# Feasibility Study for

# ARLINGTON AVENUE BRIDGES REPLACEMENT

ARLINGTON AVENUE BRIDGES PROJECT

Technical Advisory Committee Meeting #2 |
Bridge and Roadway Elements | August 31, 2020

# Meeting Purpose

ARLINGTON AVENUE BRIDGES PROJECT

- Discuss bridge and roadway elements for the project
- Explain evaluation attributes
- Review alternative-specific
  - Qualitative attributes and concept evaluation
  - Concept scoring results
- Recommend Alternatives to carry forward

# Meeting Agenda

- Technical Advisory Committee Members
- Project Scope and Process
- Project Purpose & Need, Schedule and Background
- TAC-1 Permitting/Regulatory Meeting Recap
- Review Qualitative Attributes and Concept Evaluation
- TAC Scoring and Results
- Discussion Summary, Concurrence & Agreements

# Technical Advisory Committee Members

ARLINGTON AVENUE BRIDGES PROJECT

- Nevada Department of Transportation (NDOT) – Bridge Division
- Federal Highway Administration (FHWA) – Nevada Division
- Regional Transportation Commission (RTC)
  - Engineering
  - Planning
- City of Reno (CoR) Departments
  - Public Works Capital Projects
  - Public Works Maintenance
  - Parks, Recreation & Community Services
  - Public Works Traffic
  - Stormwater
  - Fire Department

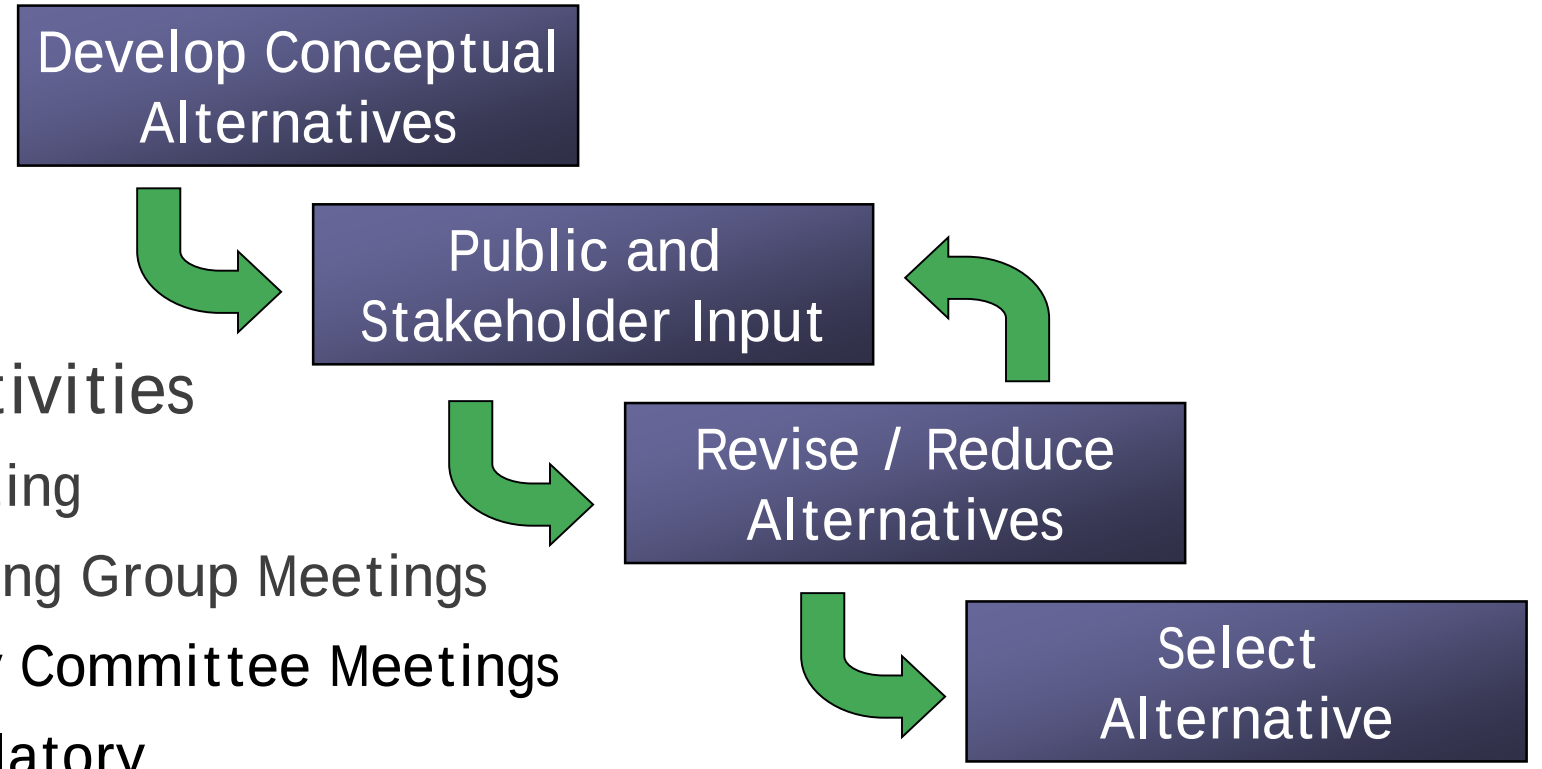
# Project Scope

ARLINGTON AVENUE BRIDGES PROJECT

- Complete a feasibility study to define scope of future phases
- Future Phases
  - National Environmental Policy Act (NEPA) and Design (2021-2025)
  - Construction (2026)
- Goal - Reduce the range of possible bridge type and aesthetic themes through engineering analysis and by conducting public outreach
- Outcome – have a bridge type and aesthetic package identified to carry forward into NEPA clearance and design
  - Document decisions using Planning and Environmental Linkages (PEL) process & NDOT PEL Checklist

# Project Process

- Modeled after Virginia Street Bridge process




- Public Outreach Activities
  - Public Kick-off Meeting
  - 3 Stakeholder Working Group Meetings
  - 2 Technical Advisory Committee Meetings
    - Permitting/Regulatory
    - Bridge/Roadway Elements
  - 1 Additional Public Meeting

