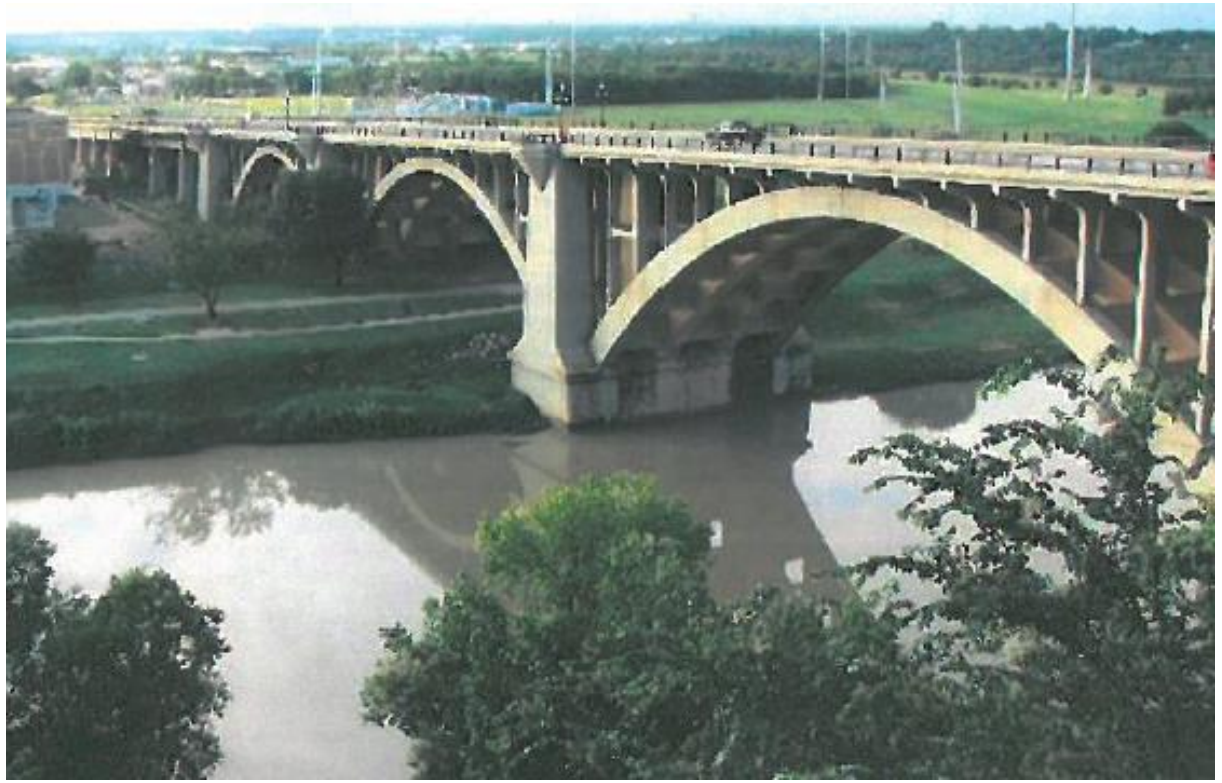
A Framework for Historic Bridge Preservation

Mary Beth Hueste
Eric Puls
Stefan Hurlebaus
Ivan Damnjanovic
Jason Crawford

Texas A&M University and
Texas A&M Transportation Institute



Sponsored by TxDOT – Fort Worth District

TxDOT Personnel

TxDOT Fort Worth District
- Maribel Chavez – District Engineer (retired)
- Alfredo Valles – District Bridge Engineer (Project Manager), now retired
- Taylor Buckner – Bridge Inspection Engineer (Assist with Project Management), now retired
- Rocky Armendariz – Bridge Inspector
- Ricardo Gonzalez – North Tarrant Area Engineer
- Jaime Aparicio – Transportation Engineer
- Greg Cedillo – South Tarrant Area Engineer
- Elisa Garcia – Environmental Specialist
- Enedina Alexander – Administrative Technician

TxDOT ENV Division
- Renee Benn – Historian (ENV Historical Branch)

TxDOT BRG Division
- Jamie Griffin
- Brian Merrill
- Michelle Veale

Overview

Motivation and Objectives

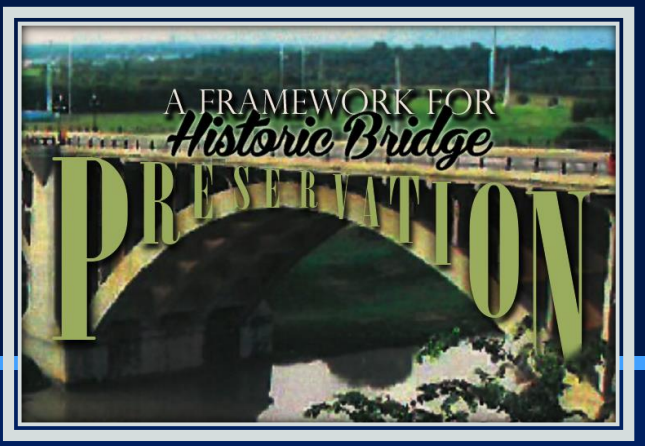
Background

Research Tasks

- Historic Bridge Prioritization Framework
- Top 10 Bridges

Conclusions and Takeaways

Motivation and Objectives



West 7th Street Bridge

Bridge carrying West 7th Street over West Fork of the Trinity River in Fort Worth (built in 1913).

Designated for removal in 2011.

TxDOT Fort Worth District desired to develop a proactive approach to identifying and preserving historic bridges in Tarrant County.

Motivation and Objectives

Benefits of historic bridges

- Representation of history
- Aesthetic value
- Commercial value
- Functionality

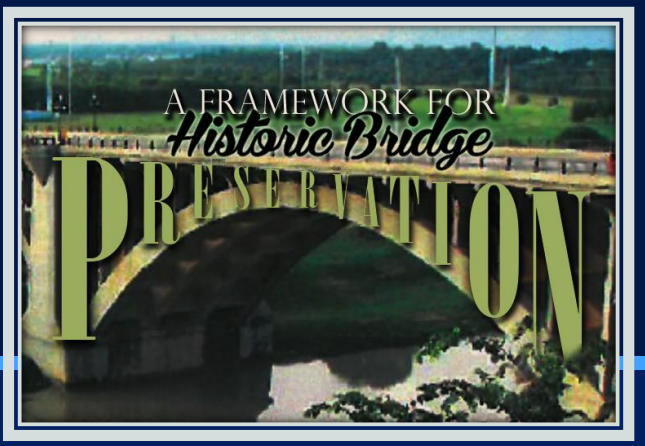
Concerns

- Deterioration is inevitable
- Funding is limited

Primary Goal: Preserve the integrity of historic bridges for future generations through better planning and management strategies

Background

- Important parameters
- Notable TxDOT studies
- Frameworks in other states



NBI Historical Significance Rating

Signifies eligibility for National Register of Historic Places (NRHP)

1. Listed on the NRHP
2. Eligible for listing on the NRHP
3. May be eligible or is on a state or local historic register
4. Eligibility is not determinable at the time
5. Not eligible

Historical Significance	Number of Bridges in Tarrant County
1	1
2	13
3	14
4	151
5	1186

