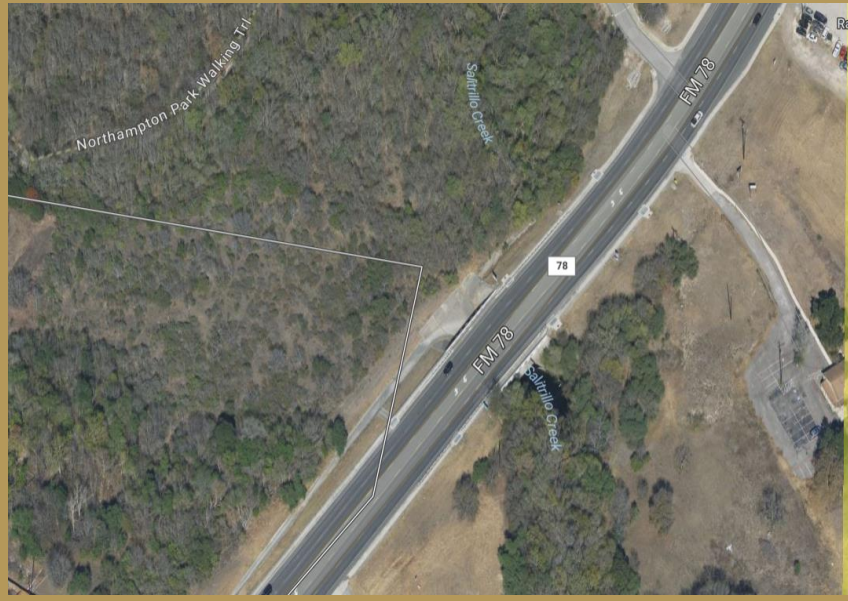


Group C2.02 - ScourGuard

Landon Courtney, Robert Villegas,
Alexis Velazquez, Juan Tapia
CREATE



Project Overview



Location: San Antonio Texas, Highway FM 78 crossing Salitrillo Creek
Problem: Scouring damage near foundation and channel lining

- **East Bank Erosion** – ~2.5' riprap exposed and undermined; moderate erosion with visible tree roots.
- **Concrete Lining Damage** – Broken section washed away; ~7' exposed and undermined; cracked riprap at the south corner.
- **Riprap Shifting & Channel Failure** – 4" shift from abutments; failed downstream lining; ~7' exposed, undermined by 3'.