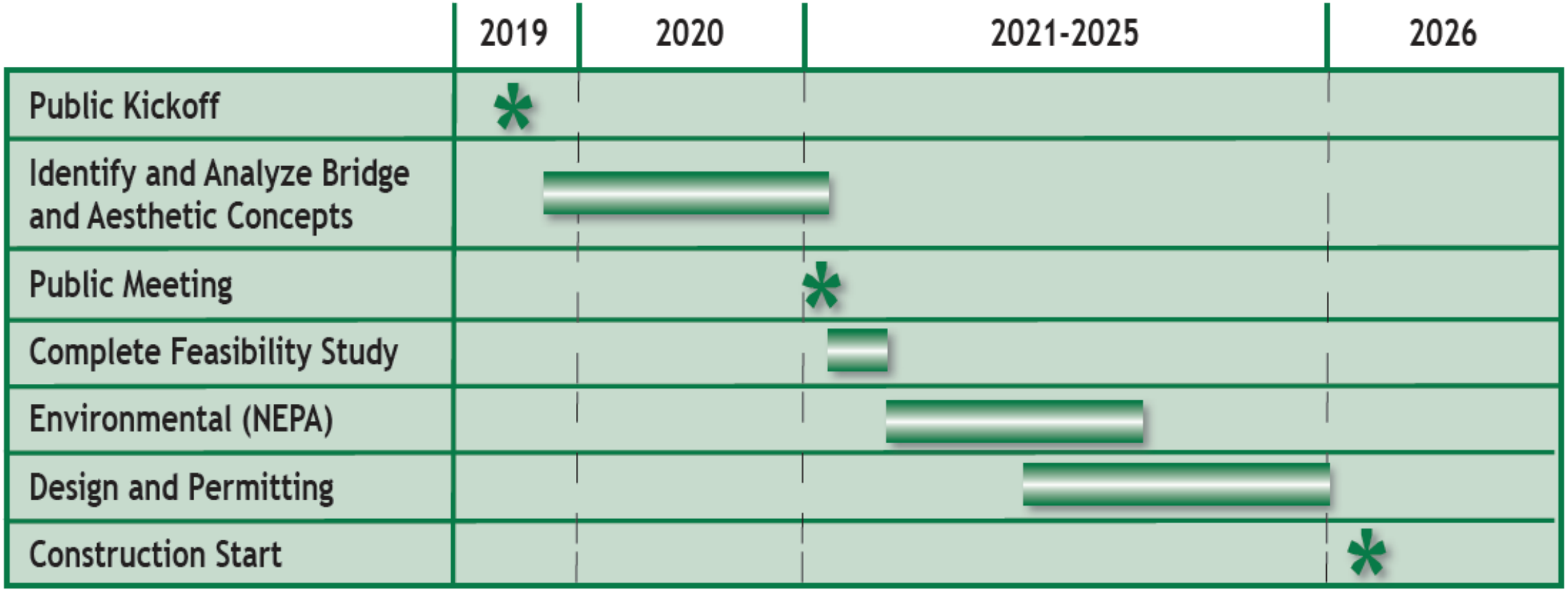
# Project Purpose and Need

ARLINGTON AVENUE BRIDGES PROJECT

- Address Structurally Deficient Arlington Avenue Bridges
- Provide Safe and ADA compliant Multimodal improvements
- Address hydraulic capacity needs
- Respond to regional and community plans

# Project Schedule

ARLINGTON AVENUE BRIDGES PROJECT



# TAC-1 Meeting Recap

ARLINGTON AVENUE BRIDGES PROJECT

- FHWA will be lead agency and STBG (federal) funds have been allocated for the next phase of the Project
- Permitting includes Federal (404, 408) and State (NDSL encroachment: NDEP 401, construction stormwater, working in waterways, groundwater discharge)
- River access for channel debris and sediment removal equipment will be required by CTWCD
- Conclusion – Elevated Bridge and Tied Arch concepts will be more challenging

***Arlington Avenue Bridges over the Truckee River***
***Level 1 Screening - Concept Bridge Alternatives, Qualitative Attribute Guidelines***

***Construction Cost***

- In relative terms, how does construction cost compare to the cost of other Alternates. Greater complexity in design and/or construction and greater bridge deck area will typically lead to increased cost.
- Are construction techniques expected to be common and familiar to a large pool of contractors and lead to more competitive bidding?

***Construction Schedule and Cost Risks***

- Does the Alternate increase the potential for unforeseen issues to arise during construction affecting schedule and/or cost?
- Will materials and/or fabrication require long lead times for delivery and installation and impact schedule?
- Could unexpected delays lead to construction activities being adversely impacted during periods of high flood flow?

***Existing Infrastructure Impacts***

- Can the Alternate be accommodated on the Arlington Avenue alignment with minimal change in roadway profile?
- Is a deep superstructure (deck and supporting components) required which could lead to a rise in roadway profile which could then affect adjacent properties?
- Will impacts to the potentially historic floodwalls be greater for an Alternate compared to others?
- Does the Alternate readily provide means for carrying utilities across the river (power, water, communications, etc.)

***Maintenance and Inspection Access***

- Will the Alternate inhibit access or require unique equipment to inspect and maintain the structure or utilities it may carry?
- Will the Alternate inhibit access for flood debris removal in an emergency situation?
- Will the Alternate permit equipment access for sediment removal and routine channel maintenance activities? The preferred Alternate will need to retain or improve existing channel access (currently from Barbara Bennet Park).

***Long Term Maintenance Costs***

- Will the Alternate require more or less frequent maintenance to ensure its long-term performance (protective painting, for example)

***Environmental Impacts***

Will construction of the Alternate have greater direct or indirect impacts on the river when compared to others?

***River Recreation Impacts***

- Will the Alternate contribute to or detract from the river recreation experience?
- Will the Alternate inhibit river recreation access?
- Will the Alternate adversely affect access to Wingfield Park?

***Bridge Aesthetics***

- How well does the Alternate represent your vision for the "look" of the structure?
- Does the Alternate compliment its surroundings, or does it detract from the visual experience in the river and/or downtown corridor?
- Should a signature structure be considered? Or is a more traditional structure with aesthetic enhancements (color and texture) more appropriate?

***Attributes Y and Z***

- Placeholders to allow the reviewer to add an attribute if the reviewer feels strongly the current attribute list does not capture an impact or concern. If an additional attribute is identified, note it on the scoring card. Proposed additions will be discussed with the group during the TAC meeting, and added/scored as may be appropriate based on the group discussion.