NRHP Eligibility Criteria

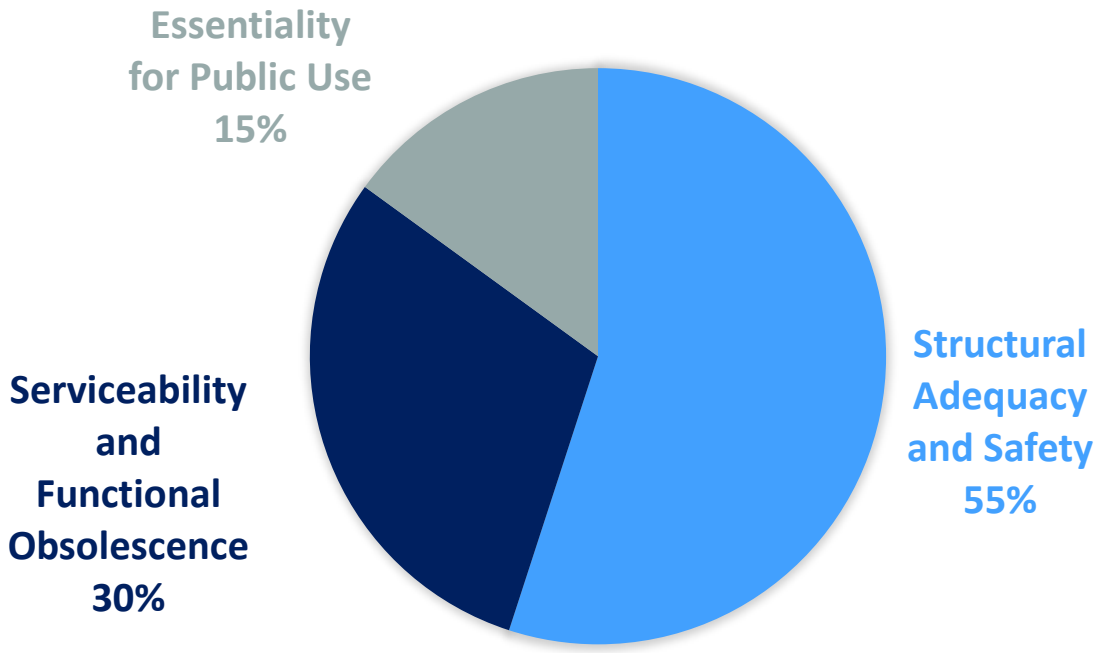
Criterion A: Associated with a significant historic event

Criterion B: Associated with a significant person in history

Criterion C: Embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master

Criterion D: Has potential to yield information important in history or prehistory

FHWA Sufficiency Rating



- Ranges from 1 to 100, indicates the sufficiency of a bridge to remain in service
- 80-100: Good condition
- 50-79.9: Eligible for rehabilitation
- < 50: Eligible for replacement

FHWA 1995

Previous TxDOT Studies

TxDOT Metal Truss Bridge Task Force (1996)

Research and evaluation of preservation options for 38 historic metal truss bridges

TxDOT Inventory Survey of Non-Truss Structures (1997-1999)

Evaluation of 40,000 bridges for NRHP eligibility

TxDOT Evaluation of 1945-1965 Bridges (2004-2009)

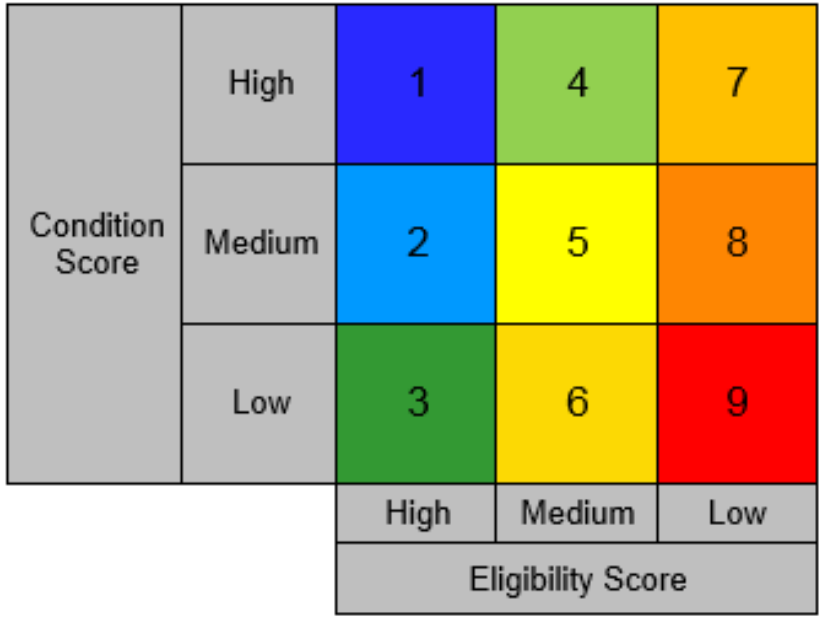
Evaluation of 14,799 bridges for NRHP eligibility

All of these previous TxDOT studies have been combined into and updated in the Multiple Property nomination entitled “Historic Road Infrastructure of Texas, 1866-1965”

State DOT Frameworks

Indiana DOT

Condition and Eligibility Scores

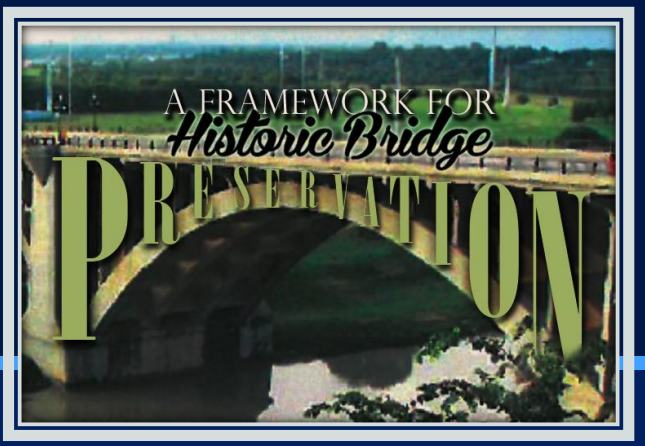


Ohio DOT

Technological and General Significance

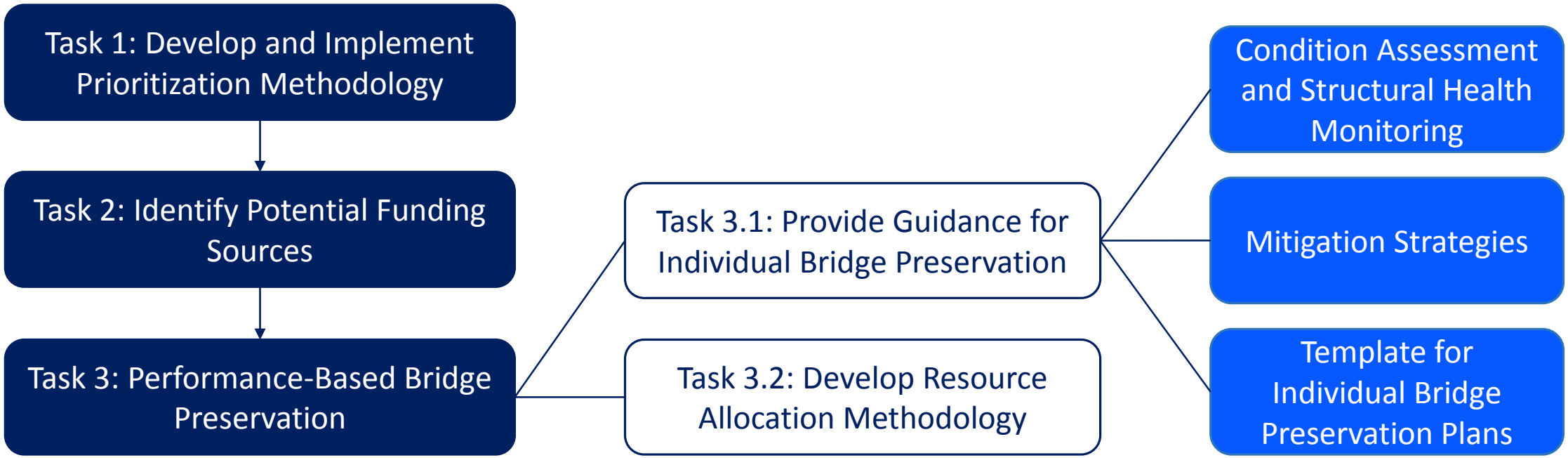
Parameters	Max Points
Technological Significance	
Length of individual span	12
Special Features	12
General Significance	
History	4
Integrity	4
Aesthetics	4

