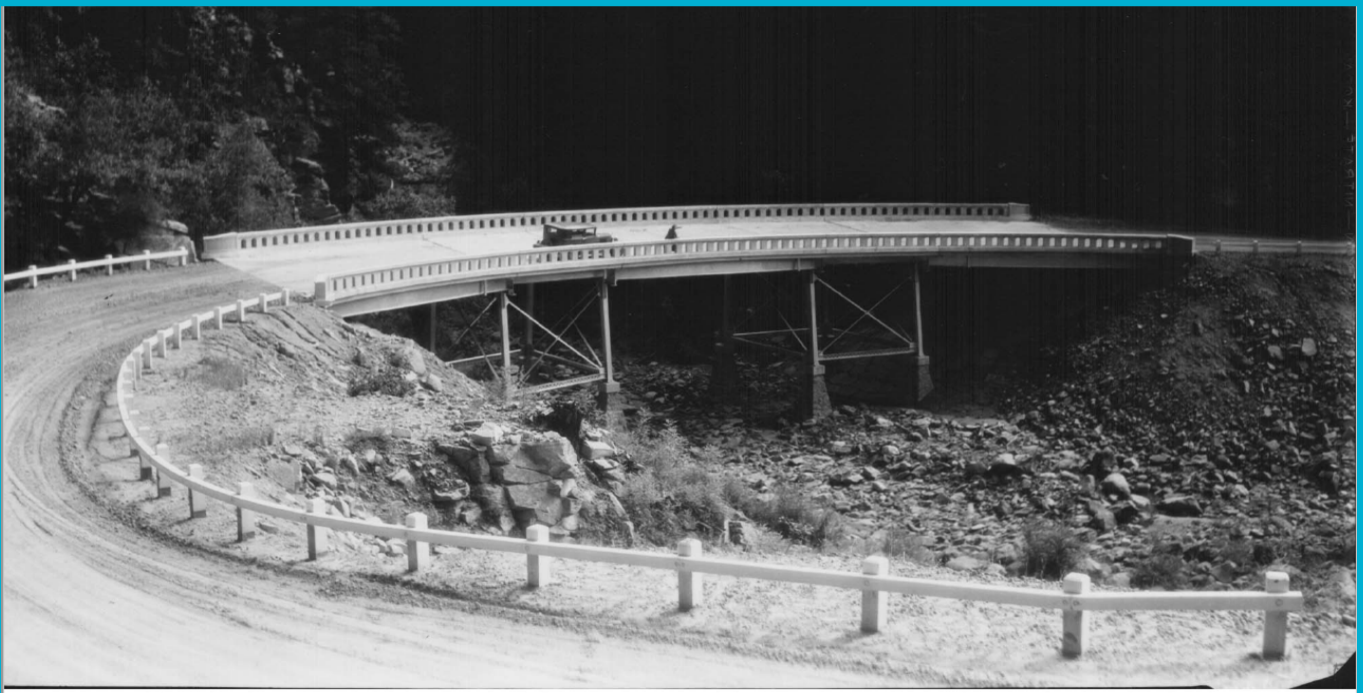
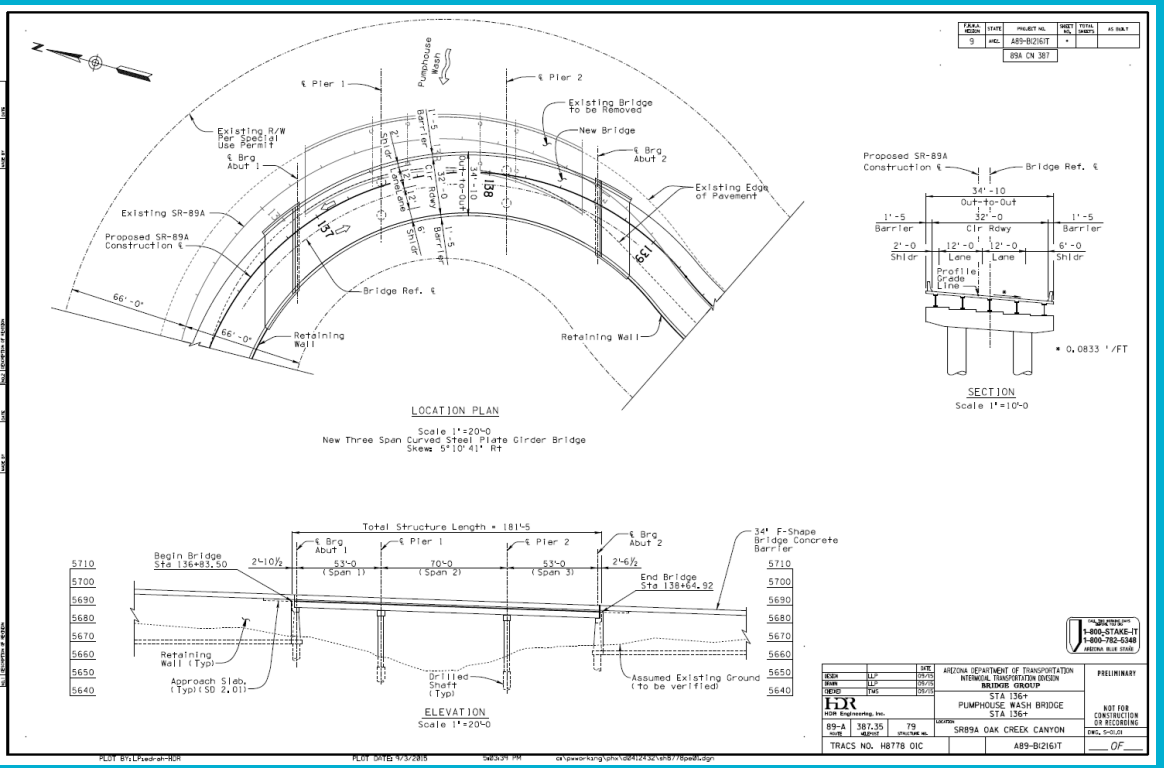
History of Pumphouse Wash Bridge in Oak Creek Canyon



