US-89 Progressive Design-Build

September 7, 2023

US-89
FARMINGTON TO I-84

Project Team

Utah Department of Transportation

Oak Hills Constructors (Granite Construction & Ralph L. Wadsworth Construction Joint Venture)

Horrocks – Lead Designer

Michael Baker International Designer

Terracon – Geotechnical Design

Gerhart Cole – Geotechnical Design

WSP & Kimley-Horn – Program Manager

ARA – Pavement Design

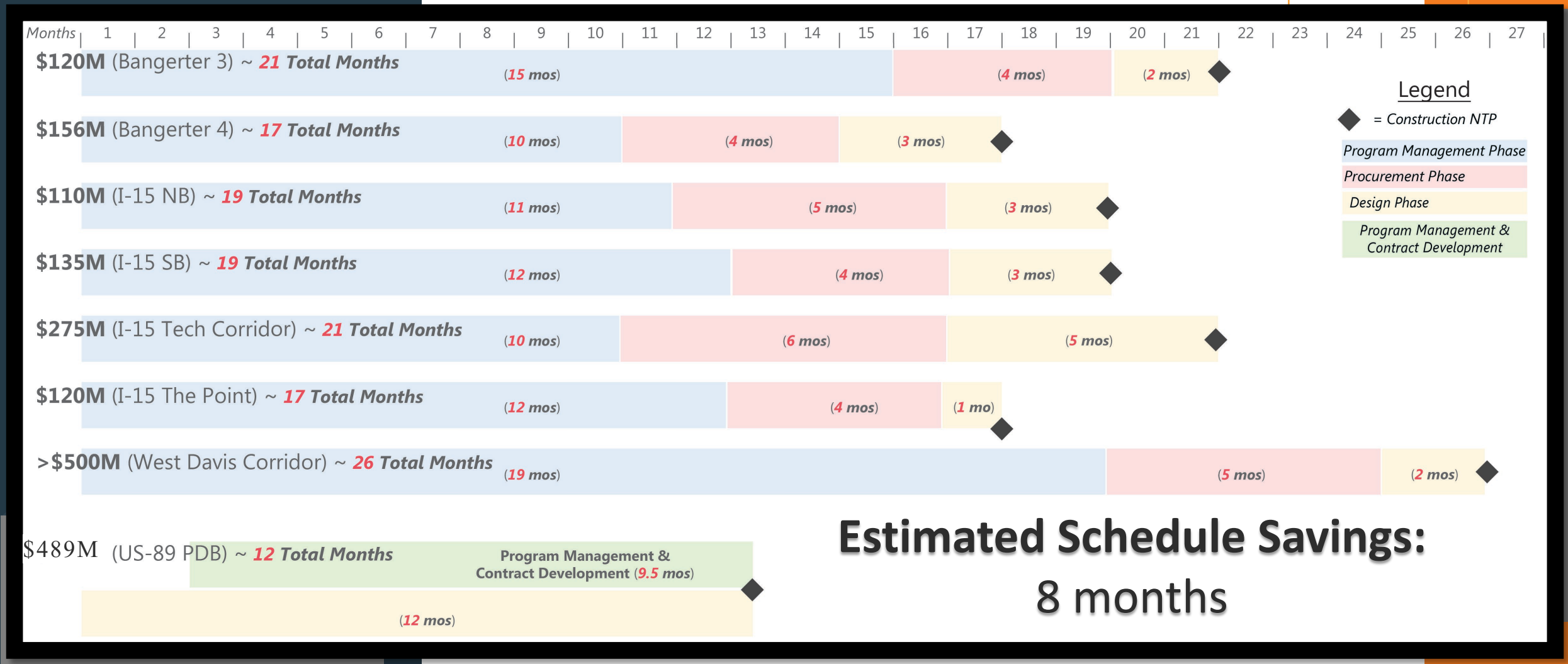
UDOT Progressive Design-Build

- First UDOT PDB project
- UDOT has used PDB three additional times
- Considering additional projects for PDB
- Single Step Selection similar to CMGC
- Multiple Cost Estimates
- Independent Cost Estimate
- Multiple Phases
  - Phase 1 – Preconstruction
  - Phase 2 – Design-Build

Why PDB?