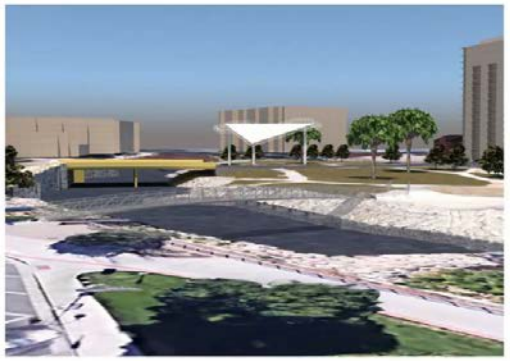
***Existing Conditions***

***North Bridge, View Looking East***

***South Bridge, View Looking East***

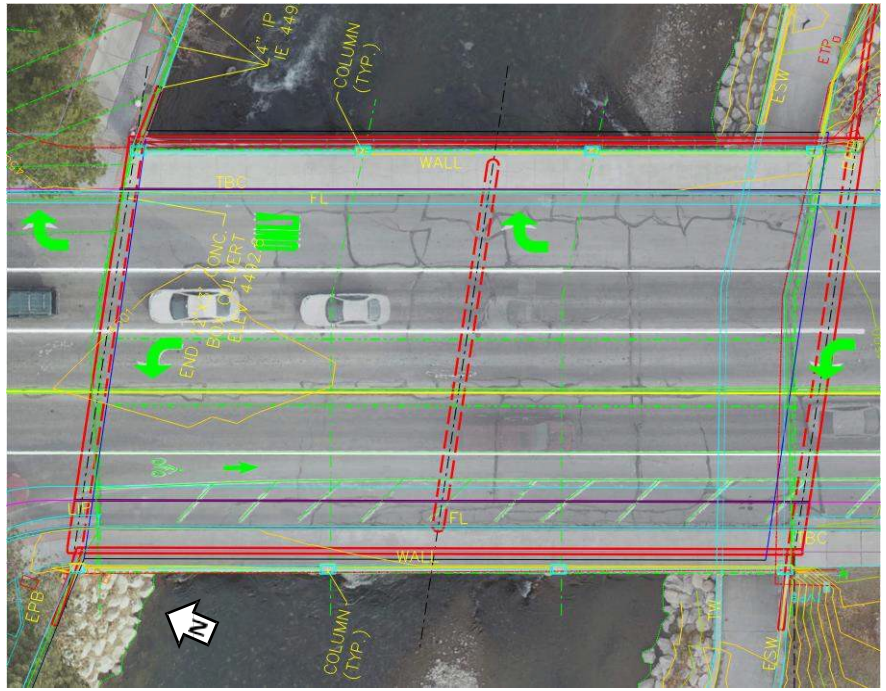
## SINGLE PIER CONCEPT

(*view looking east*)

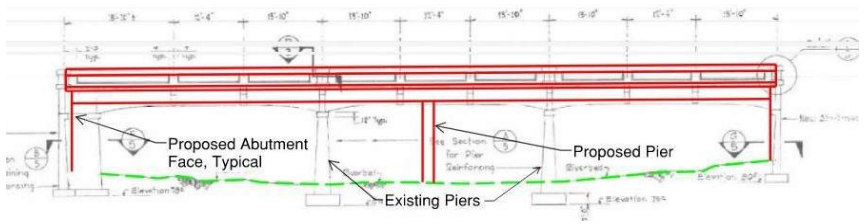


**Some things to consider when evaluating the Single Pier Concept:**

1) In-river center pier shortens span lengths and allows for thinner deck section.
2) Thin overall deck section with uniform depth optimizes ability to accommodate flood flows without raising roadway profile.
3) Relatively short spans can be accommodated using precast concrete beams, steel I-girders, or cast-in-place concrete construction.
4) An "open soffit" system (discrete steel I-girders or precast concrete beams) may increase the potential to snag flood debris under the bridge.
5) A cast-in-place concrete box girder with a "closed soffit" may eliminate the potential to snag flood debris under the bridge but requires temporary shoring/falsework in the river to support construction.
6) A single in-river pier versus two existing in-river piers reduces the potential for river debris to snag and collect on the structure.
7) A single in-river pier may reduces the number of obstructions for river activities.
8) River diversions required for abutment and pier removal and construction.
9) All three bridge types (precast, CIP and steel) involve common construction methods familiar to many contractors, increasing competition during bidding which could lead to lower costs.



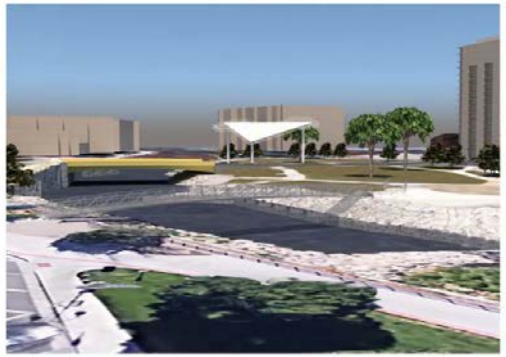

**PLAN**




**ELEVATION**

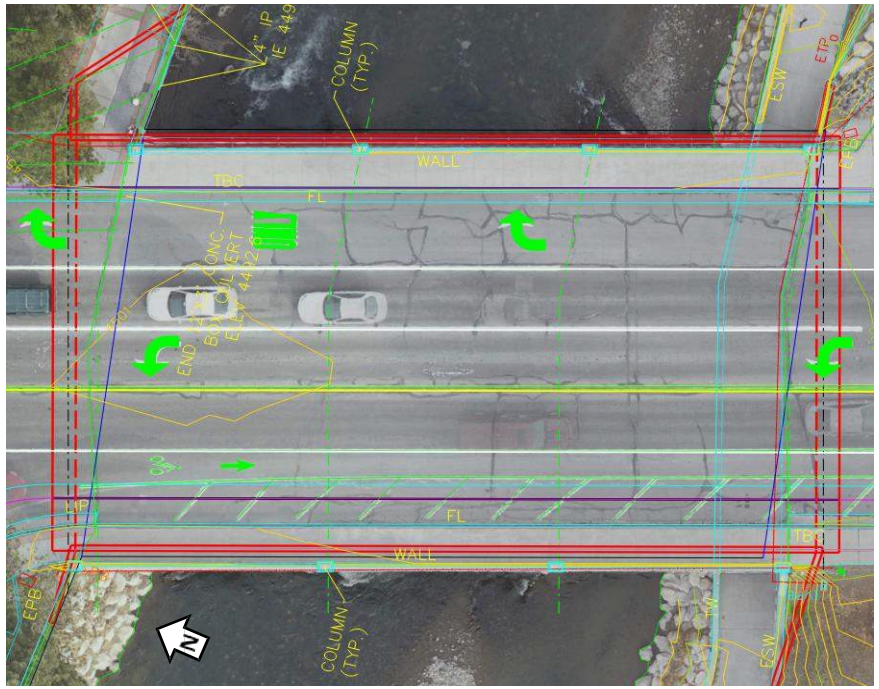
## CLEAR SPAN CONCEPT

(*view looking east*)