Research Tasks

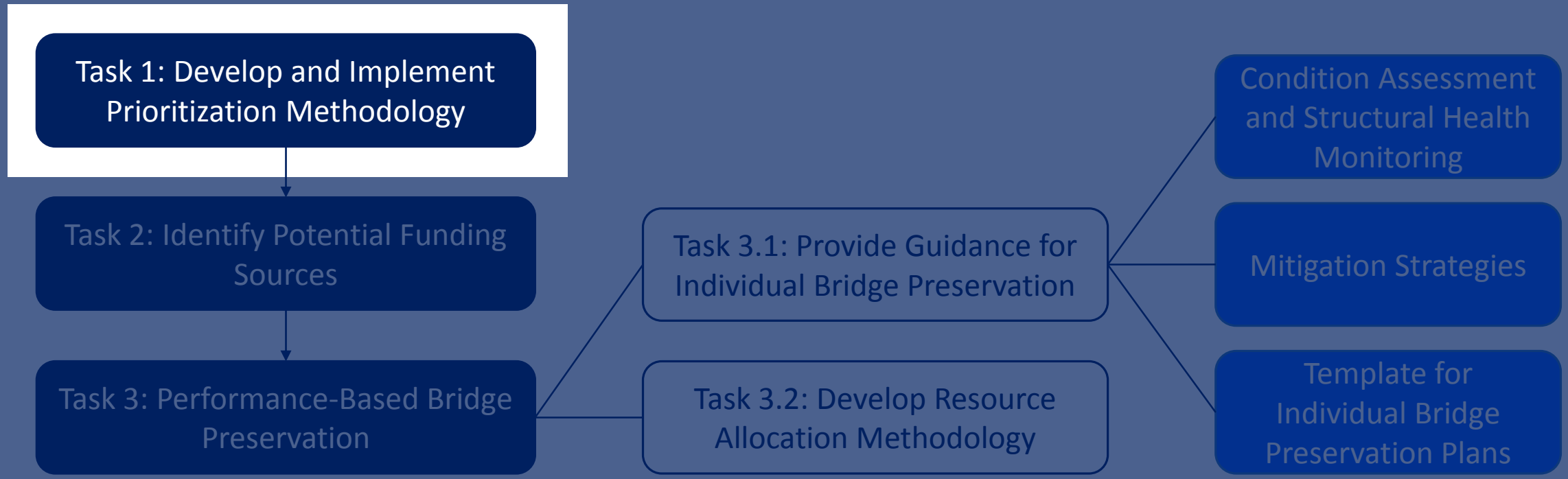


Overview of Research Framework

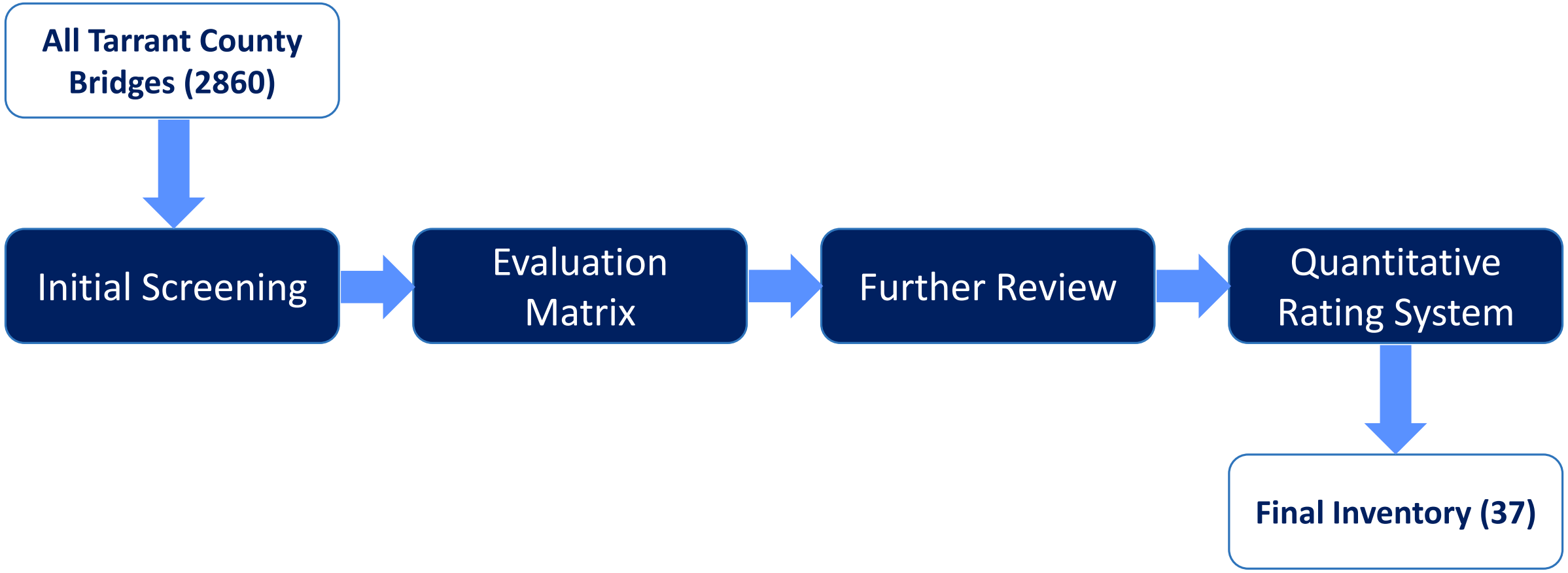
Primary Goal: Preserve the integrity of historic bridges for future generations through better planning and management strategies