- Reduces overall project delivery schedule
- Reduces risk for the owner and design-builder
- Improves collaboration between the owner and design-builder.
- Provides more flexibility in meeting the project goals.
- Owner-controlled, contractor-involved scoping

DB vs PDB



Estimated Schedule Savings:
8 months

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PDB VALUE ADDED

- Innovation and creativity due to loosely defined scope
- Release of early packages
- Risk reduction through focused geotechnical investigations
- Feasible MOT plan that reduced local road and highway traffic impacts
- Construction Quality Management Plan approved prior to DB Contract
- Utilization of existing materials

PDB VALUE ADDED

- Unconstrained dialogue to explore innovative concepts
- Public Trust
- No Surprises
  - Contractually
  - Publicly
- Contractor/Designer are involved in contract creation
- Developing PDB Delivery for UDOT

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UDOT Project Goals

Preconstruction Goals

- Develop a sound, context-sensitive design that maximizes project benefits within the available budget.
- Develop a strategic project delivery approach.
- Optimize the use of the Progressive Design-Build process

Construction Goals

- Minimize stakeholder impacts.
- Create an accurate construction schedule and meet or exceed all schedule commitments.
- Provide a quality finished product.

Project Team Core Values and Strategic Initiatives

CORE VALUES

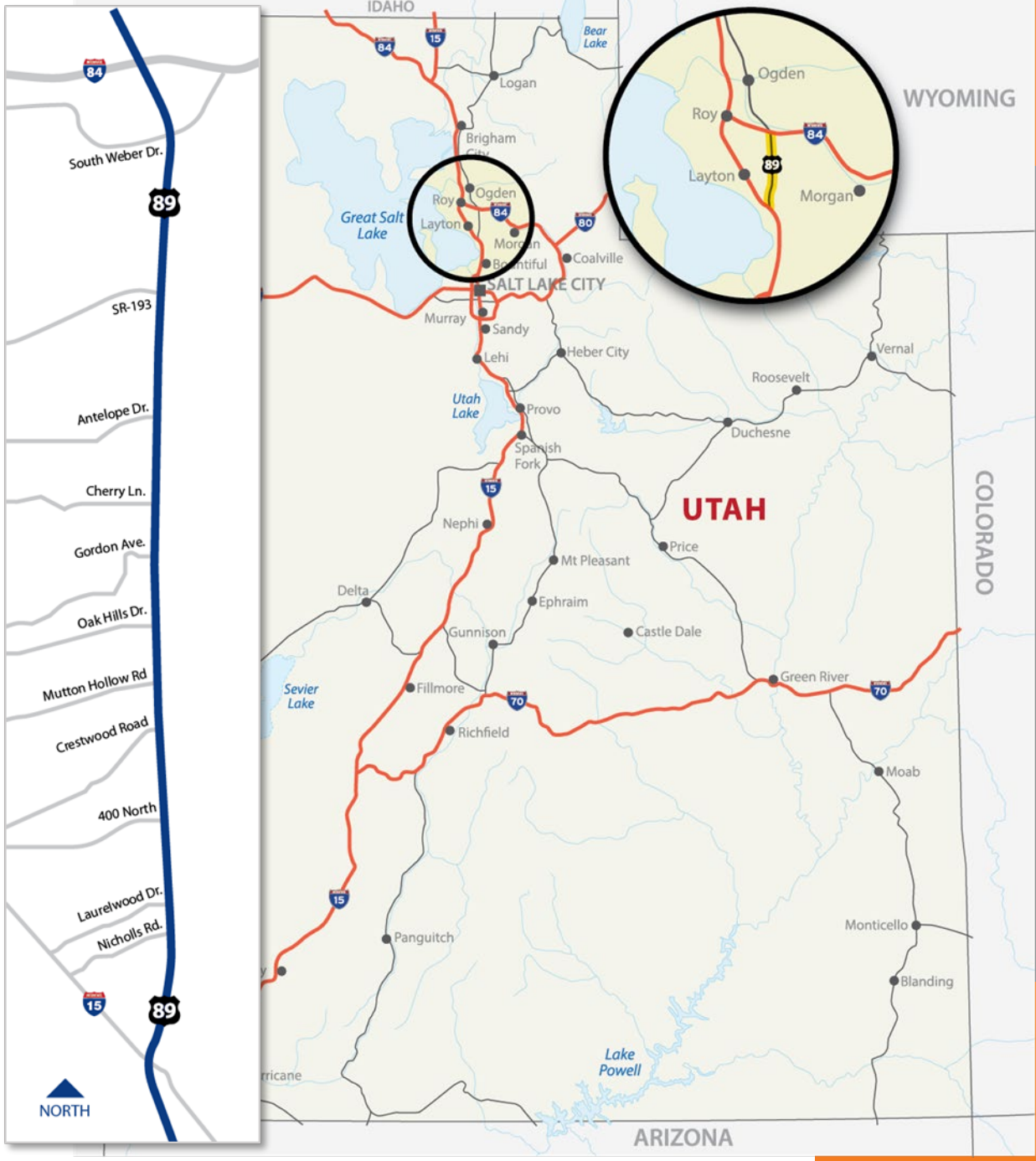
- Trust
- Safety
- Integrity
- Fiscal Responsibility
- Passion
- Public Responsiveness
- Dedication