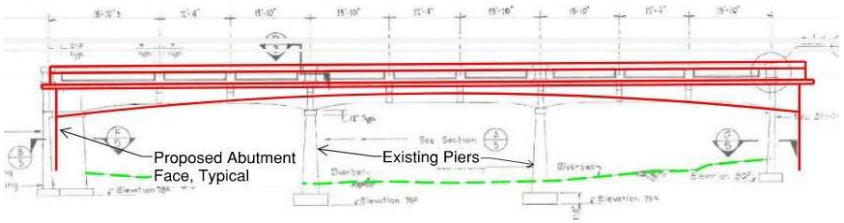


**Some things to consider when evaluating the Clear Span Concept (Rigid Frame):**

1) Thickened deck section near abutments allows for thickness at mid-span span to be comparable to the uniform depth of the Single Pier Concept.
2) Thickened deck section near abutments may impact the ability to provide freeboard above flood flows over the full length of the structure.
3) Potential for flood debris to collect is reduced with no in-river pier but may not be eliminated with the thickened deck at the abutments.
4) Structure type does not easily accommodate precast elements; temporary shoring/falsework will be required in the river to support construction.
5) A "closed soffit" may eliminate the potential to snag flood debris under the bridge.
6) No in-river center pier to obstruct recreation activities.
7) River diversions required for abutment and pier removal and for abutment construction.
8) Common construction methods familiar to many contractors, but perceived risk with the need to erect temporary falsework in the river may lead to higher bid prices.



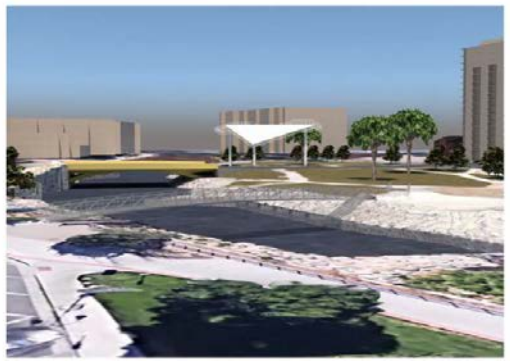

**PLAN**




**ELEVATION**

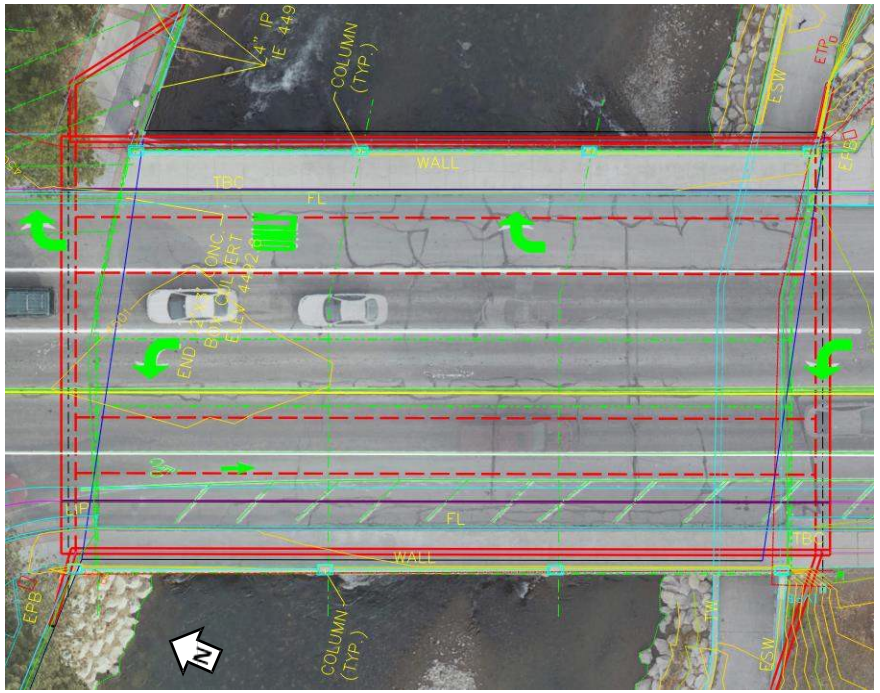
## UNDERDECK ARCH CONCEPT

(*view looking east*)

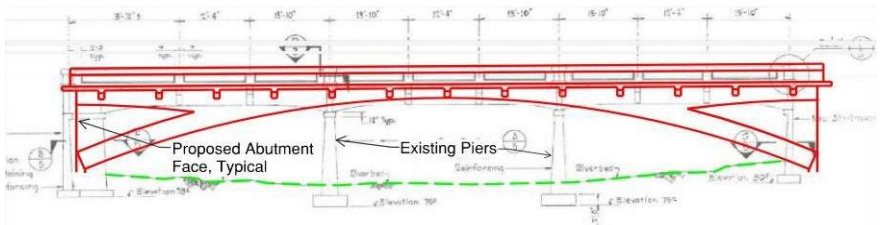


**Some things to consider when evaluating the Underdeck Arch Concept:**

1) Could be considered "more interesting" aesthetically when viewed from the river or park areas.
2) Low arch elements, especially near the abutments, will have a greater tendency to collect flood debris.
3) Low arch elements near abutments may make it difficult to provide freeboard above flood flows over the full length of the structure and may be prone to collecting debris.
4) No in-river center pier to obstruct recreation activities, but low arch elements at abutment may make it difficult to accommodate the existing path beneath the structure. The structure may also adversely impact existing access points.
5) River diversions required for abutment and pier removal and for abutment construction.
6) Complexities in design and construction will drive costs higher than for more common structure types.
7) Complexities in construction may increase cost and schedule risks.
8) Atypical construction methods may limit the pool of contractors with appropriate expertise and drive up bid prices.



