds, Sources and Uses of All Project Funding

The South Dakota Department of Transportation (SDDOT) has prioritized this SD 28 Reconstruction and Resilience Project for needing immediate FY 2022 and 2023 PROTECT discretionary grant funding. SDDOT is requesting grant \$2,900,000 in PROTECT eligible funding for project construction components only. Cost estimates were developed using 90 percent design plans.

SDDOT has already invested State dollars to see this project completed. Preliminary engineering, environmental documentation, final design, and right of way acquisition has already been or will be completed prior to grant obligation, and grant funding is not being requested for those activities. A Table showing previously incurred costs at time of this application and those anticipated to incur prior to construction / grant obligation can be seen below.

Table 4. SD 28 Reconstruction and Resilience Project Funding Breakdown

Project Element		Project Funding								Total Cost Estimate
		Federal		Other Federal		Other Federal		SDDOT		
		PROTECT		STBGP		HIP Bridge		STATE Funding (A)		
		Dollars	Project Percentage	Dollars	Project Percentage	Dollars	Project Percentage	Dollars	Project Percentage	
Future Eligible Cost	PE, NEPA, & Final Design	\$0	0%	\$533,609	4%	\$0	0%	\$133,402	1%	\$667,011
	ROW	\$0	0%	\$16,000	0%	\$0	0%	\$4,000	0%	\$20,000
	Construction	\$0	0%	\$5,122,550	35%	\$0	0%	\$212,892	1%	\$5,335,442
	Bridge Replacement & Ancillary Structural Elements	\$2,900,000	20%	\$0	0%	\$1,748,349	12%	\$1,017,087	7%	\$5,665,437
	Mobilization	\$0	0%	\$633,114	4%	\$0	0%	\$158,278	1%	\$791,392
	Work Zone Traffic Control	\$0	0%	\$268,157	2%	\$0	0%	\$67,039	0%	\$335,197
	Utilities	\$0	0%	\$0	0%	\$0	0%	\$0	0%	\$0
	Contingencies	\$0	0%	\$0	0%	\$0	0%	\$1,212,746	8%	\$1,212,746
	Construction Engineering	\$0	0%	\$339,569	2%	\$0	0%	\$84,892	1%	\$424,461
	Total Future Costs	\$2,900,000	20%	\$6,912,999	48%	\$1,748,349	12%	\$2,890,337	20%	14,451,686
PROTECT Participation Maximum (80/20)							Total Project Costs		\$14,451,686	
PROTECT Request		\$2,900,000	20%							
Other Federal Funding		\$8,661,349	60%							
State Funding		\$2,890,337	20%							
Total Future Eligible Project Costs		\$ 14,451,686								
(A)	State Matching Funds come State tax funds including motor fuel taxes and motor vehicle excise taxes.									

SDDOT is requesting 20 percent of the construction cost, or \$2,900,000 of PROTECT grant funding for NOFO eligible resilience improvements associated with replacing bridge structures in flood-prone areas. Total construction costs for the Project are approximately \$14,451,687. FY 2022 and 2023 PROTECT requested would be used for construction of the Project. SDDOT has incurred costs of \$349,594 for preliminary engineering, environmental documentation, and right-of-way acquisition. [Preliminary engineering](#) and [environmental documentation](#) for the project are complete. Future eligible Project costs are based on final design, expected to be complete by the end of 2024. Table 5 shows the breakout of project costs. SDDOT's incurred costs on the Project are not included in the Project Funding Breakdown Table and are non-participating costs.

Other Federal Funding Sources

SDDOT will supplement PROTECT funding with Surface Transportation Block Grant Program (STBGP) and Highway Infrastructure Program (HIP) Bridge funding. SDDOT programs STBGP formula funds across the state and throughout the STIP to construct multimodal transportation projects. HIP Bridge funds are programmed for bridge replacement and ancillary structural elements not eligible through PROTECT. Total Federal funds, including PROTECT will not exceed 80 percent of total cost for the Project.

Non-Federal Funding Source

Applicant Funding

SDDOT will provide the 20 percent state share (\$2,890,337) of the total project cost (\$14,451,687). The entire state's share comes from State tax funds including motor fuel taxes and motor vehicle excise taxes. The Project, PCN 06NG, is programmed in the [2023-2026 Statewide Transportation Improvement Program \(STIP\)](#) and State funding is available to provide the matching funds for the Project¹⁰.

PROTECT Funding Need

FY 2022 and 2023 PROTECT funding is necessary to deliver the resilience and reliability travelers know and expect from SD 28. Receiving PROTECT funding for the Project will uphold SDDOT's continued progress to deliver resilient, reliable, and cost-effective transportation infrastructure.

PROTECT funding will allow SDDOT to forward critical and emergent flood resiliency improvements on SD 28. SDDOT is committed to providing the most reliable and safe transportation for users of the statewide multimodal transportation system. As the agency moves forward with strengthening resilience across its transportation system, more demand is being put on existing transportation funding and resilience-specific funding across the state. If PROTECT funding is not awarded to SDDOT for the Project, the agency will continue to program other Federal-aid sources as far as they can go. However, resiliency is a critical priority for the State and SDDOT is urgently pursuing all available resources to strengthen flood resiliency in the Project area. The agency believes without the Project, flooding across SD 28 will continue to occur and is working hard to make an impact as soon as possible. PROTECT funding is necessary to advance the Project as soon as possible. Without the funding for flood resilience improvements on SD 28, the Project may see reduced scope and/or delayed project delivery. Delayed delivery of the Project would put travelers along the Project segment of SD 28 at unnecessary risk during flood events, decrease reliability, and increase travel time. The absence of funding would adversely impact the resiliency, reliability, and mobility of SD 28 as a minor rural arterial.

