U.S. Department of Transportation
Federal Highway Administration

Turner-Fairbank Highway Research Center

Impact of Collection and Analysis of Bridge Data on Understanding and Improving Performance of Bridges

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FHWA

Presentation Overview

- FHWA Turner-Fairbank Highway Research Center.
- Importance of data collection, analysis, and sharing.
  - FHWA InfoHighway™ web portal.(1)
- InfoBridge.

Office of Infrastructure R&D - Programs

- **Asset Management, Preservation, and Maintenance.**
- **Building Information Modeling (BIM) for Highway Infrastructure.**
- **Construction and Project Management.**
- **Long-Term Infrastructure Performance.**
  - **Long-Term Bridge Performance.**
  - **Long-Term Pavement Performance.**
- **Ultra-High Performance Concrete (UHPC).**
- **Additive Manufacturing.**
- **Resilience.**
- **Sustainability.**
- **Forensic Analysis.**

Source: FHWA

Office of Infrastructure R&D - Laboratories

- **Aggregate and Petrographic.**
- **Asphalt Binder and Mixtures.**
- **Chemistry.**
- **Coatings and Corrosion.**
- **Concrete.**
- **Geotechnical.**
- **Hydraulics.**
- **Non-Destructive Evaluation.**
- **Pavement Testing Facility.**
- **Structures.**

Source: FHWA

Importance of Sharing Data

- Are research data required to be shared?
- Is data collection expensive?
- Are similar data being collected over and over?
- Would sharing data in the right format reduce duplication of efforts?
- Is it easy to share data?
- Should we be selective in determining what data to share?

OPEN Government Data Act

S.760 - Open, Public, Electronic, and Necessary Government Data Act

115th Congress (2017-2018)[2]

This bill requires open government data assets made available by federal agencies to be published as machine-readable data:

1. In an open format that does not impede use or reuse and that has standards maintained by a standards organization; and
2. Under open licenses with a legal guarantee that the data be available at no cost to the public with no restrictions on copying, publishing, distributing, transmitting, citing, or adapting.

CONGRESS.GOV

Source: Congress.gov.[3]

https://infohighway.fhwa.dot.gov/ [1]

FHWA InfoHighway™

Help ▼

LTPP InfoPave™

Enables easy access and analysis of the Long-Term Pavement Performance (LTPP) program data through a variety of data selection, visualization, and exploration tools. Additional data collected by other programs are available.

LTBP InfoBridge™

Facilitates efficient and quick access to bridge performance-related data and information on more than 600,000 bridges.

FHWA InfoMaterials™

Provides access, visualization, and synthesizing of FHWA's infrastructure research and materials testing data.

FHWA InfoTechnology™

Disseminates technical knowledge on Non-Destructive Evaluation (NDE) technologies for the assessment of highway infrastructure systems and components.

Source: FHWA.[1]

https://infobridge.fhwa.dot.gov[4]