STRATEGIC INITIATIVES

- Design & Build the correct project at the right time and for the best value
- Foster community acceptance and minimize Stakeholder Impacts
- Develop a strategic project delivery approach that optimizes the value of Progressive Design Build to the Project and the Industry
- Create an accurate construction schedule and meet or exceed all schedule commitments
- Develop and provide education, knowledge sharing and mentoring opportunities for both UDOT and OHC

Project Scope

- 9.7 Miles
- 4 New Interchanges
- 2 New Grade Separated Crossings
- 3 Pedestrian Undercrossing
- 1 Superstructure Replacement
- 1 Utility Bridge
- New Surface Street Connections to the Interchanges
- Additional Lane of Travel in each Direction



Project Benefits

- Increased Safety
- Additional Lanes
- Reduced Congestion
- Minimize Cost & Schedule

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STRUCTURES ON THE PROJECT

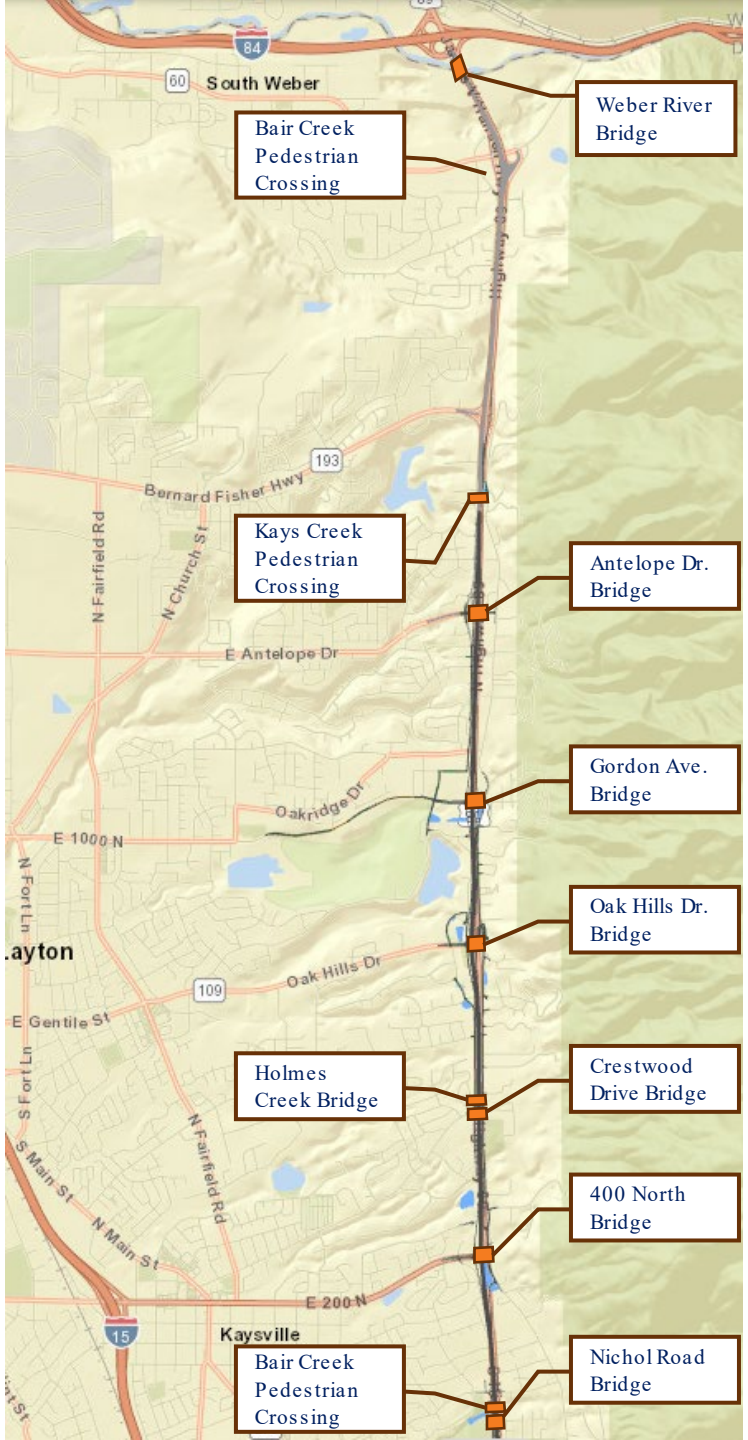
Bridges & Box Culverts (see figure)