Merit Criteria

1. Vulnerability and Risk

In 1995, riprap was placed along the inslope or ditch slope of SD 28 in the Project area to protect the roadway from erosion due to adjacent highwater and flooding concerns. Subsequently in 1997, portions of SD 28 in the Project area flooded, were overtopped, and then remained underwater. South Dakota's precipitation during the [winter of 1996-1997](#) was more than double the normal and was the highest on record. When snowmelt began in

¹⁰ [SDDOT. \(2021\) Long Range Transportation Plan 2045. Pg. 6-2.](#)

late March in the eastern part of the State, ice thickness on rivers exceeded three feet. The Big Sioux River just north of the Project area exceeded the 500-year flood recurrence interval¹¹.

SD 28 has become more vulnerable to flood events, which have grown more common and powerful based on the National Oceanic and Atmospheric Administration (NOAA) and [National Hydraulic Prediction Service \(NHPS\)](#) data. The NOAA's AHPS has river observation gauges in the Project area. One gauge is located just east of SD 28 on the Lake Poinsett Outlet and another gauge is located adjacent to SD 28 at the Big Sioux River bridge. The AHPS gauges monitor water levels and collect crest data, helpful in monitoring real time flood events. Historical data is available for the Lake Poinsett Outlet gauge but not for the Big Sioux River gauge, which was installed in 2018. At the Lake Poinsett Outlet, since the 1997 flood event (crest elevation 1656.20) inundated SD 28 in the project area, there have been three other higher crests, 2010 (crest elevation 1656.44), 2019 (crest elevation 1657.00), and 2011 (1657.60).

Figure 11. Projected Change in Winter Precipitation (CISESS and NEMAC)

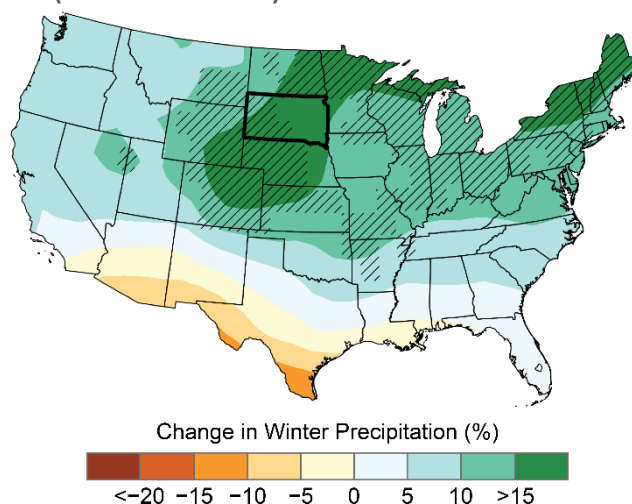
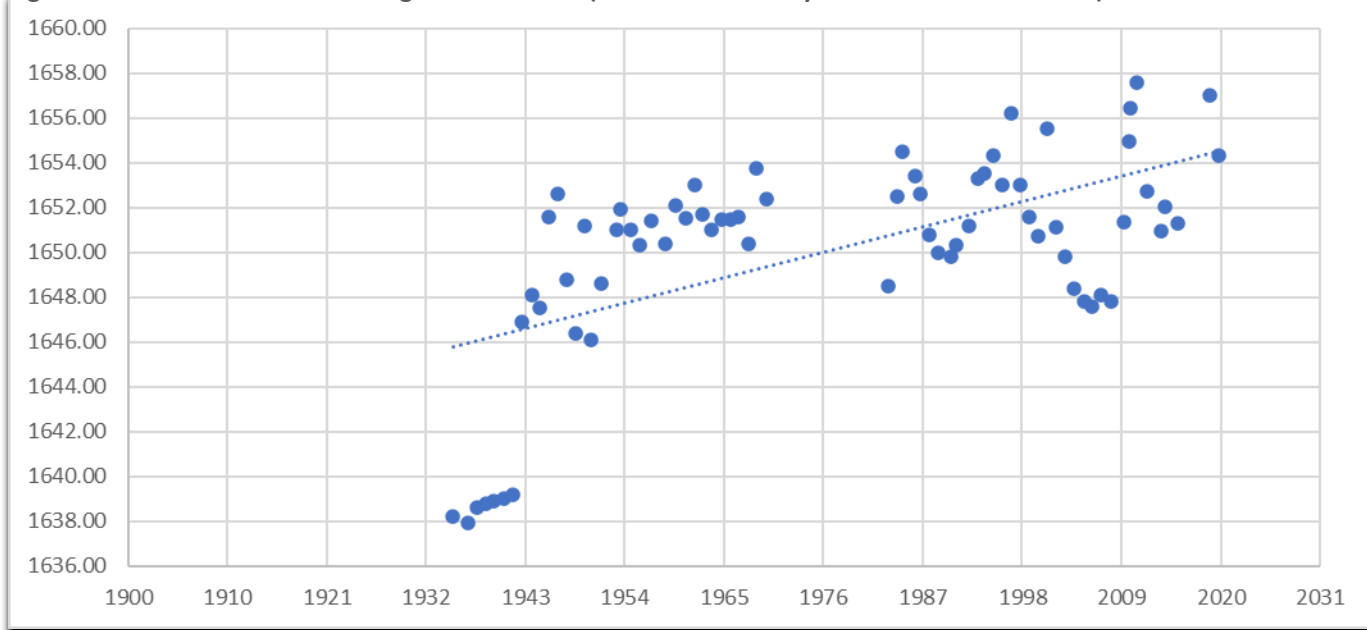


Figure 10. Lake Poinsett Outlet Gauge Recent Crests (NOAA Advanced Hydraulic Prediction Service)



The Lake Poinsett Outlet gauge references data to 1935. Of the top 10 crests at the Lake Poinsett Outlet gauge, 60 percent have occurred since year 2000. The scatter plot and trend line shown in Figure 11 also point to more significant flood events as time moves forward. This aligns with scientific data suggesting South Dakota's climate is changing and likely to exacerbate hazards¹². Climate change will result in heavier precipitation events, extreme weather, and faster snowmelt¹³. Faster snowmelts in South Dakota result in more [severe flooding](#) in the Project area, as frozen soil is less permeable and cannot absorb the runoff as quickly as thawed soil.