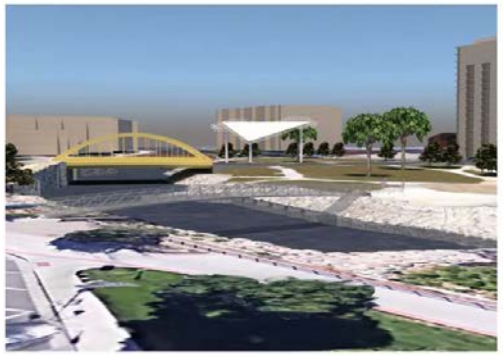

**PLAN**




**ELEVATION**

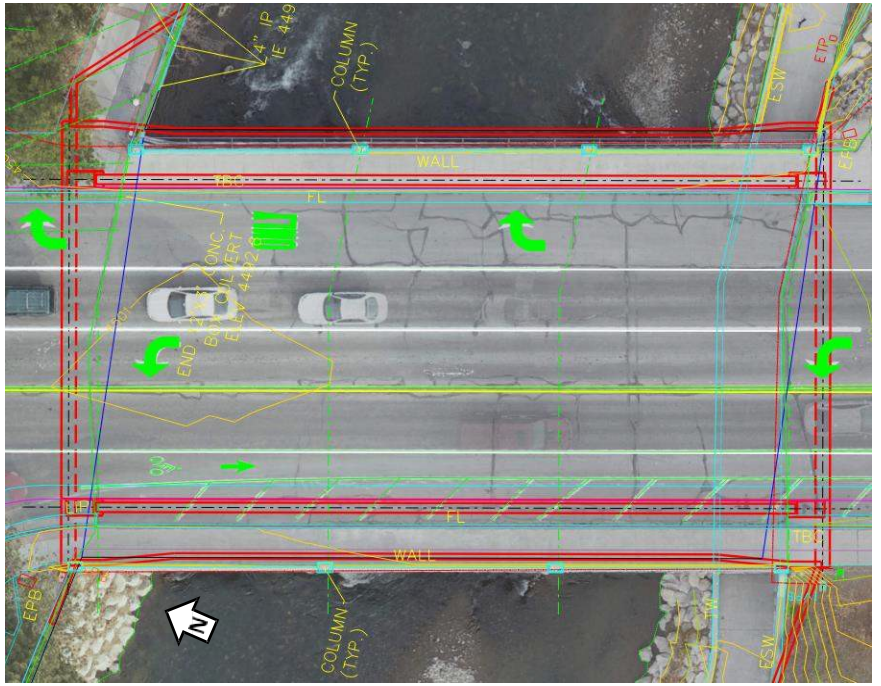
## TIED ARCH CONCEPT

*(view looking east)*



**Some things to consider when evaluating the Tied Arch Concept:**

1) Could be considered "more interesting" aesthetically when viewed at street level from nearby and distant vantage points.
2) Deck supported from above, relatively thin deck section optimizes ability to accommodate flood flows without raising roadway profile.
3) No in-river center pier to obstruct recreation activities.
4) Above-deck arch supports will inhibit equipment access for bridge maintenance and inspection.
5) River diversions required for abutment and pier removal and for abutment construction.
6) Complexities in design and construction will drive costs higher than for more common structure types.
7) Complexities in construction likely to increase cost and schedule risks.
8) Specialty construction methods may limit the pool of contractors with appropriate expertise and drive up bid prices.

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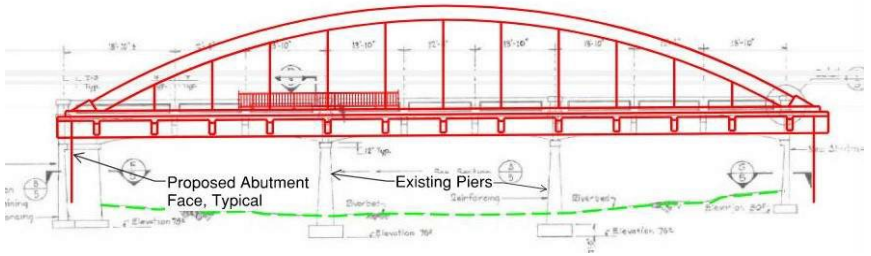



**ELEVATION**

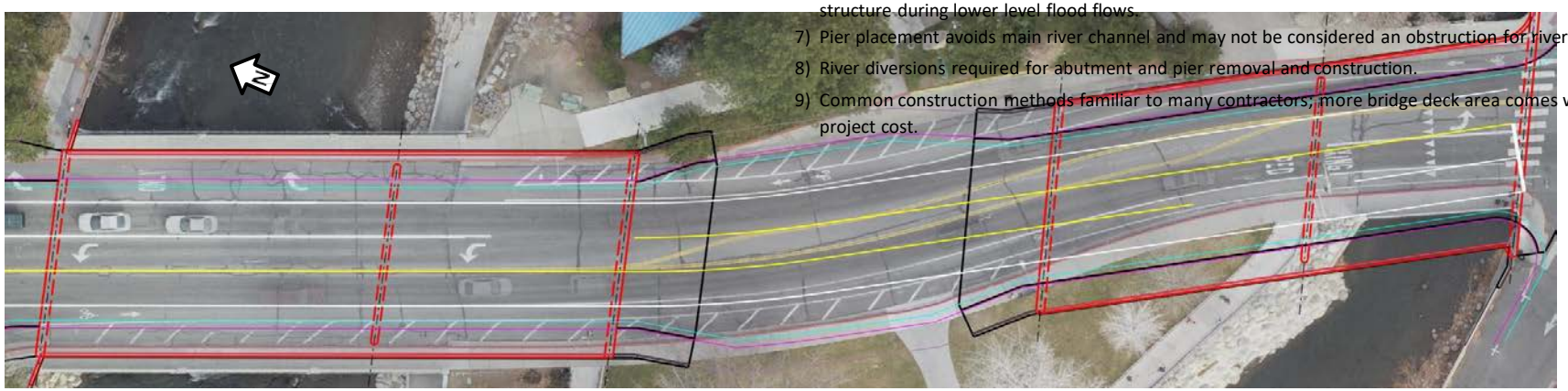
*Arlington Avenue Bridges over the Truckee River - Concept Evaluation*

## ELEVATED BRIDGE CONCEPT

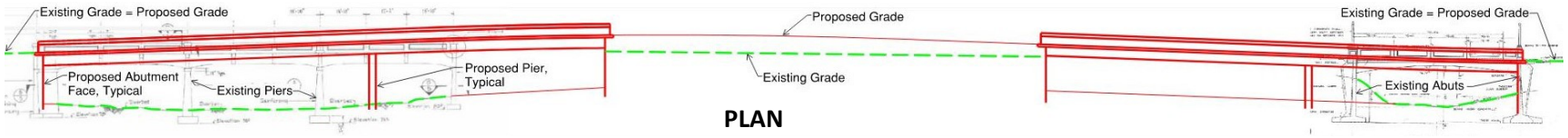
(*view looking east*)

**Some things to consider when evaluating the Elevated Bridge Concept:**

1) Thin overall deck section, longer spans and wider river openings may improve flood conveyance.
2) Spans can be accommodated using precast concrete or cast-in-place concrete construction.
3) An "open soffit" system (discrete steel I-girders or precast concrete beams) increase the potential to snag flood debris under the bridge.
4) A cast-in-place concrete box girder with a "closed soffit" may eliminate the potential to snag flood debris under the bridge but requires temporary shoring/falsework in the river to support construction.
5) Longer north and south bridges require reconfiguring some portions of Wingfield Park. More park area may be useable under the longer bridges, but new embankment on elevated profile between bridges would impact existing park facilities.
6) Improved in-river pier configuration may reduce the potential for river debris to snag and collect on the structure during lower level flood flows.
7) Pier placement avoids main river channel and may not be considered an obstruction for river recreation
8) River diversions required for abutment and pier removal and construction.
9) Common construction methods familiar to many contractors; more bridge deck area comes with added overall project cost.