Walls

- 4 Cast-in-Place Retaining Walls
- 10 MSE Retaining Walls
- 5 Ground Anchor Retaining Walls
- 11 Soil Nail Retaining Walls
- 4 Precast Concrete Post & Panel Retaining/Noise Walls
- 1 Gabion Basket Retaining Wall

Sign Structures

- 8 Full Span
- 5 Butterfly
- 7 Cantilever
- 2 VMS



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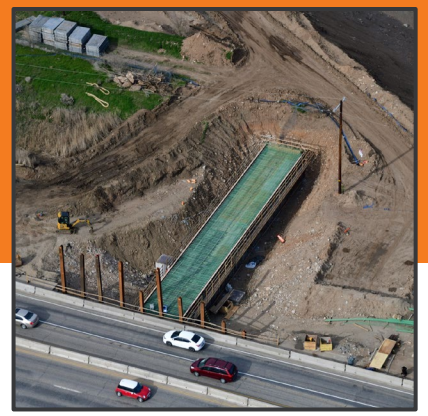
STRUCTURE TYPES USED ON THE PROJECT

Welded Plate Steel Girders

- US-89 over Weber River Superstructure Replacement
- Holmes Creek Utility Bridge

Precast/Prestressed Bulb Tee Girders

- UBT34 (UDOT Shape)
- Six Bridges over US-89



Box Culverts

- Three Pedestrian Crossings under US-89

Retaining Walls

- Single Stage MSE Walls
- Soil Nail Walls
- Ground Anchor Walls
- CIP Concrete Walls
- Precast Concrete Post and Panel Retaining/Noise Walls
- Gabion Basket Wall

Sign Structures

- 8 Full Span
- 5 Butterfly
- 7 Cantilever
- 2 VMS

CHALLENGES AND CONTRAINTS AT BRIDGE LOCATIONS

16” Holly Energy Petroleum Pipeline

- Uncertainty of Location when Deep
- High Cost to Relocate

Developing Project Scope

- Project Budget (Cadillac Escalade vs Ford Focus)

Varying Soil Conditions

- Granular
- Soft Clays
- Rock and Boulders

Seismic Criteria

- Proximity of the Wasatch Fault

Aesthetics

- UPRR Requirements
- No Falsework or Shoring at UPRR

Maintenance of Traffic

- Replacing At-Grade Intersection with Grade-Separated Interchanges

Multiple Roadway Design Alternatives Reconsidered

- Over/Under Analysis and Cost Estimating
- Cost Difference
- Public Opinion

New PDB Process

- What is needed for Type Selection Reports?
- Contract Development of Performance Specifications
- Approval of Innovative Solution not Consistent with Typical Details

Preliminary Design Process

udot.utah.gov

PROGRESSIVE DESIGN-BUILD STRUCTURE TYPE SELECTION REPORT

Structure No.: F-907
Location: Gordon Avenue over US-89; Layton UT
Project Name: US-89; Farmington to I-84
Project Number: S-0089(406)398
Project Pin: 13821

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OAK HILLS CONSTRUCTORS

- Traditional Method Type Selection Report using UDOT Template

  vs

  Design-Build Structure Selection

- Approval of the Type Selection Report

- Design Changes

Cost Estimating

Design-Builder completed four estimates.