¹¹ [USGS. Ralph W. Teller and Michael J. Burr. \(1998\) Floods in North-Central and Eastern South Dakota, Spring 1997. USGS Fact Sheet FS-021-98.](#)

¹² [State of South Dakota. \(2019\) Hazard Mitigation Plan. Pg. 3-11.](#)

¹³ [EPA. \(2016\) What Climate Change Means for South Dakota. EPA 430-F-16-043.](#)

SDDOT has had to [close or significantly reduce speeds on SD 28](#) in the Project area several times in the [past 20 years](#) as floodwaters have covered SD 28 at the Lake Poinsett Outlet bridge and created hazardous travel conditions. The high water levels and flood impacts have been exacerbated by [heavy precipitation](#) that has heightened the sense of urgency to address flooding on SD 28 in the Project area.

Historically, the structures at the Lake Poinsett Outlet and Big Sioux River have impeded floodwater flow of major flood events, backing up water behind the bridges, and causing floodwater to flow across SD 28. There have been several observations of floodwater overtopping the Lake Poinsett Outlet bridge deck, and one observation of floodwater touching the base of the bridge deck at the Big Sioux River. SDDOT has had to close SD 28 to traffic, detouring traffic south 55-miles (additional 52 minutes of travel time) of travel time), depending upon flood severity. After completion of the Project, traffic operations on SD 28 in the Project area will improve during flood events, as the new infrastructure will reduce detours and travel times associated with Spring snowmelt and/or heavy precipitation events.

The Project increases the flood resilience of SD 28 by replacing critical bridge infrastructure which currently face the most exposure to flood events. SD 28 structure 29-227-144 at the Lake Poinsett Outlet will be raised by five to six feet and lengthened from 67-feet to 205-feet with a much wider channel opening. SD 28 structure 29-227-160 at the Big Sioux River will receive a minor raise (less than six-inches) and lengthened from 163.5-feet to 271.5-feet with a much wider channel opening.

Vulnerability Elements

Exposure

According to South Dakota 511 data, SD 28 in the Project area experienced surface water hazard 13 separate times in 2019 alone. SD 28 in the Project area has seen sizeable direct impacts from climate change over the past several decades in the form of flood events. With [heavier precipitation](#), more powerful weather, and faster snowmelts, SD 28 is facing real exposure to climate change. The Project's proximity and crossing of the Lake Poinsett Outlet and Big Sioux River have resulted in negative impacts to SD 28 and the highway's associated infrastructure. Even after a significant [Emergency Relief Program](#) project and effort to raise the road after the chart topping (regionally) 1997 flood, persistent flood impacts in the project area continue to impact the corridor directly and negatively. Structure 29-227-144 at the Lake Poinsett Outlet has the greatest exposure to flooding. Additionally, structure 29-227-160 at the Big Sioux River has significant exposure to flooding, however, resultant flooding of SD 28 has not been measured at the bridge.

The Project addresses changing weather conditions and subsequent flood events that SD 28 is growingly exposed to by focusing strategically on the locations facing flood exposure:

- Structure 29-227-144 at the Lake Poinsett Outlet, and
- Structure 29-227-160 at the Big Sioux River

NOAA's AHPS provides approximate elevation levels and the anticipated associated impact for said levels. See Table 5 below to see quantifiable flood impacts at each location.

Raising and lengthening each structure will decrease flood vulnerability on SD 28. The Project strengthens resilience from not only the impacts of recent and past historic crests, but also to future high-water marks and giving floodwater more space to flow through and out of the project area. Improvements have been designed to accommodate future powerful flood events that may occur as South Dakota's climate continues to change.

Table 5 NOAA Elevation Gauge Thresholds

Big Sioux River Gauge

Flood Impacts	Elevation (ft.)	Events Since 2018 [^]
Flood Stage	1,644	5
Elevation water reaches bottom of the SD 28 bridge	1,648	0
SD 28 begins to flood	1,651	0
High-water Mark (record year)	1,646.90 (2019)	

Lake Poinsett Outlet Gauge

Flood Impacts	Elevation (ft.)	Events Since 1935
Lake Poinsett considered full	1,651.50	29
Flood Stage	1,654	9
SD 28 & bridge begins to flood (bridge deck overtopped)	1,655	5*
SD 28 bridge is overtopped (completely overtopped)	1,658	0*
High-water Mark (record year)	1,657.60 (2011)	

[^]Gauge at SD 28's Big Sioux River bridge was installed in 2018.

*NOAA Gauge information defines overtopping as the elevation water flows freely over the bridge's superstructure or the bridge rail or barrier. Water over the bridge deck would occur at an elevation of 1,655-feet, which according to the NOAA, has occurred five times (1997, 2001, 2010, 2011, and 2019).

Sensitivity

SD 28 is sensitive to recurring flood events, especially at the Lake Poinsett Outlet and Big Sioux River bridges. Flood sensitivity is especially high at the Lake Poinsett Outlet bridge however, the Lake Poinsett Outlet flows northeast to the Big Sioux River and then flows south to the Big Sioux River bridge. Therefore, flood sensitivity of structure 29-227-144 at the Lake Poinsett Outlet and structure 29-227-160 at the Big Sioux River is interconnected.

Minor flood events in the Project area expose the structures to damaging erosion and scour which has begun to degrade the substructure of both bridges. During major flood events in the project area, floodwater pushes water up against the Lake Poinsett Outlet bridge superstructure including span beams, deck, and railing. Major flood events expose both bridges to damage and risk of deck compromise including increased risk of the bridge superstructure lifting off the substructure and washing away. However, the Lake Poinsett Outlet structure is most sensitive to major flood events.

Neither bridge was designed as a low water crossing, which is a proven mitigation tactic that allows flood water to flow freely over the bridge during seasonal flooding events¹⁴. Given the design and age (72 years) of the bridges at the Lake Poinsett Outlet and Big Sioux River, the structures are sensitive to damage caused by increasing occurrences of flood events in the project area. The Project will reconstruct both bridges with a raised bridge deck elevation and increased structure length, widening Lake Poinsett Outlet and Big Sioux River channel openings. The increased elevations and wider channel openings increase the space available for floodwater flow through and out of the project area, decreasing flood sensitivity of SD 28 and the likelihood of damage from flooding.