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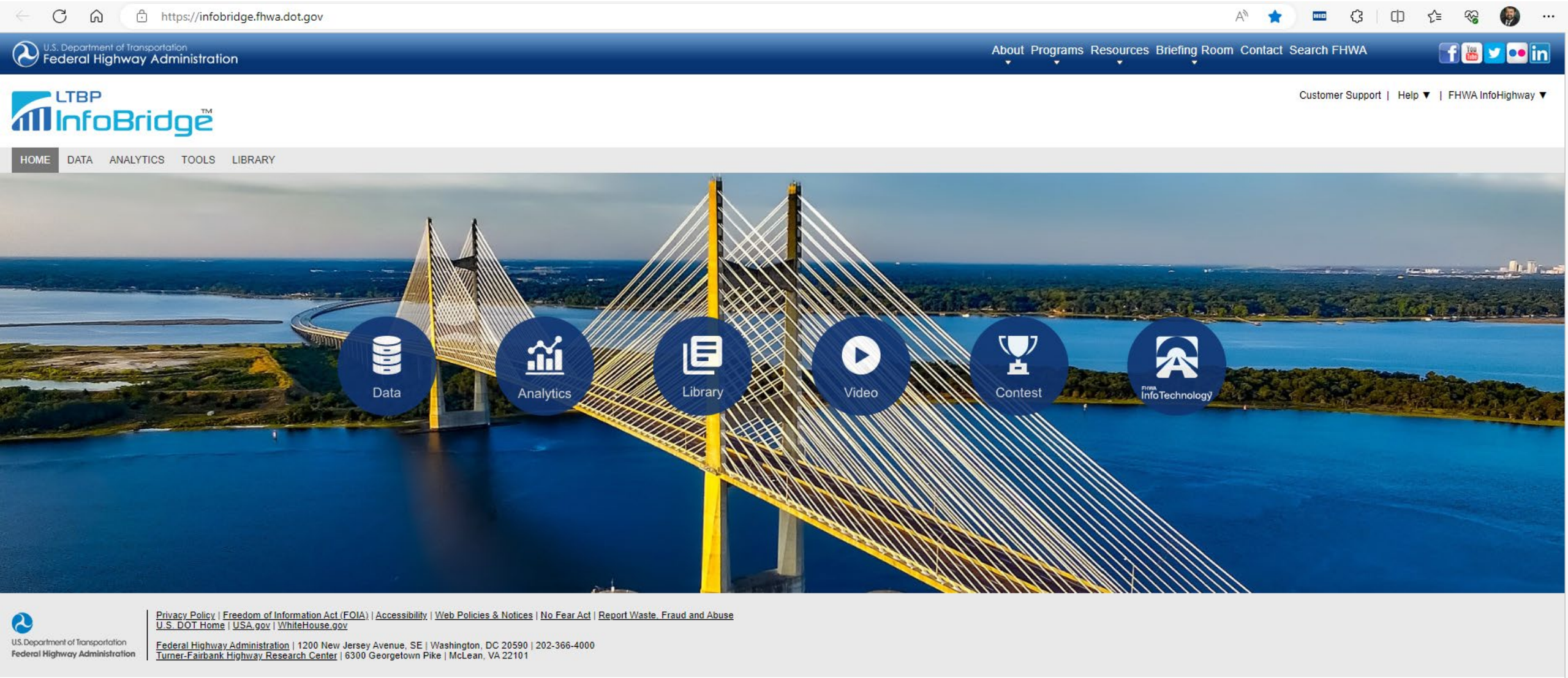
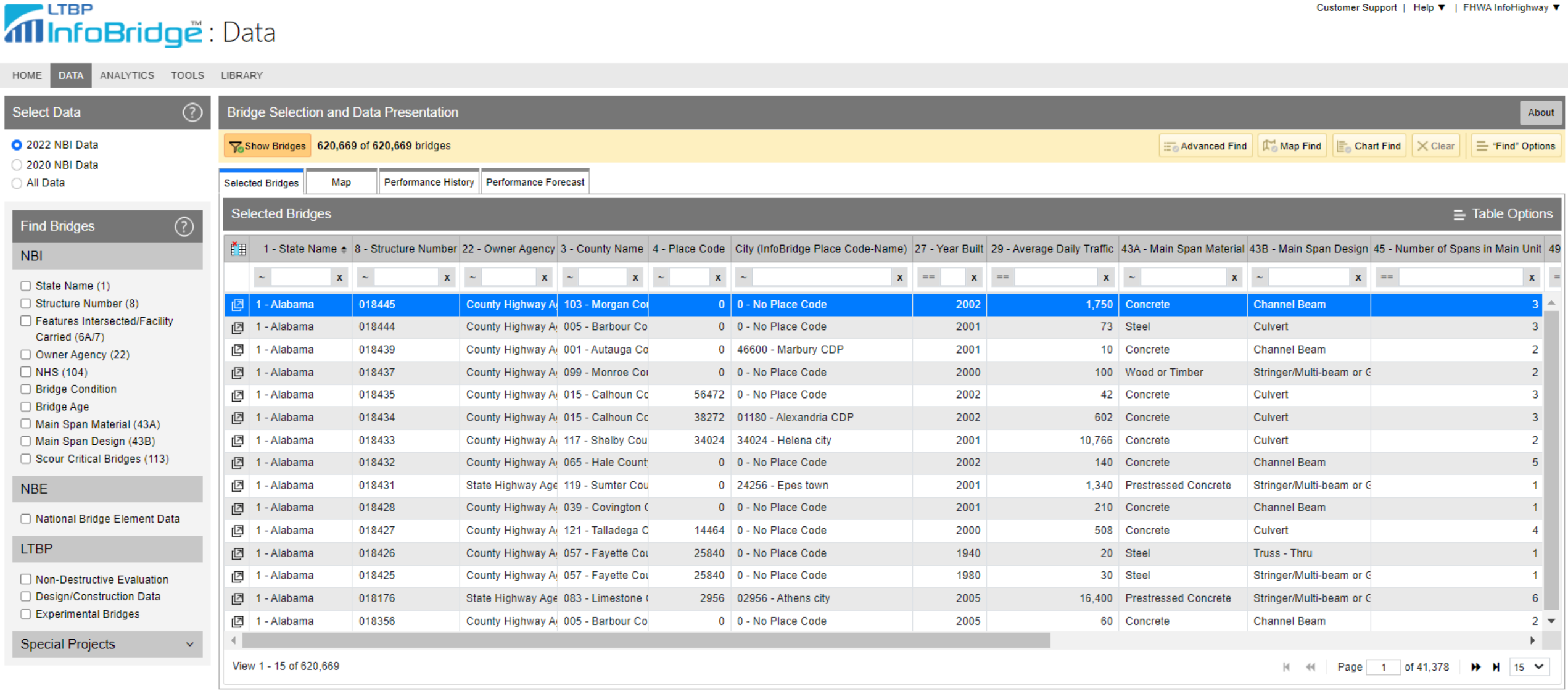
Source: FHWA.[1]