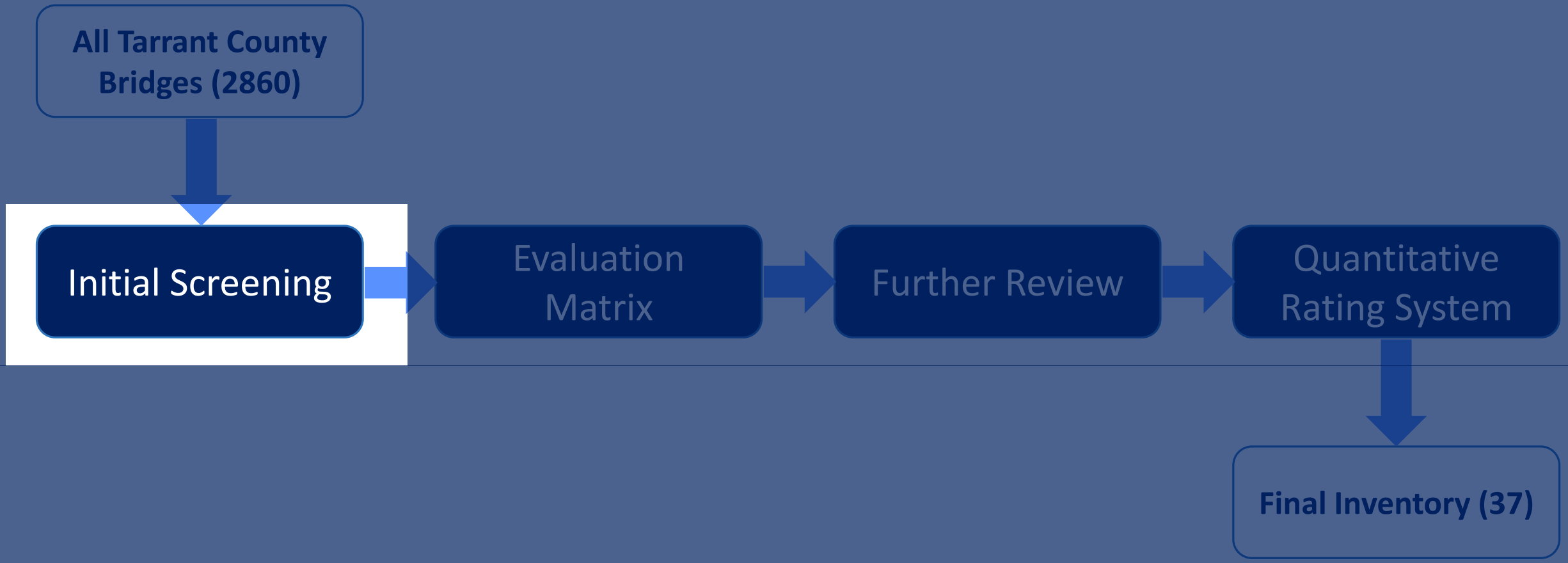
Task 1: Prioritization



Inventory Review and Prioritization



Initial Screening



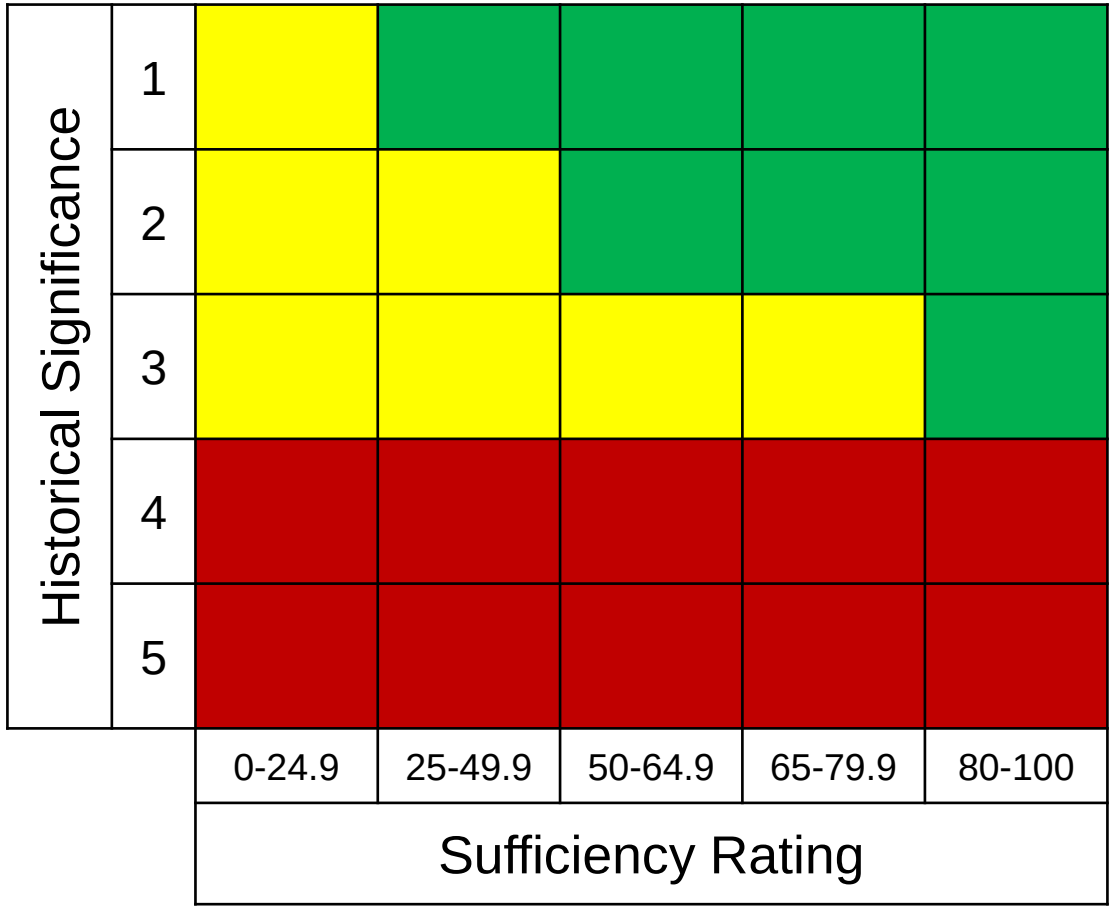
Initial Screening

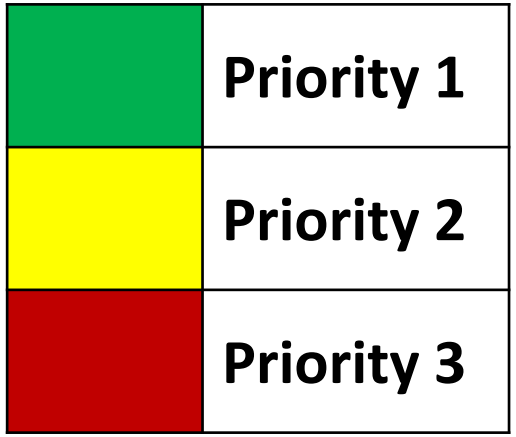
- Removed post-1972 bridges
- Removed culverts
- Removed railroad bridges
- Removed bridges with no listing for sufficiency or historical significance ratings

2427 bridges eliminated, 433 remaining

Evaluation Matrix

Evaluation Matrix





Evaluation Matrix Applied to 433 Bridges

Historical Significance	0-24.9	25-49.9	50-64.9	65-79.9	80-100
1	0	0	0	1	0
2	1	3	6	2	5
3	0	1	2	7	1
4	0	10	23	51	26
5	1	3	15	62	208