Adaptive Capacity

As described in the Project Description, SD 28 and associated infrastructure was originally constructed in 1951 and 1952 and is reaching the end of its useful life. The adaptive capacity of SD 28 in the project area has never been

¹⁴ [FEMA. \(2022\) Hurricane and Flood Mitigation for Public Facilities, Fact Sheet 1.4: Bridges. Pg 1-59.](#)

higher, as SDDOT has identified the infrastructure for reconstruction. The Project provides the best and most fiscally responsible opportunity for SDDOT to provide flood resilient infrastructure on SD 28.

2. Criticality to Community

Historic flood-related closures and projected future closures of SD 28 decrease reliability and mobility through the project area. The flood history and recent recurring flood events expose critical vulnerabilities of SD 28 to operate as a rural minor arterial roadway. SD 28 provides critical east-west mobility for traffic including freight traffic in Hamlin County between US 81 on the west and I-29 on the east.

Freight

SD 28 is considered a high freight corridor, with over 30 percent of average daily traffic (ADT) in the project area comprised of freight trucks (trucks). The reduction in mobility decreases the reliability of freight that relies on SD 28 and helps drive South Dakota’s economy. Leading [South Dakota’s economy](#), agricultural production comprises 50 percent of freight volume by commodity weight¹⁵. The project area and the eastern part of the state has the [highest crop intensity](#) in the state. SD 28 contributes to the movement of agricultural product commodities and South Dakota’s agriculture-based economy. The Project will improve freight travel time reliability on SD 28 by eliminating associated flood-related closures and resultant detours.

Table 6. SD 28 Current and Forecasted Average Annual Daily Traffic (AADT) and

Year	ADT	Truck ADT	% Trucks
2020	956	289	30.2%
2045	1,243	375	

Regional Mobility and Critical Destinations

Aside from negative impacts to freight, when SD 28 is closed during flood events, rural residents, and residents of communities near the project area have significant mobility limitations. SD 28 provides essential and critical mobility for rural residents and users who rely on the corridor to go about their everyday lives. Regionally, residents of Lake Norden (2020 population 596), Estelline (2020 population 787), and other rural residents in Spink, Beadle, Clark, Hamlin, and Deuel Counties use SD 28 for critical east-west mobility. SD 28 provides essential regional mobility between principal arterial roadways of the region including US 281, US 81, and I-29. People use SD 28 to reach essential destinations including the largest city in the state, Sioux Falls (2020 population 193,233), and smaller regional hubs such as Watertown (2020 population 22,613) and Brookings (2020 population 23,430). Each of these communities provides essential economic opportunities, historical and cultural events or sites, education including higher education, healthcare, social services, and other essential goods and services not available in small communities or rural areas within the project area. Watertown for example, has numerous healthcare clinics including a [Veterans Affairs clinic](#) and the [Lake Area Technical College](#). Brookings is home to the [South Dakota Art Museum](#), [Children’s Museum of South Dakota](#), and [South Dakota State University](#).

Using the U.S. Census Bureau’s [OnTheMap](#) tool, in 2020, 77 percent of the 2,407 people living within a 10-mile radius of the Project limits were employed outside the area, including 42 percent traveling to Brookings, Watertown, or Sioux Falls areas for work. Twenty-two percent traveled to small communities of Lake Norden, Estelline, Castlewood, Hayti, Volga, and Bryant with an additional 36 percent traveling to “other locations.” Forty-six percent of people living within a 10-mile radius of the Project area had a commute of 10 to 24 miles one-way, with an additional 23 percent traveling more than 50 miles one-way to work. The OnTheMap analysis indicates that smaller communities within the region are drawing people from the project area for work, further solidifying SD 28 as a critical rural minor arterial.

¹⁵ [SDDOT. \(2023\) Freight Plan. Pg. 5.](#)

By strengthening flood resiliency and eliminating flood-related closures on SD 28, the Project will improve the rural quality of life of residents in the area and sustain the critical rural economy within this area and throughout the state.

Emergency Services

The mobility and reliability of SD 28 through the Project area will be improved for emergency vehicles and services during flood events. With emergency healthcare located in Brookings and Watertown, SD 28 serves as a critical route and connection for emergent healthcare needs and other lifesaving services for rural communities in the project area and Hamlin County. The Project will eliminate mobility constraints and improve travel times on SD 28 that result from a flood-related closure. This is especially important for emergency responders where minutes and seconds can mean the difference between life and death.

3. Design Elements

Service Life

The expected service life of the Project is 75 years¹⁶. SDDOT determines service life by implementing a robust Transportation Asset Management (TAM) process guided by the agency's [Transportation Asset Management Plan \(TAMP\)](#). SDDOT utilizes historically based performance models to predict future conditions of distinct and varying infrastructure typologies. Incremental benefit-cost analysis determines the combination of feasible reconstruction, rehabilitation, and preventative maintenance treatments and subsequent timing to provide the best overall infrastructure over the 20-year analysis period¹⁷.

Resilient Design

The Project provides critical adaptive capacity of SD 28 to adjust to current and increasing flood vulnerabilities. Structure 29-227-144 at the Lake Poinsett Outlet will be raised by five to six feet and lengthened from 67-feet to 205-feet with a much wider channel opening. Structure 29-227-160 at the Big Sioux River will receive a minor raise (less than six-inches) and lengthened from 163.5-feet to 271.5-feet with a much wider channel opening. Recurrent flood events have increased in recent years. Most recently observed flooding across SD 28 in the Project area occurred at the Lake Poinsett Outlet bridge, when the bridge deck was overtopped in 2011 and 2019. The floodwater depth flowing across SD 28 was 12-inches and five-inches respectively. The five to six foot grade raise will eliminate flood impacts associated with historic crests.