**PLAN**




**NORTH BRIDGE** **SOUTH BRIDGE**

**ELEVATION**

# Concept Evaluation

| | | | | | | | Name: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Attribute | Construction Cost | Construction Schedule and Cost Risks | Existing Infrastructure Impacts | Maintenance and Inspection Access | Long Term Maintenance Costs | Environmental Impacts | River Recreation Impacts | Bridge Aesthetics | Attribute Y | Attribute Z |
| | ID | Alternative Description | Attribute Score (a) | | | | | | | | | |
| North Bridge | | **Single Pier Concept** | | | | | | | | | | |
| | SP-N1 | Precast Concrete Girders | | | | | | | | | | |
| | SP-N2 | Cast-in-Place Concrete Box | | | | | | | | | | |
| | SP-N3 | Steel I-Girders | | | | | | | | | | |
| | | **Clear Span Concept** | | | | | | | | | | |
| | CS-N1 | Underdeck Arch | | | | | | | | | | |
| | CS-N2 | Rigid Frame | | | | | | | | | | |
| | CS-N3 | Tied Arch | | | | | | | | | | |
| N&S Bridges | | **Elevated Bridge Concept** | | | | | | | | | | |
| | EB-NS1 | Precast Concrete Girders | | | | | | | | | | |
| | EB-NS2 | Cast-in-Place Concrete Box | | | | | | | | | | |
| | EB-NS3 | Steel I-Girders | | | | | | | | | | |
| (a) | Attribute Score: Excellent = 10; Good = 7; Fair = 4; Poor = 1 | | | | | | | | | | | |
| | See "Qualitative Attribute Guidelines" and "Concept Evaluation" summaries for additional information | | | | | | | | | | | |

# Concept Evaluation – Y&Z Attributes

ARLINGTON AVENUE BRIDGES PROJECT

- Three Attributes Suggested:
  - Permitting and Ancillary Impacts to Park (Scope Creep)
    - All Clear Span concepts rated nearly “excellent”
    - All Single Pier concepts rated “good”
    - All Elevated concepts rated “fair”
  - Crime Prevention Through Environmental Design
    - Clear Span Rigid Frame rated “excellent”
    - All Single Pier concepts rated “good”
    - Clear Span Tied Arch rated “fair”
    - Clear Span Deck Arch rated “poor”
    - All Elevated concepts rated “poor”

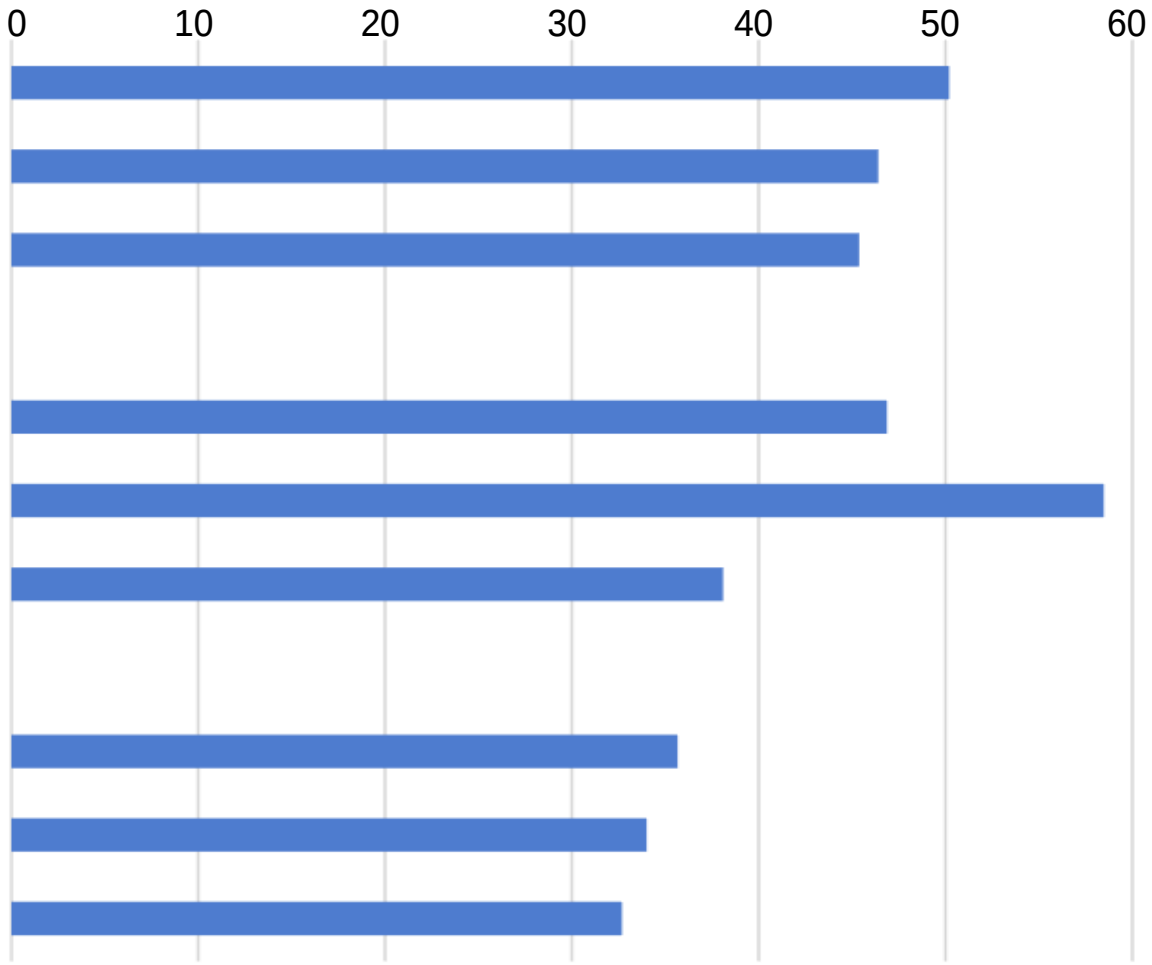
# Concept Evaluation – Y&Z Attributes

ARLINGTON AVENUE BRIDGES PROJECT

- Three Attributes Suggested:
  - Homeless Camps/Graffiti/Illicit Activity
    - All Clear Span concepts rated nearly “good”
    - All Single Pier concepts rated “fair”
    - All Elevated concepts rated nearly “poor”
- Added Attributes currently not included in the Scoring Results
- Including individuals’ scores for added attributes results in subtle change in overall ranking