Sufficiency Rating

404 bridges eliminated, 29 remaining

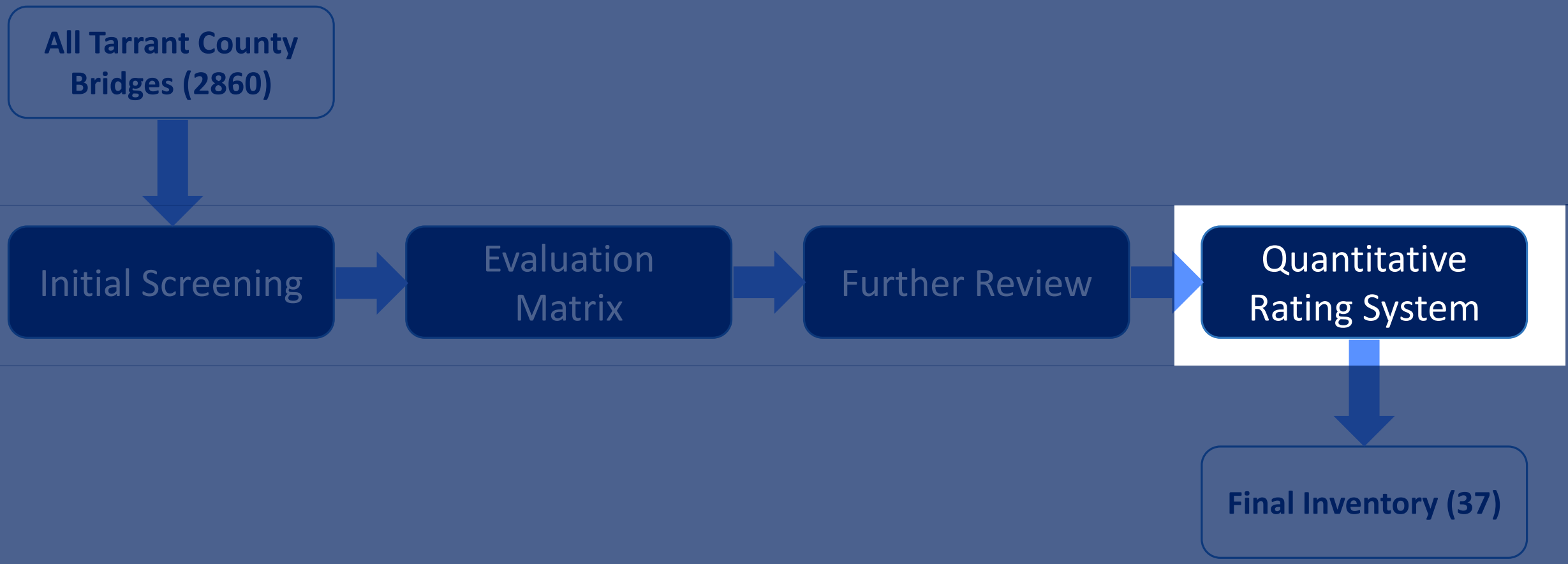
Further Review

Further Review

- All pre-1940 bridges further reviewed
- Eight bridges from third priority region displayed characteristics worthy of preservation

8 bridges returned, 37 remaining

Quantitative Rating System



Quantitative Rating System

- Modeled after system used by TxDOT for pre-1950 bridges
- Measures historical and engineering significance

Criterion	Max Possible Points
Year Built	40
Main Span Length	20
Overall Length	4
Rail Type	14
Special Design	10
Structural Integrity	8
Site Integrity	8
Sufficiency Rating	8
TOTAL	**112**

Quantitative Rating System

Year Built

Year	Points
1900-1909	40
1910-1919	35
1920-1929	30
1930-1939	25
1940-1949	20
1950-1959	15
Post-1959	10

Quantitative Rating System

Main Span Length

Concrete Girders:

Length (ft)	Points
≥ 45	20
40-45	10

Concrete Slabs:

Length (ft)	Points
≥ 30	20
25-30	10

Steel I-beams:

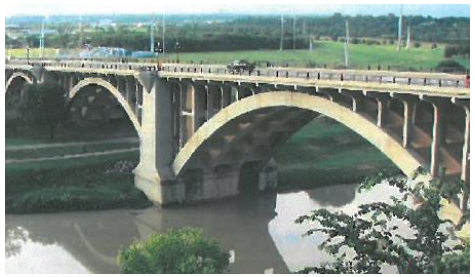
Length (ft)	Points
≥ 65	20
60-65	10

20 points for structures in top 5% among its type in state, 10 for top 10%

Quantitative Rating System

Main Span Length

Concrete Arches:



Length (ft)	Points
≥ 40	20
30-40	10

Trusses:

Length (ft)	Points
≥ 100	20
80-100	10

Plate Girders:

Length (ft)	Points
≥ 80	20
50-80	10

Rigid Frames:

Length (ft)	Points
≥ 50	20
40-50	10

Quantitative Rating System

Overall Length

Concrete Girders:

Length (ft)	Points
≥ 420	4
100-420	2

Concrete Slabs:

Length (ft)	Points
≥ 300	4
200-300	2

Steel I-beams:

Length (ft)	Points
≥ 520	4
340-520	2

4 points for structures in top 5% among its type in state, 2 for top 10%

Quantitative Rating System

Overall Length

Concrete Arches:

Length (ft)	Points
≥ 200	4
80-200	2

Trusses:

Length (ft)	Points
≥ 1000	4
300-1000	2

Plate Girders:

Length (ft)	Points
≥ 500	4
200-500	2

Rigid Frames:

Length (ft)	Points
≥ 200	4
100-200	2

Quantitative Rating System

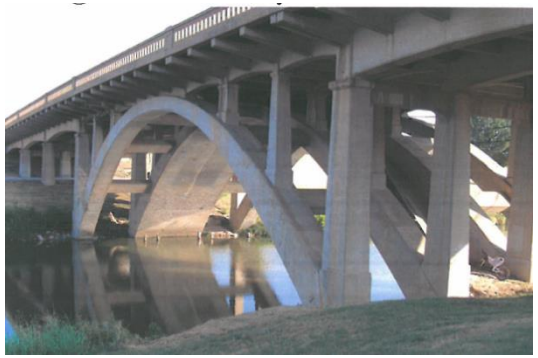
Rail Type

Rail Type	Points	Example
Types A-J	**14**	
Special Design	**12**	
Types K & L	**10**	
Type M	**8**	
Types P & Q	**6**	
Types R-8 7 R-10	**4**	
Other post-1940 standard rail	**2**	

Quantitative Rating System

Special Design

Special Design	Score
Decorative Elements	**10**
Engineering Response	**8**
Super/Substructure	**6**
Superstructure	**4**
Substructure	**2**



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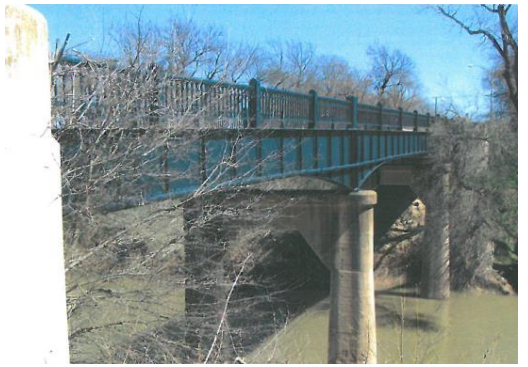

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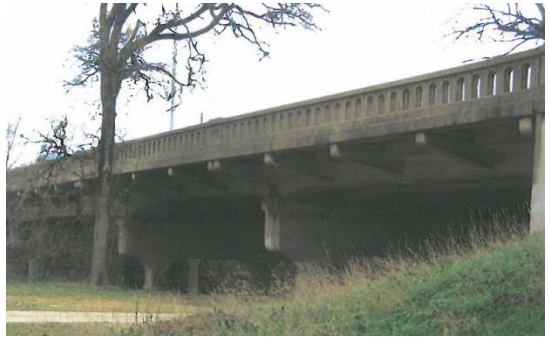