Historic Photograph Number 549 - 10/9/32 - Alt. Hwy 89 Pump House Wash Br. or Upper Oak Creek.

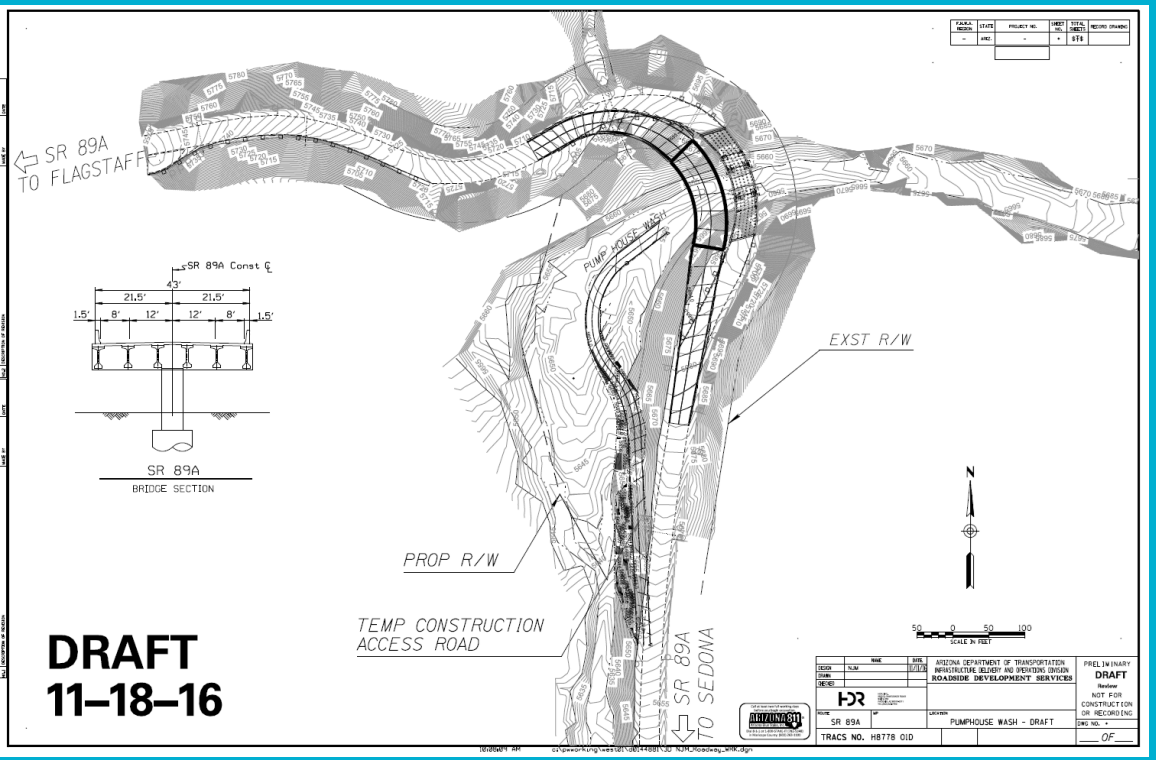
- Built in 1931 by the US Bureau of Public Roads
- Designed by BPR engineers and built by C.G. Willis and Sons for an estimated $187,000
- Pedestals at Pier line #2 and #3 were encased in concrete in 1932 at bottom of creek
- First state highway designated as a “scenic road” by ADOT in 1984.
- 160ft total length 5 Span steel stringer bridge supported by steel four-legged piers on concrete pedestals.
- Roadway construction centerline was on a 150 ft radius.
- Designed for H15 truck loading.
- Bridge barriers and expansion joints replaced in 1986. Shotcrete scour apron installed at piers #2 and #3.