1. Preliminary Opinion of Probable Construction Cost (OPCC)
   - Based on the Environmental Design
   - Provide the project team with an initial baseline cost
   - Square Foot Bridge & Wall Cost
2. Construction Proposal and Pricing (CPP1)
   - 30% Design
   - Based on Preliminary S&Ls and estimated bridge quantities
3. CPP2
   - 60% Design
   - Based on approved S&Ls and estimated bridge quantities
4. CPP2.1
   - Updated CPP2 to incorporate additional changes

Contact Documents

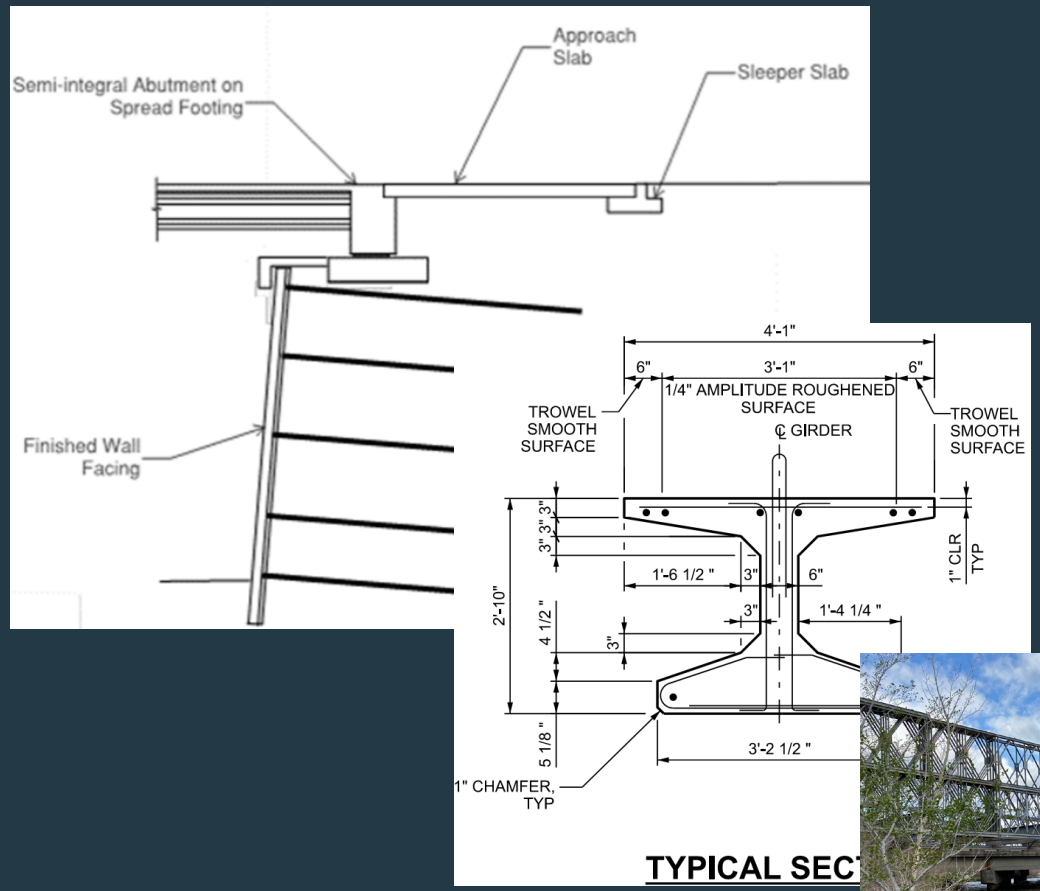
Design-Build Request for Proposal (RFP) was revised to be Basis of Design and Construction (BDC)