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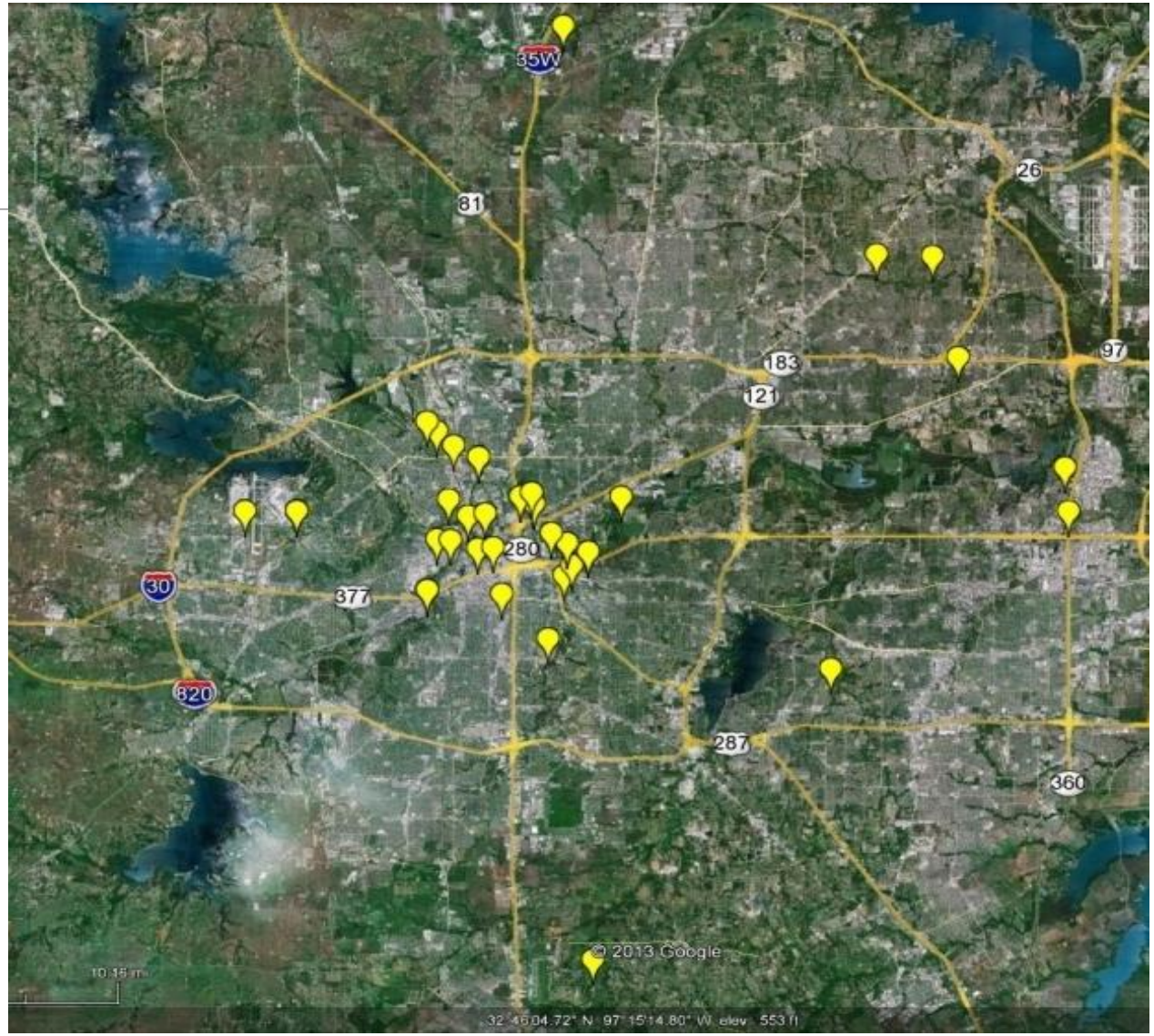
4

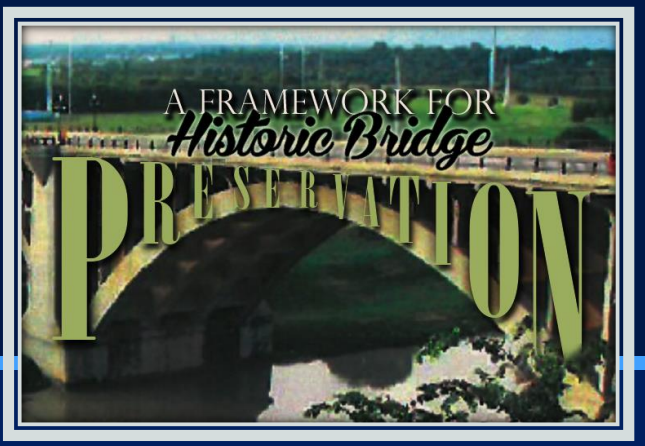
Final Inventory

Final Inventory

- 37 bridges
- Scores range from 40 to 104
- Includes all non-railroad bridges from TxDOT recommended list



Top 10 Bridges



1

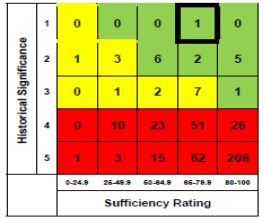
BU 287P (N. Main St.) over Trinity River

- Year Built: 1914
- Owner: TxDOT
- Historical Significance: 1
- Sufficiency Rating: 66 (upgraded from 33.5 after rehabilitation)
- Member Type: Open Spandrel Arch
- Rail Type: Special Design

HISTORIC FORT WORTH, INC.

Top 10 highest priority for maintenance and restoration: #1

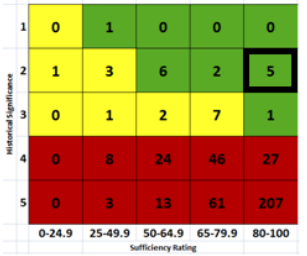
Score: 106/112



Samuels Ave. over West Fork Trinity River

- Year Built: 1914
- Owner: City of Fort Worth
- Historical Significance: 2*
- Sufficiency Rating: 81.3
- Member Type: Concrete Girder
- Rail Type: H

Score: 101/112

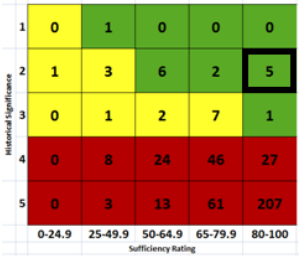


3

W. Lancaster over Clear Fork Trinity River

- Year Built: 1938
- Owner: City of Fort Worth
- Historical Significance: 2
- Sufficiency Rating: 80.2
- Member Type: Steel Truss
- Rail Type: Special Design

Score: 95/112



HFW HISTORIC FORT WORTH, INC.

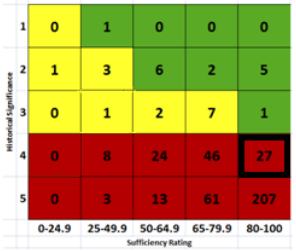
Top 10 highest priority for maintenance and restoration: #2

4

SH 180 WB over Sycamore Creek

- Year Built: 1928
- Owner: TxDOT
- Historical Significance: 4
- Sufficiency Rating: 92.2
- Member Type: Concrete Girder
- Rail Type: H