# Concept Evaluation – Scoring Results

| | | Score | Rank |
|---|---|---|---|
| North Bridge | **Single Pier Concept** | | |
| | SP-N1 Precast Concrete Girders | 50 | 2 |
| | SP-N2 Cast-in-Place Concrete Box | 46 | 4 |
| | SP-N3 Steel I-Girders | 45 | 5 |
| | **Clear Span Concept** | | |
| | CS-N1 Underdeck Arch | 47 | 3 |
| | CS-N2 Rigid Frame | 58 | 1 |
| | CS-N3 Tied Arch | 38 | 6 |
| N&S Bridges | **Elevated Bridge Concept** | | |
| | EB-NS1 Precast Concrete Girders | 36 | 7 |
| | EB-NS2 Cast-in-Place Concrete Box | 34 | 8 |
| | EB-NS3 Steel I-Girders | 33 | 9 |



# Concept Evaluation – Scoring Results

ARLINGTON AVENUE BRIDGES PROJECT

| | | Score | Rank | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North Bridge | **Single Pier Concept** | | | | | | | | | | | |
| | SP-N1 Precast Concrete Girders | 50 | 2 | 2 | 7 | 2 | 7 | 1 | 2 | 3 | 3 | 2 |
| | SP-N2 Cast-in-Place Concrete Box | 46 | 4 | 1 | 8 | 1 | 9 | 2 | 2 | 5 | 5 | 7 |
| | SP-N3 Steel I-Girders | 45 | 5 | 2 | 9 | 4 | 8 | 4 | 2 | 4 | 4 | 4 |
| | **Clear Span Concept** | | | | | | | | | | | |
| | CS-N1 Underdeck Arch | 47 | 3 | 6 | 4 | 5 | 1 | 5 | 6 | 2 | 2 | 2 |
| | CS-N2 Rigid Frame | 58 | 1 | 4 | 5 | 3 | 1 | 2 | 1 | 1 | 1 | 1 |
| | CS-N3 Tied Arch | 38 | 6 | 5 | 6 | 6 | 3 | 5 | 5 | 6 | 6 | 5 |
| N&S Bridges | **Elevated Bridge Concept** | | | | | | | | | | | |
| | EB-NS1 Precast Concrete Girders | 36 | 7 | 8 | 1 | 8 | 4 | 5 | 6 | 7 | 7 | 6 |
| | EB-NS2 Cast-in-Place Concrete Box | 34 | 8 | 7 | 2 | 7 | 5 | 8 | 6 | 8 | 9 | 9 |
| | EB-NS3 Steel I-Girders | 33 | 9 | 8 | 3 | 9 | 6 | 9 | 6 | 8 | 7 | 8 |

# Concept Evaluation – Y&Z Attributes

| | | Score | Rank | Score | Rank |
|---|---|---|---|---|---|
| North Bridge | **Single Pier Concept** | | | | |
| | SP-N1 Precast Concrete Girders | 50 | 2 | 68 | 2 |
| | SP-N2 Cast-in-Place Concrete Box | 46 | 4 | 64 | 3 |
| | SP-N3 Steel I-Girders | 45 | 5 | 63 | 5 |
| | **Clear Span Concept** | | | | |
| | CS-N1 Underdeck Arch | 47 | 3 | 64 | 4 |
| | CS-N2 Rigid Frame | 58 | 1 | 84 | 1 |
| | CS-N3 Tied Arch | 38 | 6 | 58 | 6 |
| N&S Bridges | **Elevated Bridge Concept** | | | | |
| | EB-NS1 Precast Concrete Girders | 36 | 7 | 43 | 7 |
| | EB-NS2 Cast-in-Place Concrete Box | 34 | 8 | 41 | 8 |
| | EB-NS3 Steel I-Girders | 33 | 9 | 40 | 9 |

# Scoring Details

| | | | Construction Cost | | | Construction Schedule and Cost Risks | | |
|---|---|---|---|---|---|---|---|---|
| | | | L | H | Avg | L | H | Avg |
| North Bridge | | **Single Pier Concept** | | | | | | |
| | SP-N1 | Precast Concrete Girders | 4 | 10 | 7.6 | 3 | 10 | 6.8 |
| | SP-N2 | Cast-in-Place Concrete Box | 2 | 10 | 6.6 | 2 | 8 | 5.6 |
| | SP-N3 | Steel I-Girders | 4 | 10 | 6.8 | 3 | 9 | 5.8 |
| | | **Clear Span Concept** | | | | | | |
| | CS-N1 | Underdeck Arch | 1 | 7 | 4.6 | 3 | 7 | 5.3 |
| | CS-N2 | Rigid Frame | 4 | 10 | 6.4 | 4 | 10 | 7.1 |
| | CS-N3 | Tied Arch | 1 | 4 | 2.4 | 1 | 5 | 2.5 |
| N&S Bridges | | **Elevated Bridge Concept** | | | | | | |
| | EB-NS1 | Precast Concrete Girders | 1 | 7 | 4.3 | 1 | 8 | 5.0 |
| | EB-NS2 | Cast-in-Place Concrete Box | 1 | 6 | 3.8 | 1 | 8 | 4.1 |
| | EB-NS3 | Steel I-Girders | 1 | 6 | 3.5 | 1 | 8 | 4.3 |