- Contract
- Performance Specifications
  - Based on proposed scope and 30% to 60% design
- Contract Drawings
  - Included approved S&Ls
- Special Provisions

Alternate Technical Concept (ATC) became a Progressive Concept Evaluation (PCE)

- Team Design and Construction Innovations

Innovations



Ground Anchor Walls Supporting Spread Footings

- Non-typical Utah design/detailing
- Not allowed without Structures Division approval
- Structures Division did not want to set a precedent and required a design deviation
- Saved $3.7M by not relocating petroleum line

UBT34 Girder

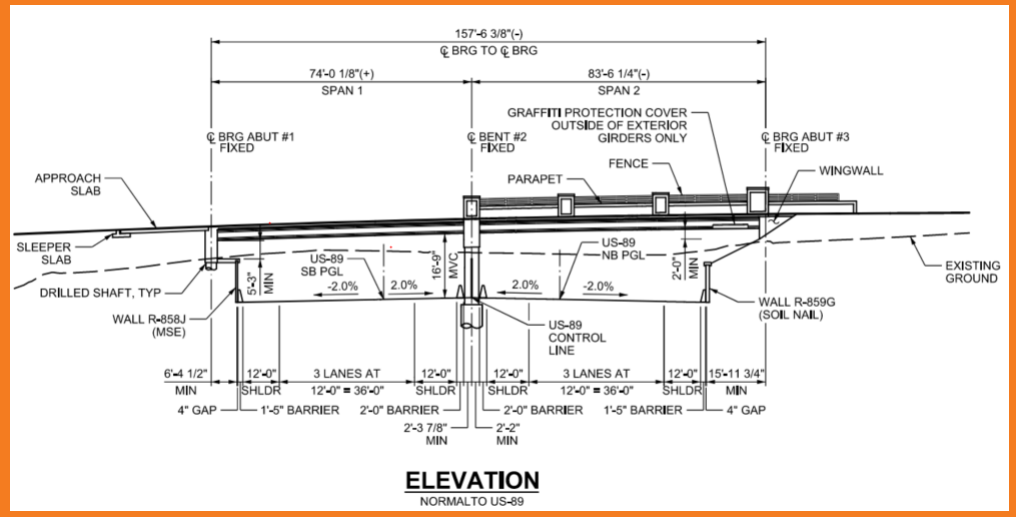
- Developed Standard Drawings for UDOT
- Reduced girder procurement time
- Reduce structure depth for short spans

Temporary Bridge

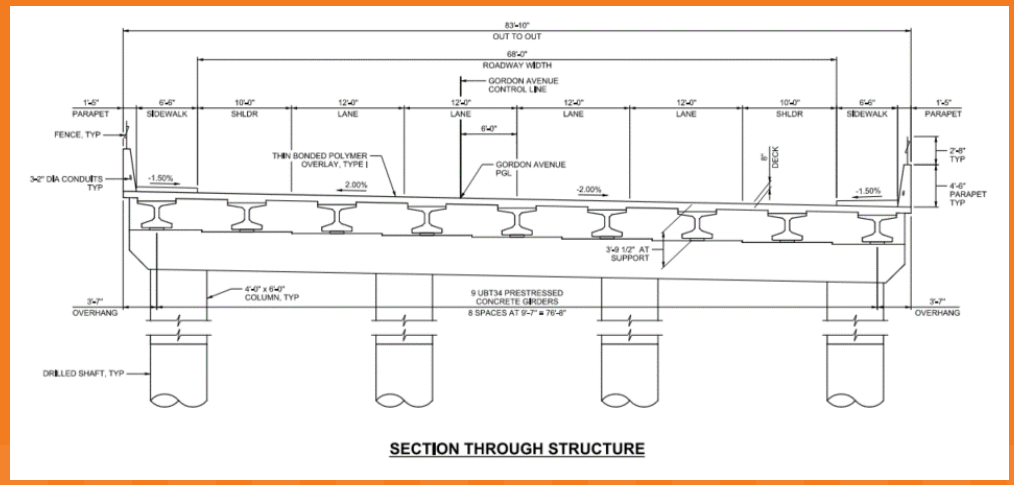
- Better ride than existing bridges
- Cost savings due to previous use on another project
- Allowed for two lanes in each direction during construction