Score: 94/112



E. Exchange Avenue over Marine Creek

Year Built: 1930

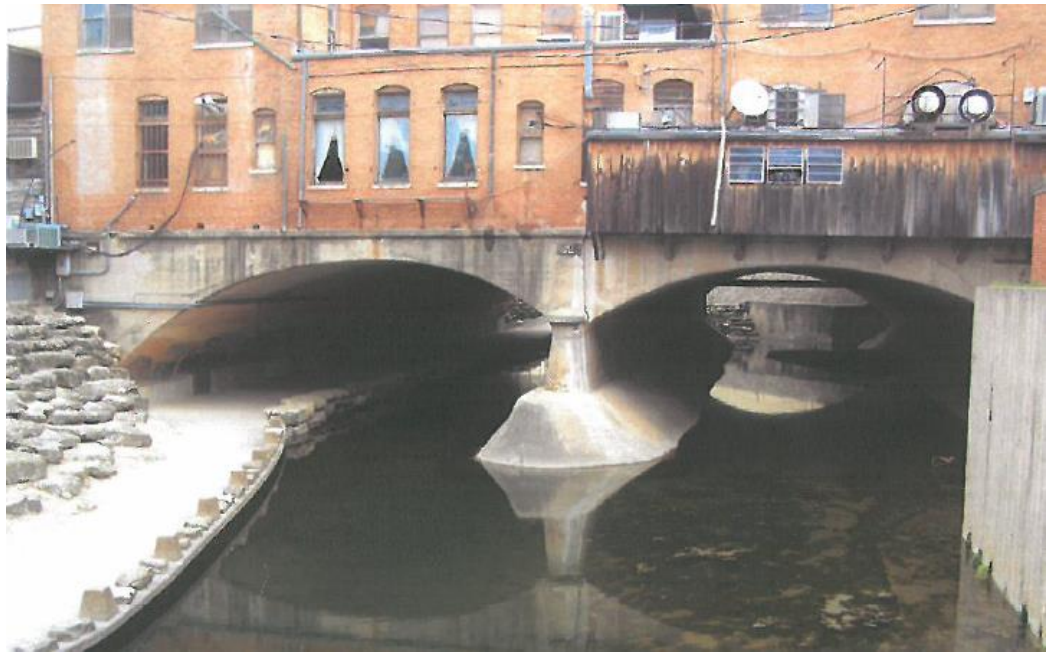
Owner: City of Fort Worth

Historical Significance: 2*

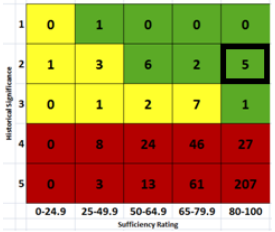
Sufficiency Rating: 81.3

Member Type: Closed Spandrel Arch

Rail Type: Special Design



Score: 93/112



6

E. Vickery Blvd. over Sycamore Creek

02-220-ZV39-00-003

Off-system

Owner: City of Fort Worth

Year Built: 1930

AADT: 4,350

Hist. Sig.: 3

Span Type: Arch

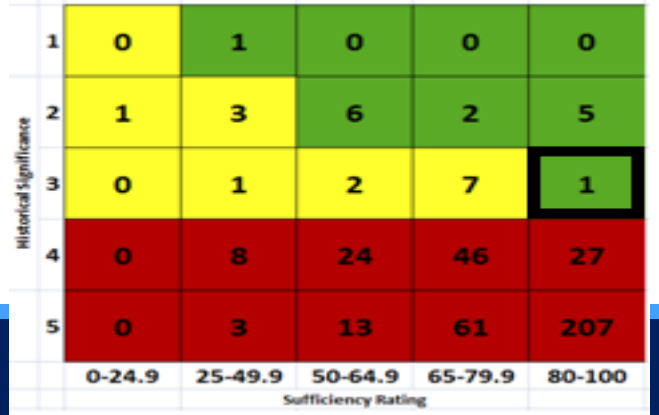
Roadway Type: Deck

Member Type: Concrete Arch

Rail Type: H

Sufficiency Rating: 90.4

Score: 93/112



7

SH 199 (Henderson St.) over Clear Fork Trinity River

On-system

02-220-0171-05-018

Owner: TxDOT

Year Built: 1930

AADT: 28,000

Hist. Sig.: 2

Span Type: Arch

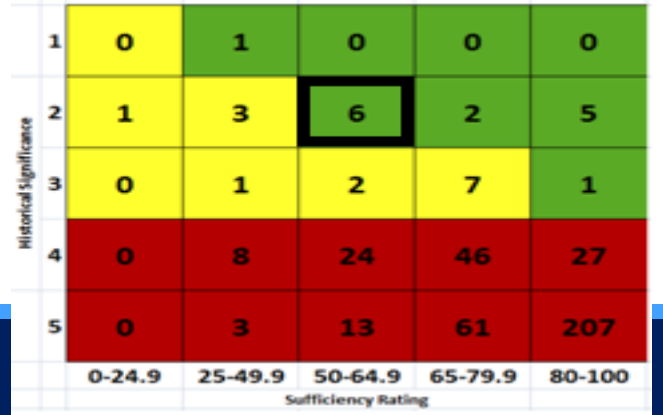
Roadway Type: Deck

Member Type: Concrete Arch, Open Spandrel

Rail Type: H

Sufficiency Rating: 57.5

Score: 93/112



HISTORIC FORT WORTH, INC.

Top 10 highest priority for maintenance and restoration: #4

8

SH 199 (Henderson St.) over W. Fork Trinity River

02-220-0171-05-017

On-system

Owner: TxDOT

Year Built: 1931

AADT: 28,000

Hist. Sig.: 2

Span Type: Continuous

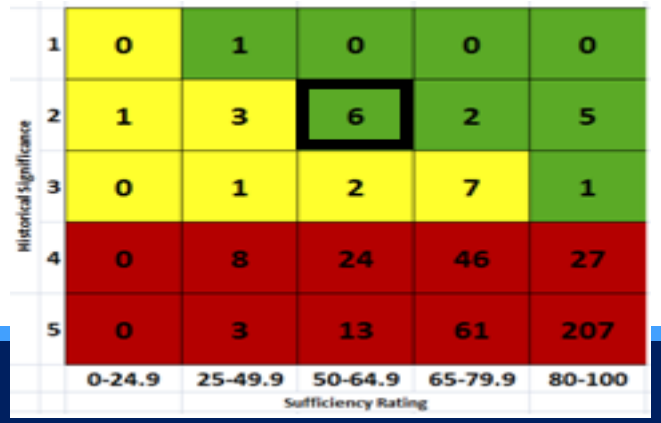
Roadway Type: Deck

Member Type: Concrete Girder, Var. Depth – Tee Beam

Rail Type: Special Design

Sufficiency Rating: 55.0

Score: 91/112



HISTORIC FORT WORTH, INC.