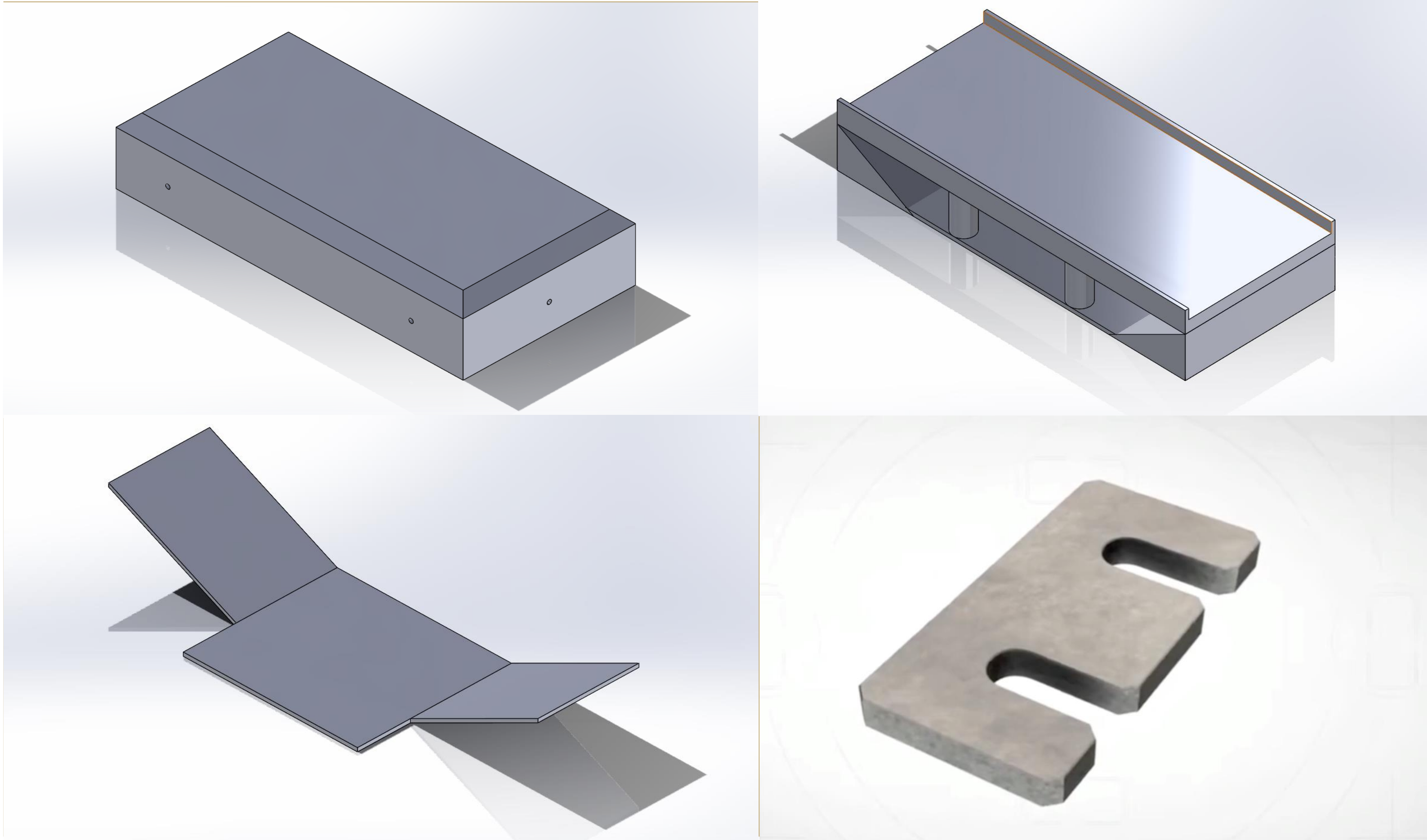
Engineering Solution

Our Engineering solutions addresses bridge scour by implementing a revetment mat and an Aquacast retaining wall to protect against erosion and stabilize the channel.

- Site planning
- Grading and Earth work
- Concrete Slope
- Overturning , sliding , bearing capacity calculations

Cost Analysis

COST ANALYSIS			
Material	Amount	Price/Unit	Total Price
Precast Concrete Blocks	20.1 CY	\$600 / CY	\$12,100
Revetment Rope	3,500 LFt	\$1.20 / Ft	\$4,200
Concrete Leveling Pad	41 CY	\$175 / CY	\$7,200
Geotextile Filter Fabric	2,000 ft²	0.45 / ft²	\$900
Helix Anchors	36 units	150 / unit	\$5,400
Grout/Mortar	3x80lb bags	\$20 / Bags	\$60
Interlocking Retaining Wall	369 ft²	\$35 / ft²	\$12,900
Material Cost			\$42,760
Contingency 15%			\$6,414
Total Cost			\$49,000



Solution Specifications

Concrete	Area (ft²)	Volume (ft³)	Volume (CY)	Weight (lb)
Left Slope	407.6	273.1	10.1	40,965
Center Flat	798.6	535.1	19.8	80,265
Right Slope	407.6	273.1	10.1	40,965
Total	1,613.8	1,081.3	40.1	162,195

- A concrete slab has been designed to match the bridge foundation elevation that's 8 inches thick
- Elevation drop: ~1 ft from bridge foundation to river channel toe
- Slab ensures revetment mat sits flush with bridge skirt
- Soil backfill required to regrade existing channel to a 2:1 slope
- Filter fabric placed between compacted soil and concrete for drainage and stability

Height (ft)	Total Blocks Needed	Wall Width (ft)	Total Base Length (ft)	Base Depth (ft)	Surcharge (psf)	Factor of Safety (M)
4.92	525	2.62	75	0.66	209	1.5

Mat	Blocks (L x W)	Block Count	Area (ft²)	Volume (cy)	Weight (lb)	
Left Slope	14 x 21	294	407.6	5.04	20,417	
Center Flat	18 x 32	576	798.6	9.88	40,000	
Right Slope	14 x 21	294	407.6	5.04	20,417	
Total	—	1,164	1,613.8	19.96	80,834	

- Precast concrete blocks: 4" x 10" x 20"
- Three mats will be pre-cast then assembled on sight
- Layout avoids half blocks and ensures durability.
- Slight uncovered edges will be sealed with non-shrink grout or mortar

- Our wall is going to be 75ft by 4.92ft to ensure it is adequate for our site
- We have calculated for the stability and hydrodynamic forces of the wall that support our dimensions

Stability Checks

There are many factors that contribute to the design of a retaining wall. For a wall to remain stable, and to not fail under loads and stresses, the wall must pass a series of stability checks:

- **Overturning** – The ability to resist lateral pressures acting on wall. Resistance to overturning prevents the wall from tipping in any direction.

$$F_{\text{Overturning}} = F_{\text{Stm}} = \frac{M_o}{M_R} \geq 1.5$$

- **Sliding** – Determines whether the resisting forces can overcome the active pressures acting on the wall. This check ensures the wall from sliding out of its position