History of Pumphouse Wash Bridge project



- Project Assessment completed Sept 2015
- Recommended a full replacement with a shifted centerline and 2 phases of construction with a partial removal of existing bridge.
- Recommended bridge was a 3 span steel girder bridge with significant retaining walls
- Recommendation for replacement stated *“The bridge replacement alternative will need agreement among SHPO, The Advisory Council on Historic Preservation (ACHP) and FHWA reached through the Section 106 process of the NHPA Programmatic Section 4(f) evaluation”*
- Moving forward with replacement was dependent on the Section 4(f) evaluation determining the bridge rehabilitation was not feasible and prudent.

Final Design



- Final Design Kick-off meeting occurred Sept 2016
- Design team discovered the existing alignment was advantageous to an increased shift which allowed for single phase construction of the new bridge.
- Single phase construction allowed for a single season job in a location where weather conditions were difficult to manage.
- Single phase construction and single phase demolition substantially helped with Maintenance of Traffic in a critical corridor.
- Existing bridge could be used to transport girders across the wash and lift into place with minimal impacts to the traveling public.
- Allowed for single pier column and single drilled shaft

Phasing challenges

- Fracture Critical Bridge would not allow phased demolition

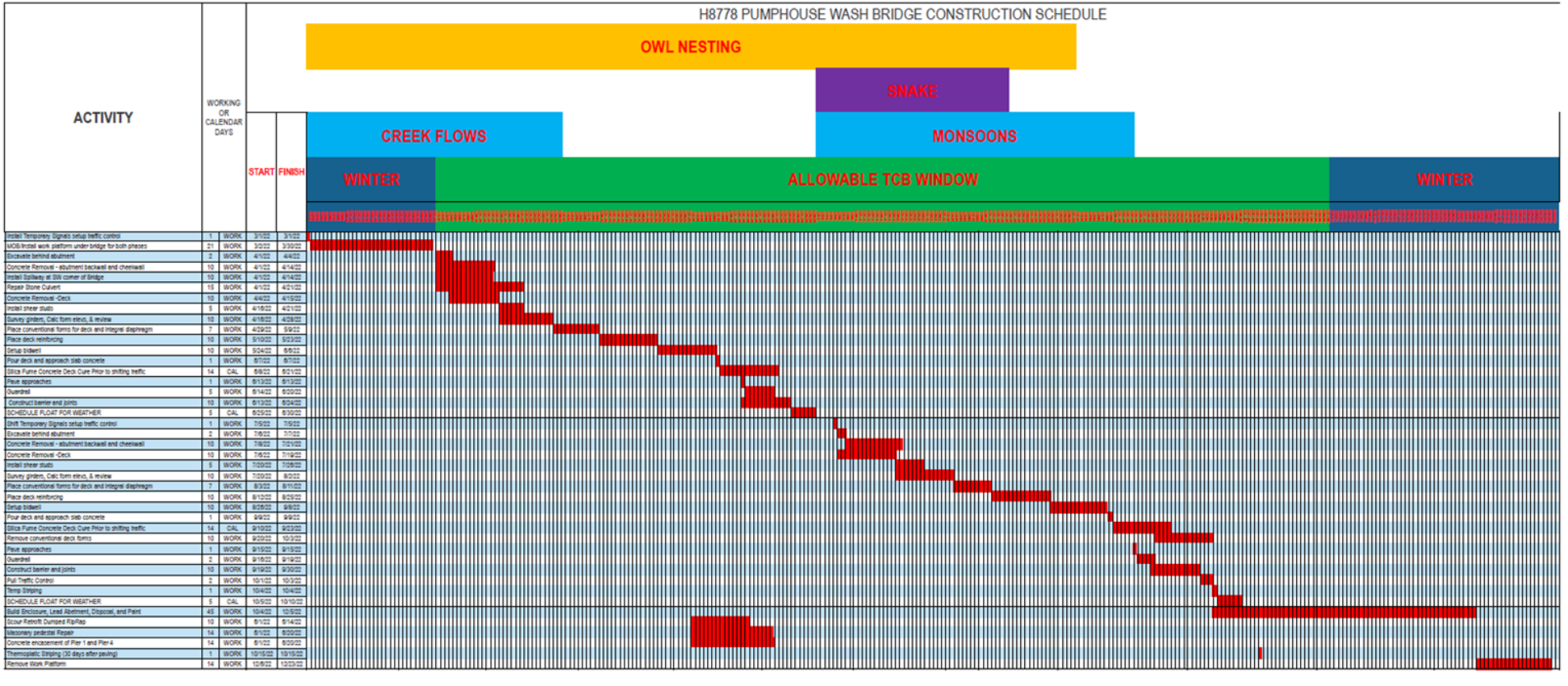
Field Visit to Pumphouse Wash Bridge project

- Project Field visit occurred Feb 2017
- Attendees included J2, HDR, FHWA, NAU biologists, City of Sedona, US Fish and Wildlife, US Forest Service, and all design disciplines.
- Discovered two substantial culverts that required extension as part of the roadway shift.
- Stone culvert was possibly 4(f)
- Proposed access road was highly discouraged due to impacts to snake habitat.

Environmental concerns

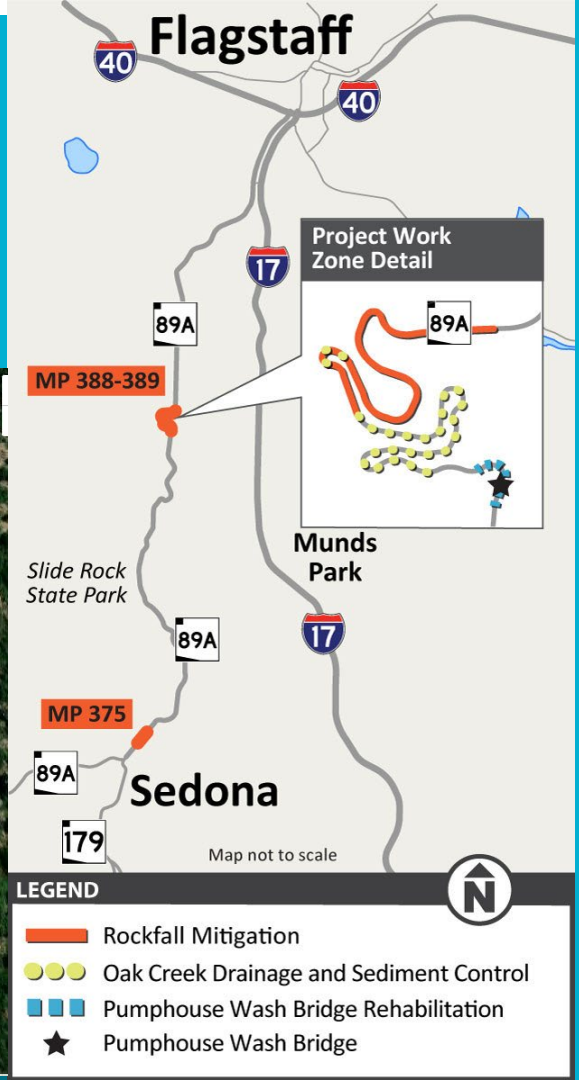
- Proposed Critical Habitat for **Narrow-headed Garter Snake**
- Designated Critical Habitat for **Mexican Spotted owl** nesting
- Proposed Critical habitat for **Yellow-billed Cuckoo**
- Lead Paint abatement
- 404 Permit using ADOT regional permit No. 96
- Biologic Evaluation (BE) was required
- Noise concerns for Owl required detailed construction schedule with a list of loudest equipment with decibel levels during nesting season
- Winter weather, seasonal flooding and narrow headed garter snake activity in the wash significantly limited construction activities in the wash.