Top 10 highest priority for maintenance and restoration: #7

9

SH 180 EB over Sycamore Creek

02-220-0008-05-048

On-system

Owner: TxDOT

Year Built: 1938

AADT: 6,650

Hist. Sig.: 3

Span Type: Simple Span

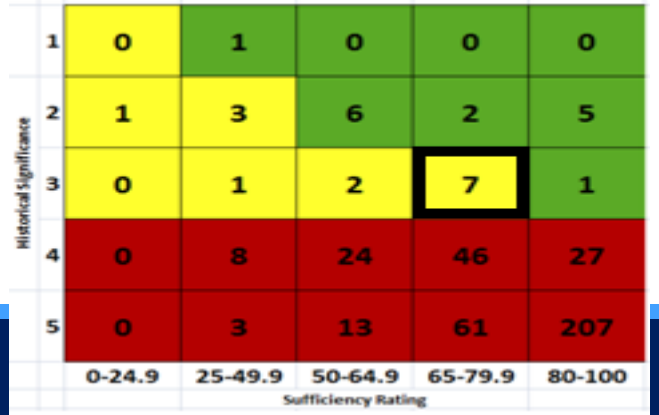
Roadway Type: Deck

Member Type: Concrete Girder - Tee Beam

Rail Type: H

Sufficiency Rating: 74.7

Score: 91/112



10

US 377 (E. Belknap) over Trinity River

02-220-0081-01-001

On-system

Owner: TxDOT

Year Built: 1932

AADT: 5,800

Hist. Sig.: 2

Span Type: Continuous

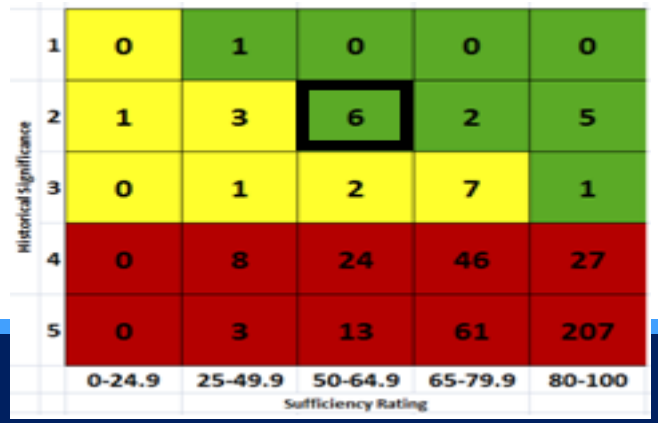
Roadway Type: Deck

Member Type: Concrete Girder, Var. Depth – Tee Beam

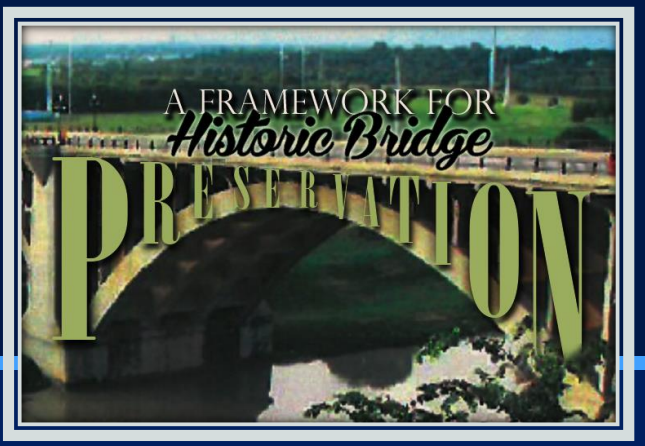
Rail Type: Special Design

Sufficiency Rating: 56.6

Score: 87/112



Conclusions and Takeaways

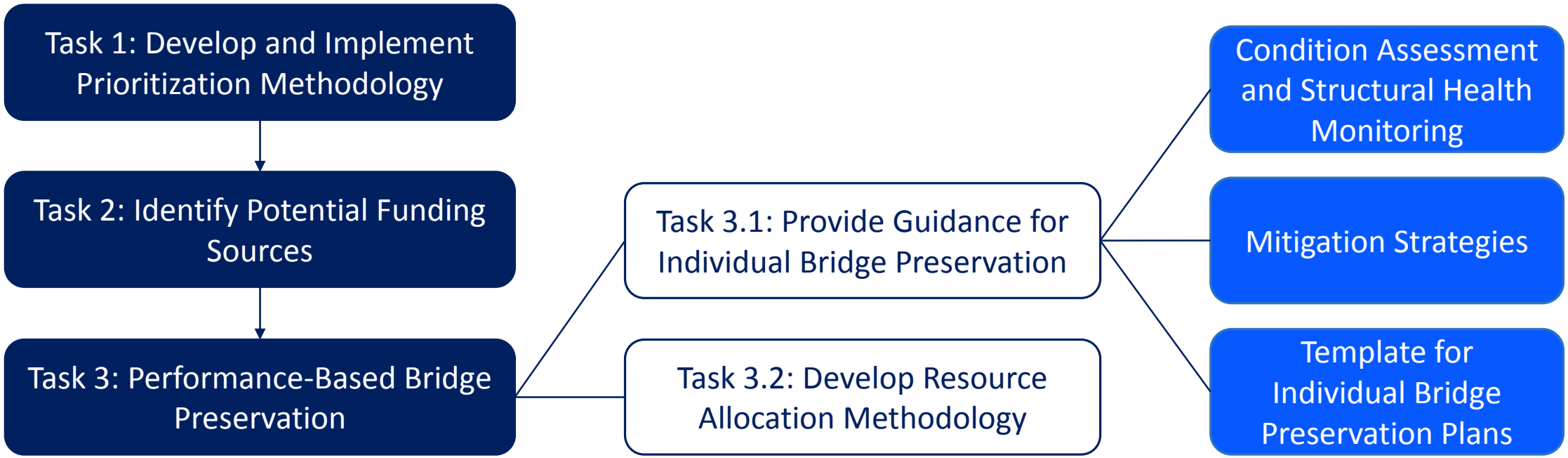


Conclusions and Takeaways

- Historical significance and sufficiency ratings provide initial guidance, but are not adequate parameters for an accurate prioritization of bridges.
- A quantitative rating system was applied to the bridge inventory to provide a more detailed assessment.
- Past preservation programs are useful as models but often require modification for a specific bridge inventory.
- The prioritization framework used in this project could also be applied to other bridge inventories, particularly in Texas.

Additional Research Tasks…

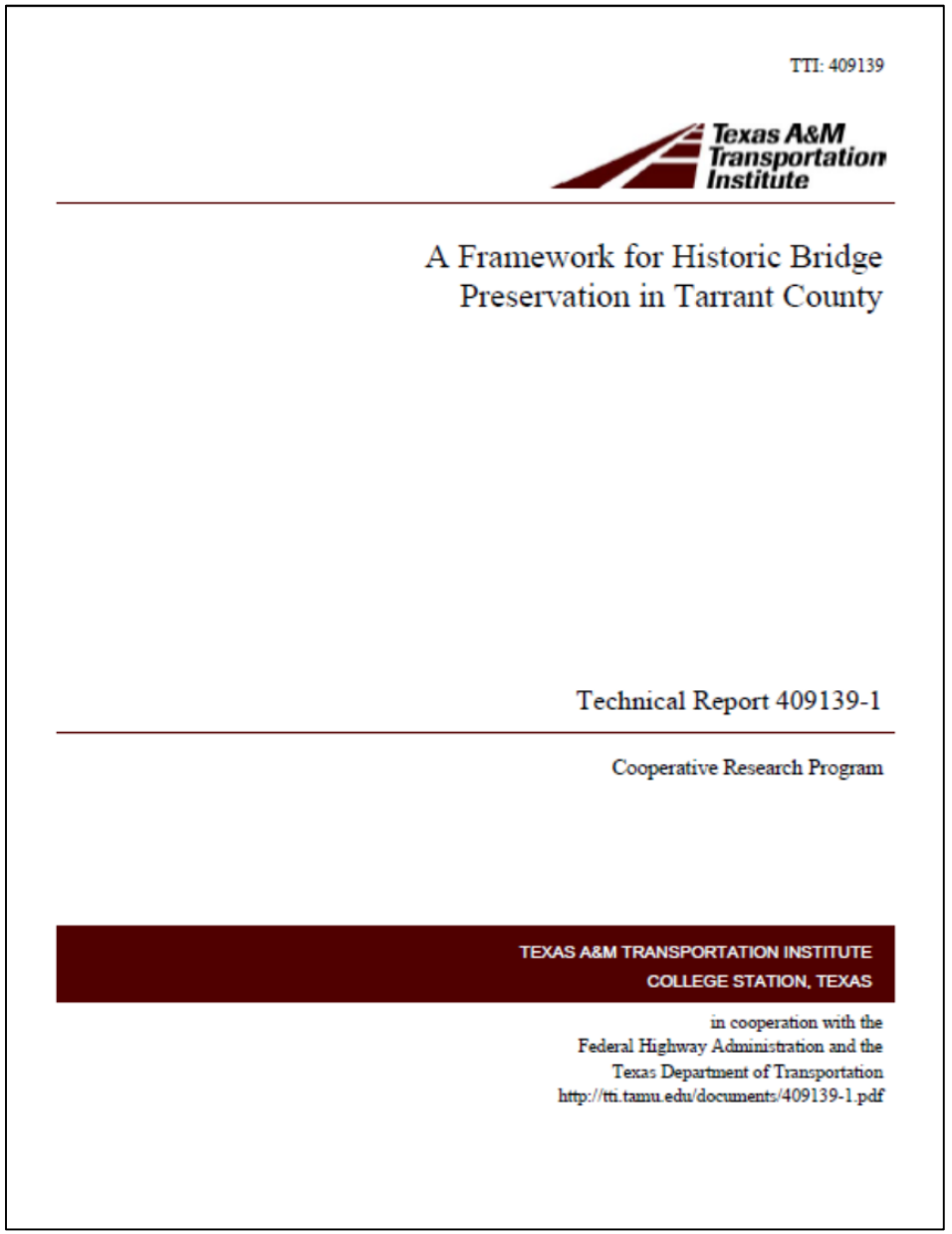
Primary Goal: Preserve the integrity of historic bridges for future generations through better planning and management strategies



More information:
tti.tamu.edu/documents/409139-1.pdf

Thank you!

QUESTIONS?



TTI: 409139

Texas A&M Transportation Institute

A Framework for Historic Bridge Preservation in Tarrant County

Technical Report 409139-1

Cooperative Research Program

TEXAS A&M TRANSPORTATION INSTITUTE
COLLEGE STATION, TEXAS

in cooperation with the
Federal Highway Administration and the
Texas Department of Transportation
http://tti.tamu.edu/documents/409139-1.pdf