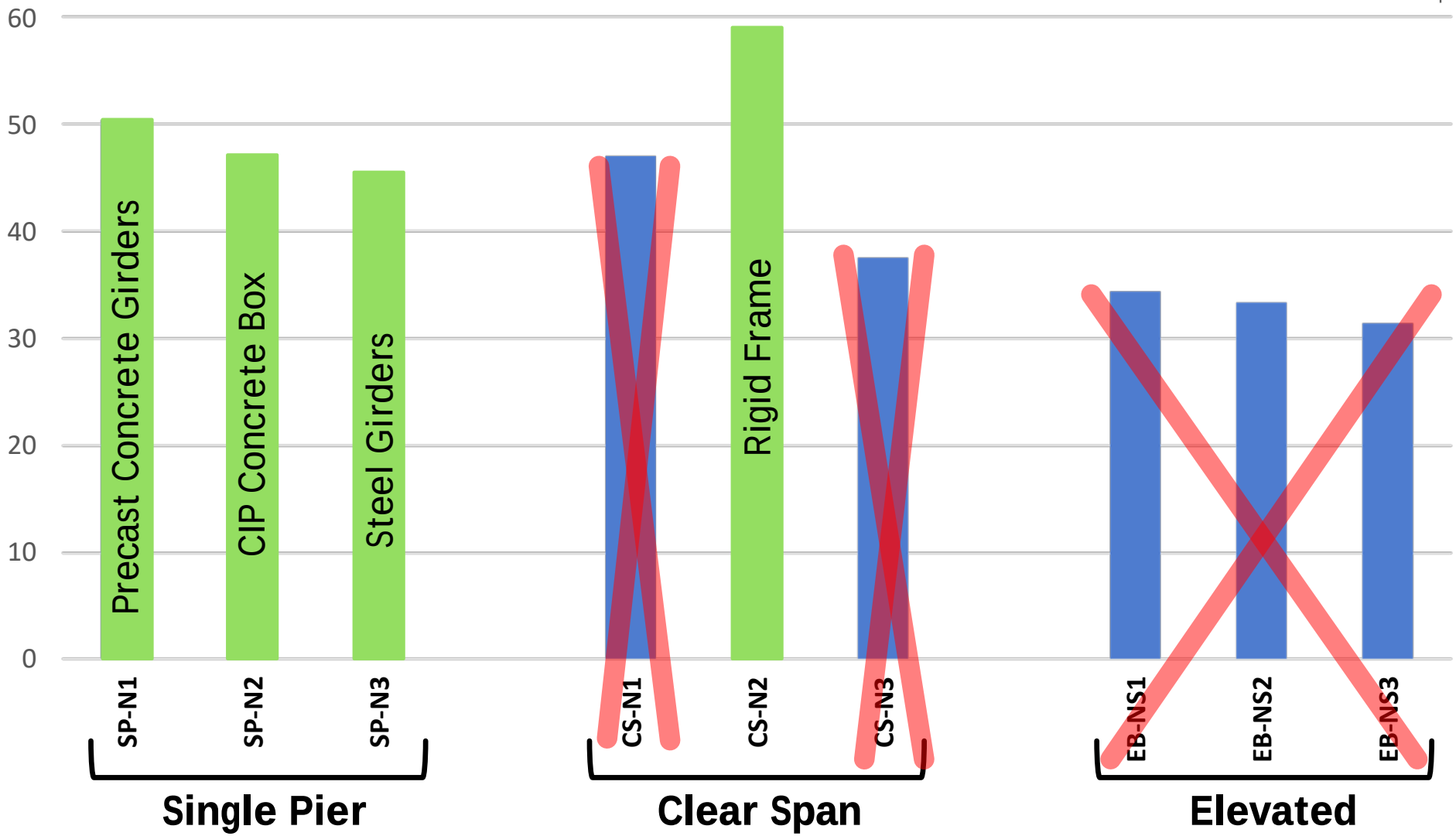
# Scoring Details

| | | | Existing Infrastructure Impacts | | | Maintenance and Inspection Access | | | Long Term Maintenance Costs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | H | Avg | L | H | Avg | L | H | Avg |
| North Bridge | **Single Pier Concept** | | | | | | | | | | |
| | SP-N1 | Precast Concrete Girders | 5 | 9 | 7.0 | 5 | 9 | 6.9 | 4 | 10 | 6.5 |
| | SP-N2 | Cast-in-Place Concrete Box | 4 | 9 | 6.6 | 4 | 9 | 6.6 | 3 | 10 | 6.5 |
| | SP-N3 | Steel I-Girders | 5 | 9 | 7.0 | 4 | 9 | 6.5 | 3 | 10 | 5.3 |
| | **Clear Span Concept** | | | | | | | | | | |
| | CS-N1 | Underdeck Arch | 1 | 9 | 5.8 | 4 | 8 | 5.8 | 4 | 7 | 5.8 |
| | CS-N2 | Rigid Frame | 6 | 10 | 7.5 | 5 | 10 | 7.9 | 6 | 10 | 7.9 |
| | CS-N3 | Tied Arch | 4 | 9 | 6.3 | 1 | 7 | 3.5 | 1 | 7 | 3.5 |
| N&S Bridges | **Elevated Bridge Concept** | | | | | | | | | | |
| | EB-NS1 | Precast Concrete Girders | 1 | 7 | 2.9 | 1 | 8 | 5.0 | 1 | 8 | 5.0 |
| | EB-NS2 | Cast-in-Place Concrete Box | 1 | 7 | 2.8 | 1 | 9 | 4.8 | 1 | 7 | 4.8 |
| | EB-NS3 | Steel I-Girders | 1 | 7 | 2.9 | 1 | 7 | 4.9 | 1 | 7 | 3.8 |

# Scoring Details

| | | | Environmental Impacts | | | River Recreation Impacts | | | Bridge Aesthetics | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | H | Avg | L | H | Avg | L | H | Avg |
| North Bridge | | **Single Pier Concept** | | | | | | | | | |
| | SP-N1 | Precast Concrete Girders | 2 | 7 | 5.0 | 2 | 10 | 5.8 | 1 | 7 | 4.7 |
| | SP-N2 | Cast-in-Place Concrete Box | 2 | 7 | 4.5 | 2 | 10 | 5.4 | 1 | 8 | 4.4 |
| | SP-N3 | Steel I-Girders | 2 | 7 | 4.1 | 2 | 10 | 5.7 | 1 | 7 | 4.3 |
| | | **Clear Span Concept** | | | | | | | | | |
| | CS-N1 | Underdeck Arch | 4 | 7 | 6.0 | 1 | 8 | 6.3 | 1 | 9 | 6.8 |
| | CS-N2 | Rigid Frame | 4 | 10 | 6.8 | 5 | 10 | 8.4 | 3 | 10 | 6.8 |
| | CS-N3 | Tied Arch | 4 | 7 | 5.3 | 4 | 10 | 7.3 | 4 | 9 | 6.9 |
| N&S Bridges | | **Elevated Bridge Concept** | | | | | | | | | |
| | EB-NS1 | Precast Concrete Girders | 1 | 7 | 4.0 | 1 | 10 | 6.1 | 1 | 7 | 3.7 |
| | EB-NS2 | Cast-in-Place Concrete Box | 1 | 7 | 3.8 | 1 | 10 | 5.9 | 1 | 7 | 4.1 |
| | EB-NS3 | Steel I-Girders | 1 | 6 | 3.9 | 1 | 10 | 6.1 | 1 | 7 | 3.4 |

# Identify Concepts to Carry Forward



# Discussion Summary, Concurrence & Agreements

ARLINGTON AVENUE BRIDGES PROJECT

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# Thank you for Participating!

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