Restrictions on construction activities



Bundling of projects had significant impact on public outreach and environmental

1. F0154 Rockfall Mitigation
2. H8907 Erosion Control
3. F0047 Pavement Rehabilitation
4. H8778 Pumphouse Wash Bridge



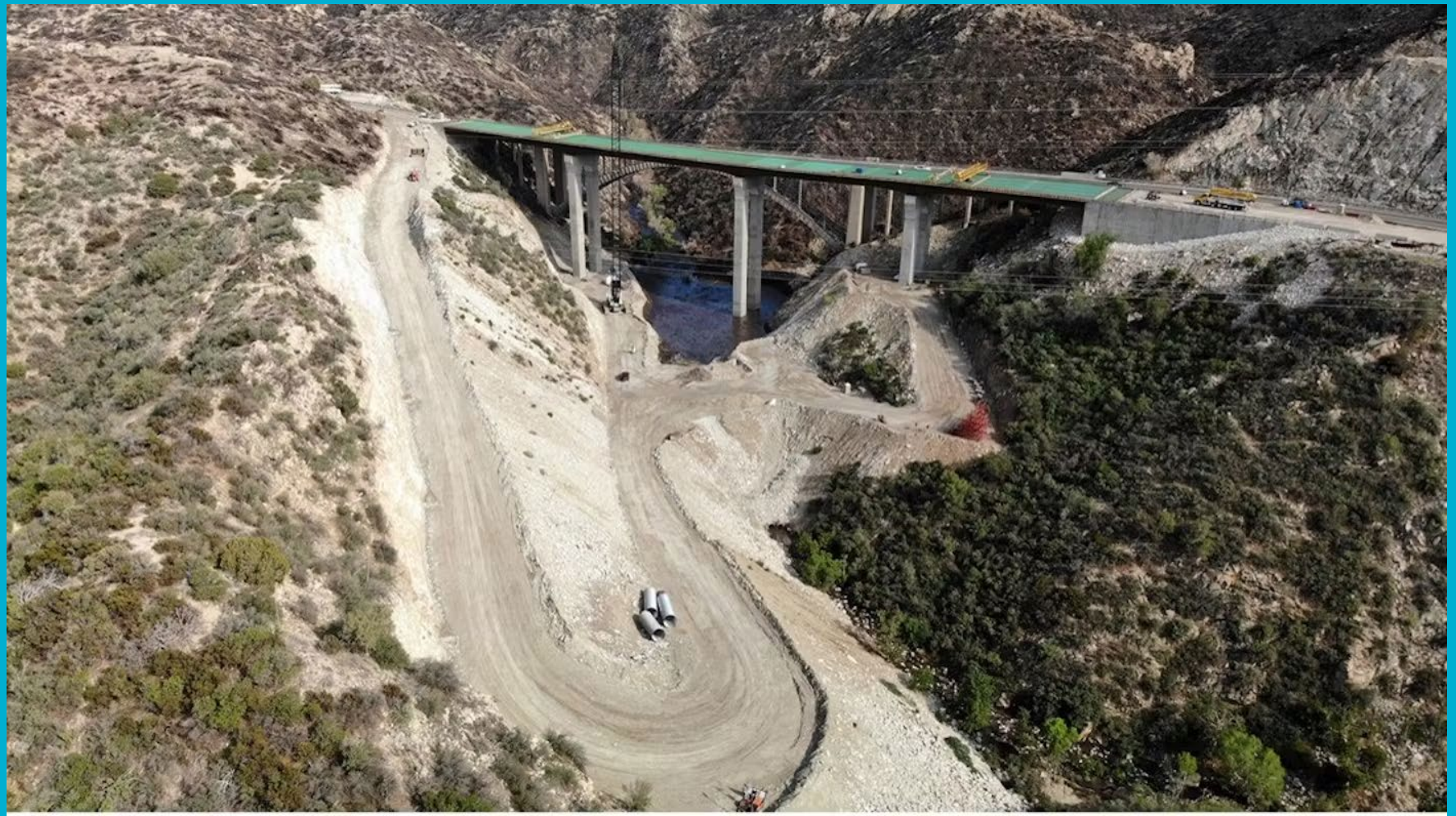
Rockfall Mitigation

Erosion Control

Significant construction access and equipment needed for bridge construction

Significant construction access and equipment needed for bridge construction

Pinto Creek Bridge construction access roads



Pinto Creek Bridge blowout of construction site. Pumphouse wash had a larger watershed and faster velocities

Pinto Creek Bridge blowout of construction site. Pumphouse wash had a larger watershed and faster velocities

Filling in the wash was not feasible due to potential for a snake being under every single rock.

Filling in the wash was not feasible due to potential for a snake being under every single rock.

Filling in the wash was not feasible due to potential for a snake being under every single rock.

Substantial flows were coming from every direction. This creates the need for a network of temporary pipes

Back to the drawing board

- Piers in wash required large drill rigs to core thru rock which required construction access, large tanks for slurry construction, spoils piles, drill rig construction pad with radius for swings, cranes for reinforcing cages, shaft casing, cofferdam for wash flows, and substantial shoring.
- No long term traffic closures could be agreed upon. Single lane closures with traffic signals were used throughout the duration of the project. Full closures were allowed for a short period.
- Emergency vehicles required access at all times. This required construction to stop anytime an EV needed to come thru the site.
- Narrow construction window would not allow conventional construction
- Traffic backups due to single lane closures impede concrete from getting to the site in time