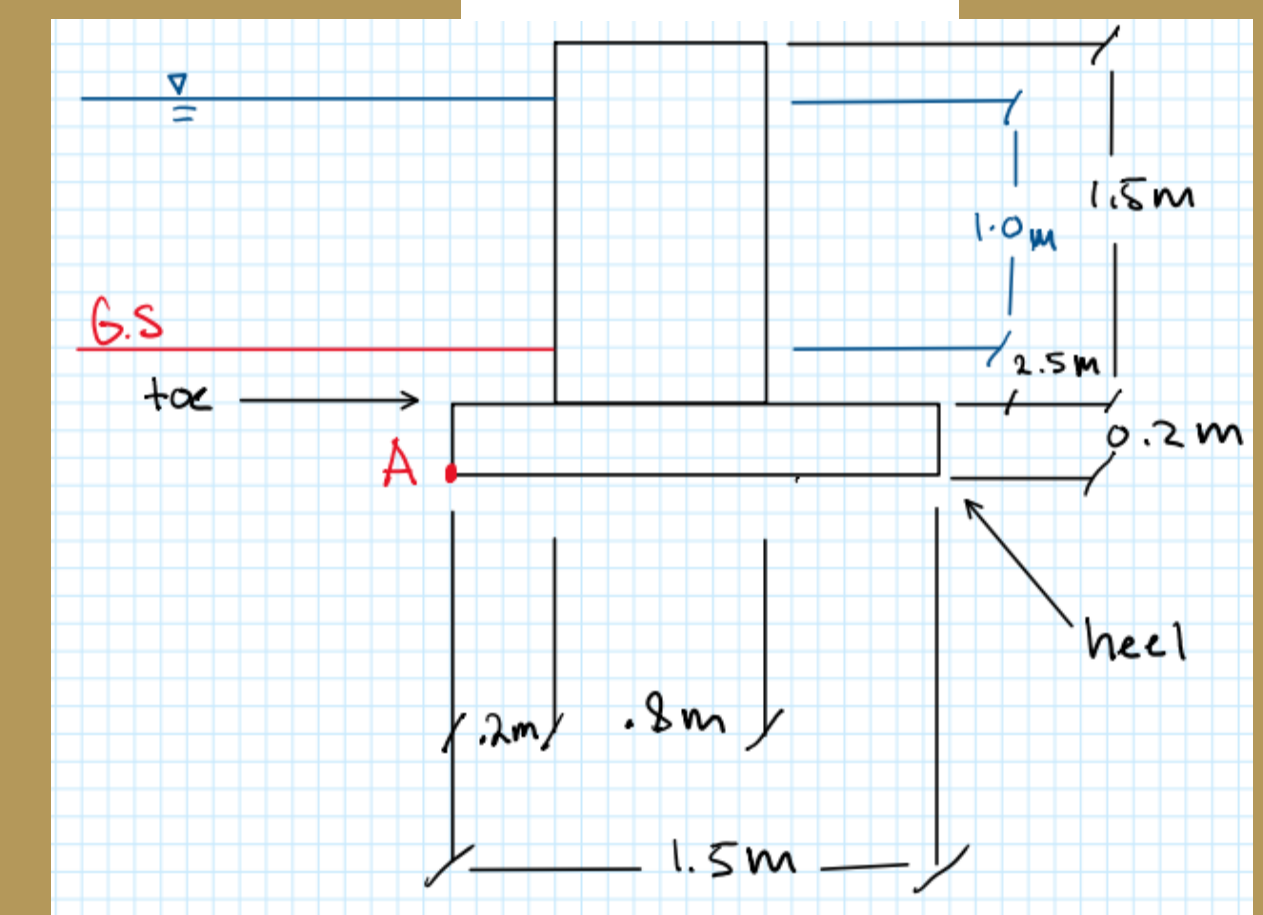
$$\frac{\mu \sum V + P_p + P_a}{P_a} \geq 1.55$$

- **Bearing capacity** – Evaluated whether the bearing pressure exerted by the wall exceeds the maximum allowable bearing capacity of the soil. In other words, it ensures that the soil does not fail under pressure due to the wall.

$$q_u = c'N_c + \gamma_u DN_f + 0.5\gamma_u BN_f$$

$$P_{\text{max}} = \frac{\sum v}{B} \left(1 + \frac{6 \cdot e}{B} \right) < q_{\text{ua}}$$

$$P_{\text{min}} = \frac{\sum v}{B} \left(1 - \frac{6 \cdot e}{B} \right) > 0$$



Constraints and standards

- Before implementation of our solutions we must use flowable fill to repair existing scour.
- We did calculate settlement but have assumed the existing rip rap to have consolidated the soil beneath.
- The site is prone to a 60-year storm.
- The river channel has already experienced significant erosion and will require replacement.