Currently, a crest elevation of [1,658-feet would completely overtop](#) the Lake Poinsett Outlet bridge, something that has never occurred according to [NOAA data](#). After Project completion, the crest elevation that would completely overtop the bridge would have to reach 1,663- to 1,664-feet and 1,660 to 1,661-feet to overtop the bridge deck. The high-water mark, which occurred in 2011, at the Lake Poinsett NOAA gauge is 1,657.60-feet, over two-feet lower than the proposed new bridge deck height. The Lake Poinsett Outlet structure will also be lengthened by 138-feet, significantly widening the channel opening.

The Lake Poinsett Outlet drains to the Big Sioux River, meaning floodwater that flows beneath structure 29-227-144 at the Lake Poinsett Outlet, also flows beneath structure 29-227-160 at the Big Sioux River. By raising the Lake Poinsett Outlet bridge, floodwaters that would normally slow down from running into the bridge's superstructure will now flow more freely northeast to connect with Big Sioux River. The floodwater flow and increase of volume is not likely to contribute to higher flood elevations at the Big Sioux River bridge as the bridges are over ten river-miles apart. SDDOT has observed floodwater touching the bottom of the deck on structure 29-227-160 at the Big Sioux

¹⁶ [SDDOT. \(2022\) Transportation Asset Management Plan. Pg. 3-16.](#)

¹⁷ [SDDOT. \(2022\) Transportation Asset Management Plan. Pg. 1-2.](#)

River and has incorporated a more resilient bridge design to minimally (approximately six-inches) raise the bridge deck and lengthen the structure by 108-feet. Redundancy in infrastructure investment is critical to strengthen resiliency on SD 28 structures prone to flooding. The SDDOT Region Bridge Engineer is confident that the additional bridge deck elevations and channel widening of the replacement structures will alleviate current and future flood vulnerabilities on SD 28.

Safer Design

The Project increases safety by strengthening bridge flood resilience on SD 28. Current flood vulnerabilities expose drivers to hazardous driving conditions when water is flowing over SD 28 or overtopping the bridge deck. During flood events where floodwater is running into the superstructure or overtopping the Lake Poinsett Outlet bridge deck, drivers caught in the project area are most susceptible to sudden failure of SD 28 structures or washout. Increased flood resilience will also allow SD 28 to stay open during flood events, helping drivers avoid long detours and increased travel time, meaning less exposure to crash risks and increased greenhouse gas emissions on detour routes.

The Project is timely, and if flood resilience isn't addressed soon, consequences of resulting flood impacts to the roadway may cause irreversible damage to infrastructure or in a worst-case scenario, the loss of life or livelihood for user(s) traveling on SD 28 during an extreme flood event or failure of infrastructure caused by floodwaters.

Operations & Maintenance

SDDOT estimates life-cycle costs of the Project to be \$73,391. Table 7 presents estimated operations and maintenance activities that would be performed in the Project area consistent with the agency's [Transportation Asset Management Plan](#).

Table 7 Project Life Cycle Costs*

SD 28 Project Age	Treatment	Cost Per Mile	Length (Miles)	Cost (FY 2023)
0	SD 28 Reconstruction & Resilience Project			
3 (2028)	Rout and Seal	\$2,462.22	3.52	\$8,667
4 (2029)	Chip Seal	\$188.35	3.52	\$663
10 (2035)	Chip Seal	\$4,946.31	3.52	\$17,411
17 (2042)	TBD^	\$13,252.84	3.52	\$46,650
TOTAL				\$73,391

^Treatment to be established through SDDOT's TAMP.

*Structure specific items are not included and will be prescribed and scheduled through ongoing routine inspections.

SDDOT is committed to operating and maintaining the Project in a State of Good Repair, and currently performs routine maintenance and quality assurances of transportation infrastructure including bridge structures across the State. SDDOT uses AASHTOWareTM Bridge Management (BrM) software to predict future conditions and needs at both the network and Project level to identify timely and cost-effective preservation, rehabilitation, and replacement treatments¹⁸. As conditions and needs across the State's infrastructure inventory are analyzed, operations and maintenance funding will be programmed to keep the Project in a state of good repair. Keeping the Project and associated SD 28 infrastructure in a state of good repair is critical to SDDOT's goal of strengthening flood resilience in the Project corridor. SDDOT operations and maintenance funding for the Project comes from State tax

¹⁸ [SDDOT. \(2022\) Transportation Asset Management Plan. Pg. 1-2.](#)

funds including motor fuel taxes and motor vehicle excise tax. State funds are supplemented by Federal funds, as eligible/applicable¹⁹.

Tracking of Flood Hazards

Over the service life of the Project, SDDOT will utilize NOAA's AHPS gauges at the Lake Poinsett Outlet and Big Sioux River to track flood events and resultant river crests. With the addition of the Big Sioux River gauge in 2018, SDDOT has a powerful accessible resource to track historical, current, and projected water/flood levels at critical bridge infrastructure on SD 28. Performance of the replacement bridge structures will be monitored and to mitigate flood hazards, should they occur after Project completion.

4. Public Engagement, Partnerships, and Collaboration

Public engagement for the Project is led by SDDOT's [Public Involvement Plan](#). Guided by principles of accessibility and effective engagement with the public, public involvement for the Project started years before the writing of this PROTECT application, through development of SDDOT's [LRTP](#), [Strategic Highway Safety Plan](#), and STIP. SDDOT has provided, to the maximum extent possible, consistent, accessible, and collaborative public engagement of [South Dakotans from all walks of life](#). Through the development and robust public involvement processes implemented by SDDOT, thousands of South Dakotans helped to shape transportation policy, programming, and implementation resulting in this Project.

For the Project specifically, SDDOT conducted a public information meeting for the project on April 21, 2021. The meeting included a public notice, flyer, location map, handout, and displays. A [recorded virtual presentation](#) was included and public comments were collected from the meeting date until May 19, 2021.