Gordon Avenue Bridge

- Layout
  - Two-Span Prestressed Concrete Girders
  - UBT34 Girders
- Constraints
  - Avoid impacts to petroleum pipeline
  - Construct foundation in dense soil with large boulders
  - Minimize the structure depth
- Type Selection
  - Single Span (Steel and Prestressed Girders Evaluated)
  - Two-Span (Steel and Prestressed Girders Evaluated)
- Foundation
  - Abutments - 3'-0" diameter drilled shaft
  - Bents – 6'-0" diameter drilled shaft

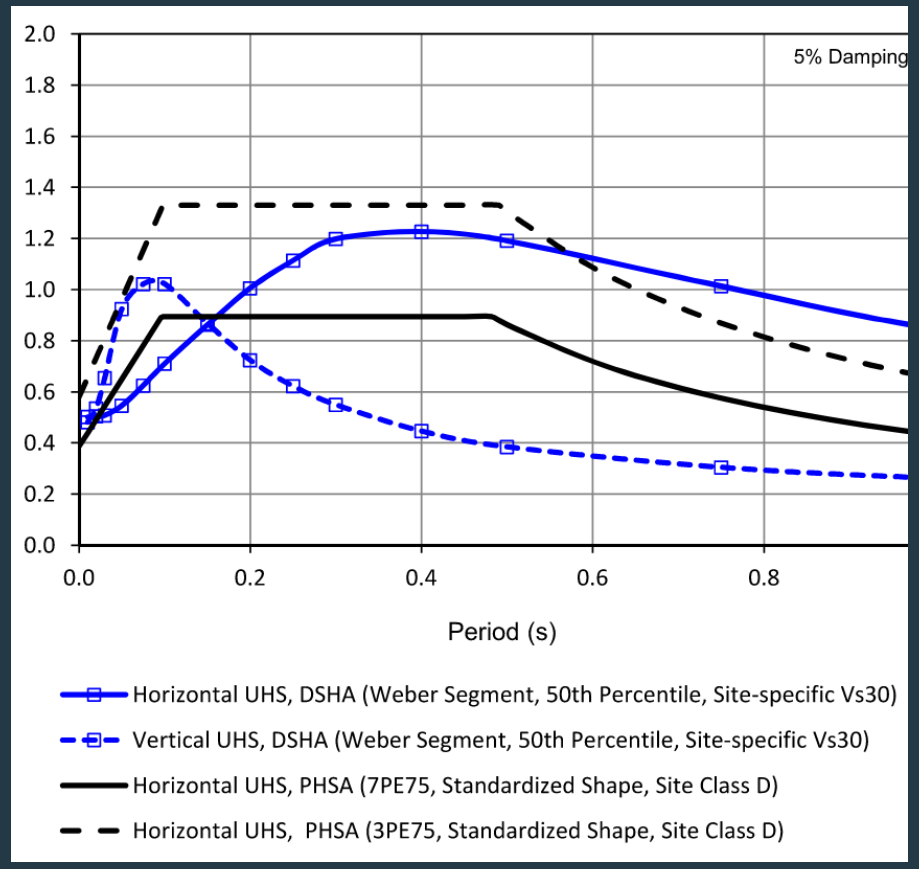


ELEVATION
NORMAL TO US-89



SECTION THROUGH STRUCTURE

Opportunities for Solutions



Seismic Site-Specific Considerations

- Distance from Wasatch Fault
- Near Fault Fling

Opportunities for Solutions

Seismic Analysis and Design

- Response Spectrum Analysis including Vertical Response Spectrum
- Additional vertical check using the Caltrans method
- Designed and Detailed using the AASHTO Guidelines for LRFD Seismic Bridge Design

ADVANTAGES OF PDB

- Open Communication
  - Lay all you cards on the table
- Developing the Performance Specifications as a Team
- Vet and Discuss Contractor Preferences before Construction
- Additional Field Investigation
- Ideal for Complex Jobs
- Better Understanding of Construction Schedule
- Contractor and ICE do the Estimating

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UDOT Keeping Utah Moving

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