- Construction access to the wash was limited at the bottom of deep canyon with steep slopes
- Environmental mitigation was a huge risk to any contractor bidding the job.
- Only available construction yard was miles from the site. Creating challenges with traffic backups.

Precast Concrete Arch Bridge

- Lightweight panels allows for small cranes
- Required full closure of 89A for at least 2 weeks
- No EV access
- Single span of wash while easily accommodating the tough geometry

	PRODUCT	SPAN RANGE	FEATURES & BENEFITS
PLATE			
	MULTI-PLATE® & Aluminum Structural Plate (MP & ALSP)	5′ to 26′	• Long history of strength, durability and economy • Variety of sizes and shapes available • Prefabrication of parts allows for fast & easy installation • Ideal structures for rehabilitation and relining
	Steel & Aluminum Box Culverts	8′-9″ to 45′	
	BridgeCor®, SUPER-SPAN™ & SUPER-PLATE®	18′ to 65′	
	Bridge Plank	2′ to 5′-10″ (net span between bridge stringers)	• Economical solution for bridge deck rehabilitation and new construction
PRECAST			
	CON/SPAN® Bridge Systems O-Series® & B-Series	12′ to 65′	• Fully engineered, modular systems • Precast arch units, head & wingwalls for fast installation • Clear span, three-sided structures provide natural bottom for environmental applications
	BEBO® Arch Systems	12′ to 102′	
	EXPRESS® Foundations	N/A	• Foundation blends the speed of precast with the economy of cast-in-place • Pick weights and sizes customized to your equipment

Single span steel tub girder bridge

- Significant secondary forces and deflections
- Multiple bolted splices required to transport girders to field
- Required full closure of 89A for at least 3 months
- No EV access
- Single span of wash
- Required proprietary bearings to handle torsion and uplift
- Shoring towers required to keep girders stable until everything is bolted together
- Not possible to achieve system redundancy so fracture critical designation would be given
- Akokli Creek Bridge spanned 167.45ft with a 328 ft radius