Outreach to both internal and external stakeholders has occurred on the Project:

- Internal Stakeholders
 - Design staff
 - Right-of-way staff
 - Utility coordination staff
 - Environmental staff
 - Area and Region staff
- External Stakeholders
 - Property Owners and Homeowners
 - Commercial, Trucking/Freight Operations
 - Local Government Agencies
 - Tribal Governments
 - Federal Agencies
 - Business Community
 - Other State Agencies
 - Advocacy Groups

5. Equity and Justice⁴⁰

SDDOT's [Public Involvement Plan](#) guides meaningful public involvement inclusive [of all users](#) and those impacted by the Project. Public involvement has been and will continue to be a critical guiding component of the Project's development. The Project will not create disproportionately high or adverse impacts to populations within the project area or to users of SD 28.

The project area is completely within Census Tract 9551 (population 2,562 within Census Tract) in Hamlin County, South Dakota. Based on the [Climate and Economic Justice Screening Tool \(CEJST\)](#), the Project area is not considered disadvantaged nor considered a Justice40 community. [USDOT's Equitable Transportation Community \(ETC\) Explorer](#) does not define Census Tract 9551 as a "disadvantaged" community however, there are indicators of disadvantaged communities in the Project area. For example, based on the ETC Explorer, Census Tract 9551 meets the

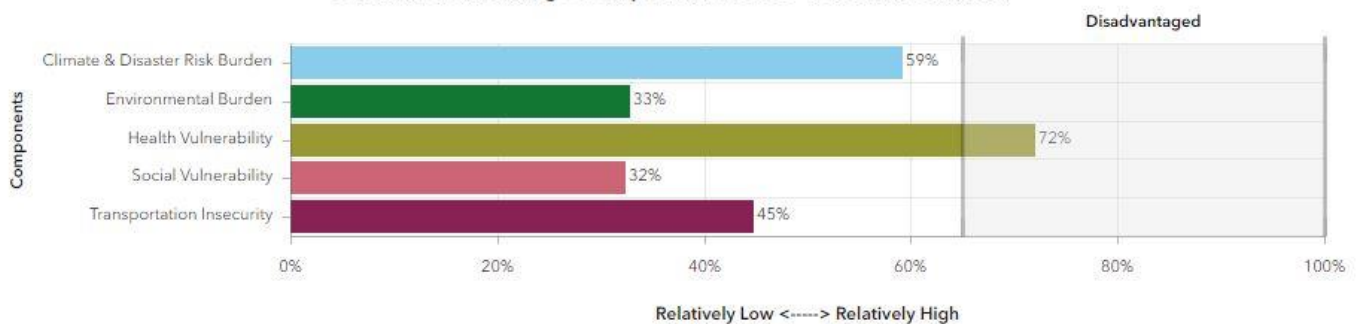
¹⁹ [SDDOT. \(2021\) Long Range Transportation Plan. Pg. 6-2.](#)

disadvantaged threshold of 65 percent for Health Vulnerability (72 percent), and falls six percentage points short for Climate & Disaster Risk Burden (59 percent).

Figure 12. Climate and Economic Justice Screening Tool (CJEST) Disadvantaged Indicators

Component	Disadvantaged?	Census Tract 9551 Disadvantaged Indicator
Climate & Disaster Risk Burden	No	- Anticipated Changes in Extreme Weather - Annualized Disaster Losses
Environmental Burden	No	- PM 2.5 Level - Risk Mgmt Sites Proximity
Health Vulnerability	Yes	- Cancer Prevalence - High Blood Pressure Prevalence - Diabetes Prevalence - Poor Mental Health Prevalence
Social Vulnerability	No	17 or Younger - Limited English Proficiency
Transportation Insecurity	No	None

Figure 13. USDOT Equitable Transportation Community (ETC Explorer Disadvantaged Scores Overall Disadvantage Component Scores - Percentile Ranked



Additionally, the [Health Resources and Services Administration](#) has designated Hamlin County, including Census Tract 9551 as a medically underserved area for primary care. Compounding health vulnerabilities and designation as a medically underserved area indicates emerging vulnerable populations in the Project area.

Although not officially defined as a disadvantaged community, the project area (Census Tract 9551) has indicators of disadvantaged and vulnerable populations. Project impacts will have a positive impact on these populations, especially in the areas of climate disaster and risk, and health vulnerabilities. For example, the Project will strengthen the resilience of SD 28, reducing flood-related vulnerabilities and hazards for users of the roadway while improving reliability and mobility for users to access healthcare and other resources outside of the Project area.

6. Climate Change and Sustainability

The Project will eliminate flood impacts on SD 28 that often result in closure of the road, reduced mobility, and increased travel times. The resultant increase in flood resiliency will increase mobility and travel time reliability. The BCA estimates that the Project will yield an overall greenhouse gas emissions [reduction of more than 88,000 metric tons](#) of greenhouse gas emissions (including Carbon dioxide, Nitrogen oxides, Sulfur dioxides, and fine particulate matter) by eliminating closures of SD 28 for flood events in the Project area.

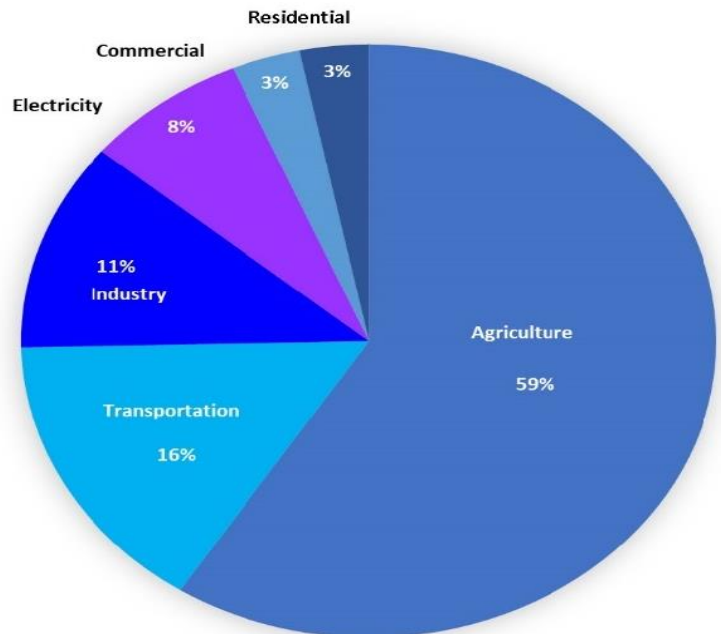
SDDOT's [Draft Carbon Reduction Strategy](#) identifies actionable, context driven strategies to reduce emissions in the State which has distinguishable differences from other places in the U.S.²⁰:

- Long distances and drive times to urban centers health care, essential businesses and services, etc.
- Agricultural production requires connected extensive roadway network to ship and receive products associated with agricultural production, the driver of South Dakota's economy.
- The state is home to nine dispersed and primarily rural Native American and Tribal communities.
- A significant percentage of out-of-state truck freight and tourists rely on South Dakota's roadway network.
- Given the state's economy and population densities, South Dakota's transportation system users depend on highways and motor vehicles as the primary, more practical transportation mode.

Recognizing the socio-economic context of the state, SDDOT has identified key components impacting carbon reduction in the state. The SD 28 Reconstruction & Resilience Project reflects key priorities of SDDOT, as the agency moves forward to do its part in reducing carbon:

- Travel time affects emissions²¹
 - The closure and/or delay of traffic caused by SD 28 increases vehicular emissions and carbon output in the Project area.
 - Reconstructing SD 28 with more resilient bridge structures will reduce said emissions by providing travel time reliability through the corridor and eliminating delays and/or detours associated with flood events.
- Settlement Patterns and South Dakota's Economy Shape Travel and Emissions²²
 - The public road network in eastern South Dakota, where the Project is located, generally follows the one-mile grid to provide access to farms.
 - The Project also introduces resiliency of farmers or farm operators to ship and receive agricultural commodities and other agricultural products necessary for South Dakota's agricultural-based economy.

Figure 14. South Dakota 2019 Carbon Emissions by Economic Sector



After Project completion, resiliency, safety, and reliability of SD 28 will be improved, decreasing GHG emissions which have historically resulted from vehicle-miles traveled (VMT) and travel time. Accompanying benefits of the Project will help SDDOT forward high-level strategies to reduce carbon emissions associated with the naturally occurring socio-economic conditions of the state. For example, agriculture is the largest producer of carbon emissions in South Dakota by economic sector²³. The quantifiable GHG reduction of the Project may seem like a drop in the bucket in the fight against climate change however, as part of the bigger picture, the Project forwards critical policy and strategic direction of [SDDOT's Draft Carbon Reduction Plan](#).

²⁰ [SDDOT. \(2023\) Draft Carbon Reduction Strategy. Pg. 4.](#)

²¹ [SDDOT. \(2023\) Draft Carbon Reduction Strategy. Pg. 8.](#)

²² [SDDOT. \(2023\) Draft Carbon Reduction Strategy. Pg. 11.](#)

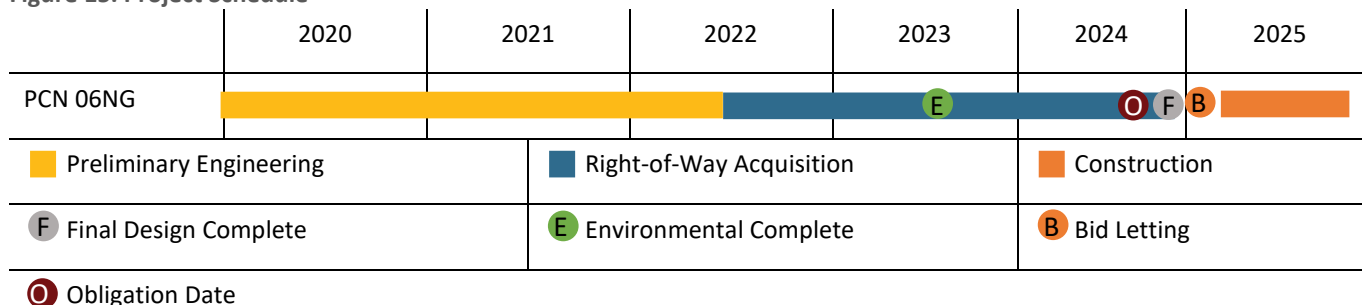
²³ [SDDOT. \(2023\) Draft Carbon Reduction Strategy. Pg. 16.](#)

7. Schedule and Budget

Project Schedule

The Project will be ready for construction in 2025. The Project schedule identifying major milestones is presented below. All planning agreements, permitting, review periods, and approvals have been considered. SDDOT anticipates construction to begin in Spring 2025 and completion in Fall 2025. Associated asphalt surfacing of SD 28 will occur as part of PCN 057Q in 2026.

Figure 15. Project Schedule



Project Budget

SDDOT is requesting 20 percent of the construction cost, or \$2.9 million of PROTECT grant funding for eligible resilience improvements associated with replacing bridge structures. Total construction costs for the Project are approximately \$14,451,687. FY 2022 and 2023 PROTECT requested funds of \$2,900,000 would be used for construction of the Project. SDDOT has incurred costs of \$349,594 for preliminary engineering, environmental documentation, and right-of-way acquisition. [Preliminary engineering](#) and [environmental documentation](#) for the project are complete. Future eligible Project costs are based on final design. Table 5 from the Grant Funds, Sources and Uses of All Project Funding section above, shows the breakout of project costs. SDDOT's incurred costs on the Project are not included in the Project Funding Breakdown Table.

PROTECT Eligible Costs

The Project's total future cost is \$14.452 million, total future PROTECT eligible cost is \$2.9 million. SDDOT is requesting \$2.9 million or 20 percent of Project cost through the FY 2022 and 2023 PROTECT Resilience Improvement Grant.

Other Project costs are funded through State tax funds including motor fuel taxes and motor vehicle excise tax, and other Federal funding sources including STBGP and HIP Bridge funding. Total Federal share on the Project will not exceed 80 percent of total project costs.

PROTECT Eligible Activities

The requested \$2.9 million of PROTECT grant funding will be utilized for eligible resilience improvements for structure 29-227-144 at the Lake Poinsett Outlet and structure 29-227-160 at the Big Sioux River. PROTECT eligible improvements include raising and lengthening the structures to strengthen flood resilience of SD 28, as thoroughly detailed in the preceding sections of this application.

8. Innovation

SDDOT has established an innovative project delivery practice through an e-Construction process that includes a web portal for construction-related data, the implementation of electronic payroll submissions, and the creation

of an electronic change order process that has cut processing time from 30 days to less than one week. In December 2018, SDDOT initiated MySD, which is a web portal that gives contractors and other entities that do business with SDDOT one location to sign in for all their business needs. Contractors use this portal to access the SDDOT Electronic Payroll Submission System (EPSS). The EPSS allows contractors to submit payrolls electronically, which saves more than 100,000 pieces of paper mail annually. The Project will utilize this process prior to, during, and after its implementation.

SDDOT is also applying for an Advanced Digital Construction Management Systems (ADCMS) Grant Program to advance other components of e-Construction.

SDDOT plans to use a significant amount of recycled asphalt pavement (RAP) to construct PCN 05Q7, the surfacing for the Project. Plans include the stockpiling of salvaged asphalt from PCN 04HM to use in Class Q3R asphalt for PCN 05Q7. This will be a 20 percent RAP mix. SDDOT has successfully utilized these recycled materials in several projects recently, recording high quality performance of the pavement. Utilizing RAP in PCN 05Q7 improves energy efficiency and reduces carbon production by using salvaged materials with lower embodied carbon than producing new asphalt material.

Benefit-Cost Analysis

1. Economic Analysis

Per the NOFO, a Benefit Cost Analysis (BCA) is required for a Resilience Improvement Grant under 23 U.S.C. 176(d)(4)(A)(iii), since a qualifying Resilience Improvement Plan has not yet been developed. The BCA provides an indication of the economic desirability of a scenario, but results must be weighed by decision-makers along with the assessment of other effects and impacts. Projects are considered cost-effective if the benefit-cost ratio is at least 1.0. The larger the ratio number, the greater the benefits per unit cost. Results of the BCA are shown in Table 1. See Attachment B for the complete benefit-cost analysis workbook.

Table 1 – Total Project Results

	Initial Capital Cost (2021 Dollars)	Project Benefits (2021 Dollars)	Benefit-Cost Ratio (7% Discount Rate)	Net Present Value (2021 Dollars)
No Build vs. Build	\$10.15 million	\$49.55 million	4.88	\$39.40 million

FHWA FY 2022 and FY 2023 Priority Considerations

1. Exceptional Benefits

[USDOT's Equitable Transportation Community \(ETC\) Explorer](#) does not define Census Tract 9551 as a "disadvantaged" community however, there are indicators of disadvantaged communities in the Project area. For example, based on the ETC Explorer, Census Tract 9551 meets the disadvantaged threshold for health vulnerability, including thresholds of other component indicators.

Additionally, the [Health Resources and Services Administration](#) has designated Hamlin County, including Census Tract 9551 as a medically underserved area for primary care. Compounding health vulnerabilities and designation as a medically underserved area indicates emerging vulnerable populations in the Project area.

Although not officially defined as a disadvantaged community, the Project area (Census Tract 9551) has indicators of disadvantaged and vulnerable populations. Project impacts will have a positive impact on these populations, especially in the areas of climate disaster and risk, and health vulnerabilities. For example, the Project will

strengthen the resilience of SD 28, reducing flood-related vulnerabilities and hazards for users of the roadway while improving reliability and mobility for users to access healthcare and other resources outside of the Project area.

2. Workforce Development, Job Quality, and Wealth Creation

This project will be subject to SDDOT bidding and contract regulations and policies. SDDOT maintains a [Disadvantaged Business Enterprise \(DBE\) Program](#) in accordance with regulations of USDOT, 49 CFR Parts 23 and 26. As part of its DBE Program, SDDOT maintains a directory identifying all certified DBEs and women-owned DBEs. The department has also developed a [Business Development Program](#) that is intended to encourage current and future DBE firms to take advantage of the twin opportunities of learning about how to set and achieve long-term business goals based on their skills and abilities; and to meet short-term participation standards as listed in 49 CFR Part 26, Appendix C. Additionally, SDDOT continues to facilitate competition for FHWA projects by taking all reasonable steps to eliminate obstacles such as unnecessary or unjustified bundling or other contract requirements that may preclude small business and DBE participation in procurement as prime contractors and subcontractors. In an effort to ensure there is competitive bidding on all sizes of projects, the department keeps track of and reviews the number of all bidders on an annual basis.

3. Construction Readiness

SDDOT has completed preliminary engineering, environmental documentation, and is underway with ROW acquisition and final design. Floodplain permits have been pulled and the Project is included in the [2023-2026 STIP](#) and draft 2024-2027 STIP. With ROW acquisition and final design expected by the end of 2024, the Project is well positioned to meet statutory obligation deadlines ahead of 2025.

4. Funding Needs

If PROTECT funding is not awarded to SDDOT for the Project, the agency will continue to program other Federal-aid sources as far as they can go. However, resiliency is a critical priority for the State and SDDOT is urgently pursuing all available resources to strengthen flood resiliency in the Project area. The agency believes without the Project, flooding across SD 28 will continue to occur. Therefore, SDDOT is working hard to make an impact as soon as possible. PROTECT funding is necessary to advance the Project as soon as possible. Without the funding for flood resilience improvements on SD 28, the Project may see reduced scope and/or delayed project delivery. Delayed delivery of the Project would put travelers along the Project segment of SD 28 at unnecessary risk during flood events, decrease reliability, and increase travel time. The absence of funding would adversely impact the resiliency, reliability, and mobility of SD 28 as a minor rural arterial.

All supporting documents and the PROTECT grant application narrative are also available to view at the following webpage:

<https://www.srfconsulting.com/sddot-sd28-protect/>