Single span segmental precast box girder bridge

- Significant secondary forces and deflections
- Multiple splices with large shoring towers
- Required full closure of 89A for at least 6 months
- No EV access
- Single span of wash
- Required proprietary bearings to handle torsion and uplift
- Shoring towers required to keep girders stable until fully post-tensioned

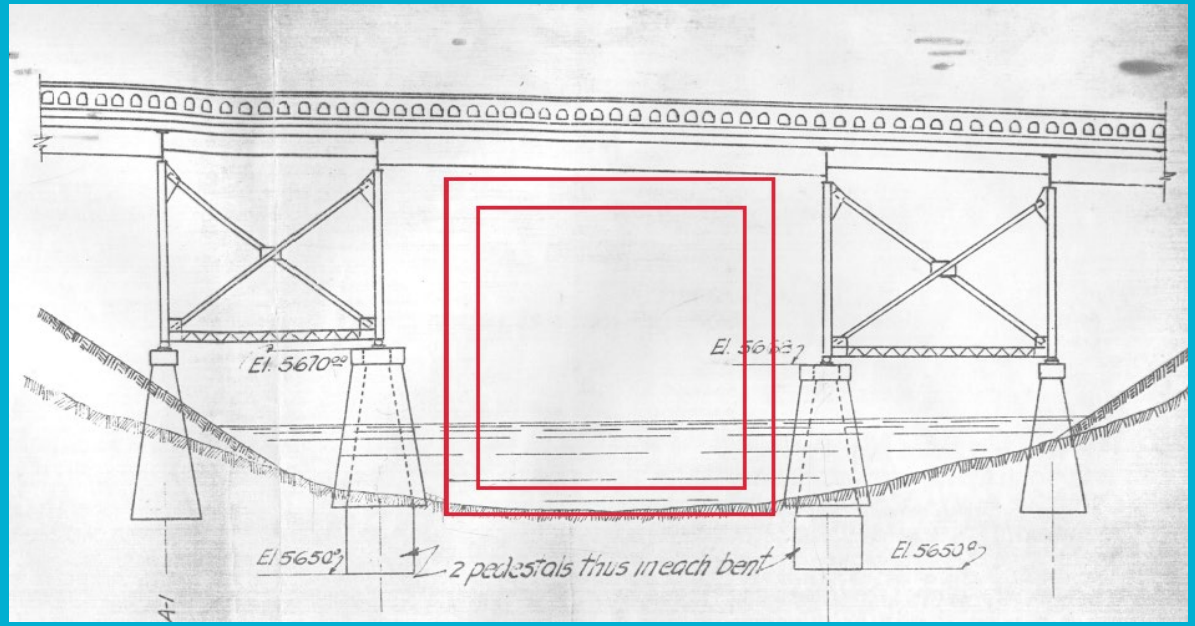
Cast-in-Place Reinforced Concrete Box Culvert

PROS

- Traffic maintained on bridge while box culvert is built below in single phase without equipment
- Uses lightweight aluminum formwork system that can be hand built without equipment.
- Box culvert is a pipe which has more efficient hydraulic performance

CONS

- Significant footprint due large inlet and outlet aprons could create a significant permanent impact to wildlife
- Risk of blowout and stripping of concrete due to high velocities and sediment
- Requires multiple day closure to demo existing bridge, backfill and pave over
- Substantial excavation that could chase up unstable slopes



Rehabilitate Existing Bridge

PROS

- Existing bridge was not that bad
- Substantially reduced Environmental impacts
- Substantially reduced construction risks
- Reduced construction time and scope provided best chance of biddable project
- No need for FHWA Historic American Engineering Record (HAER) documentation

CONS

- Tight geometry restricted truck length to 30 ft based on Auto Turn Analysis
- Potentially reduced lifespan
- Continued need for Fracture Critical in depth inspection
- Lead paint substantially increased cost
- Risk of unknown knowns and unknown unknowns

Need to make a decision

- Extensive discussions with all of bridge management, Environmental, Consultant team, district, and stakeholders
- Multiple field visits with project team
- Extensive alternative analysis
- Decision was made to Rehabilitate the existing bridge

Autoturn analysis showed 40ft trucks could sneak thru the phased condition with TCB

- 24/7 flaggers were posted at locations with turnarounds
- Signed for 30 ft max vehicle length