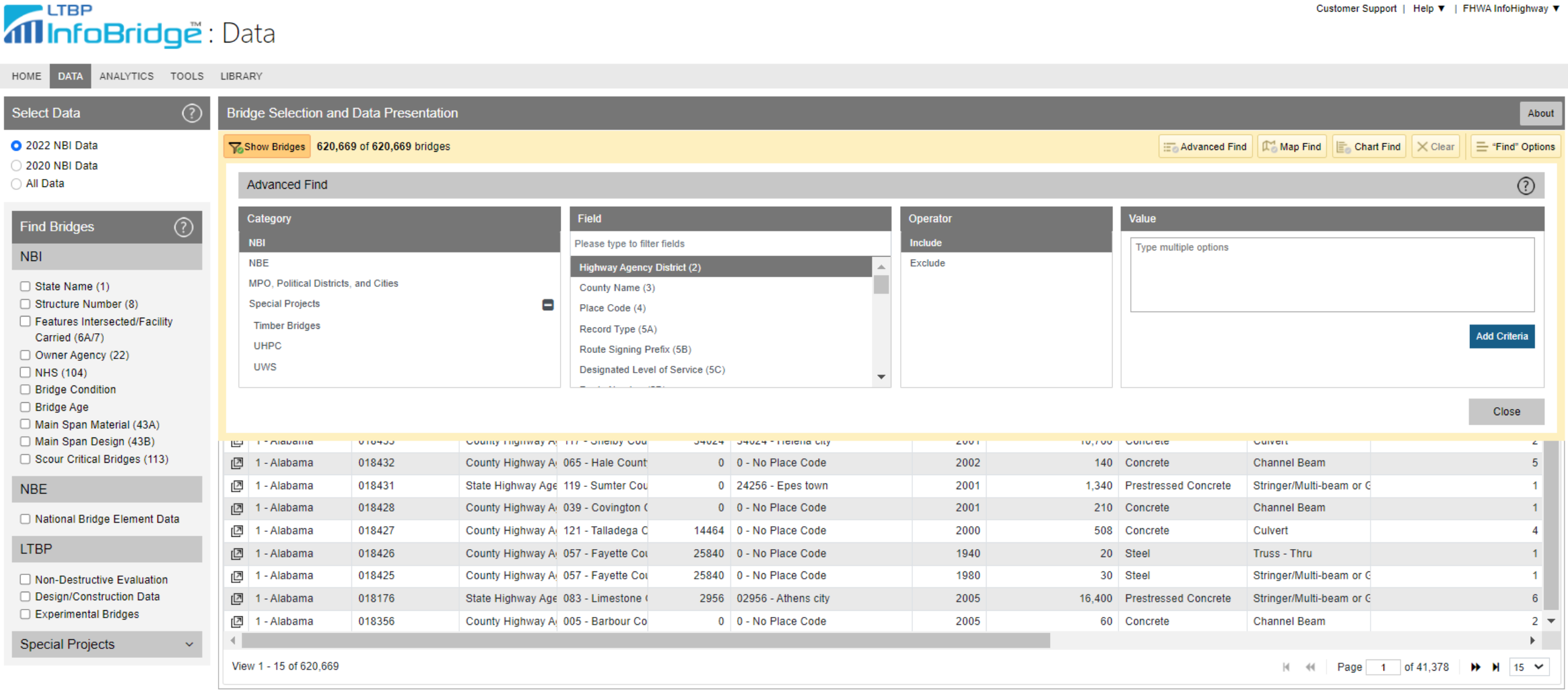
Source: FHWA.[4]



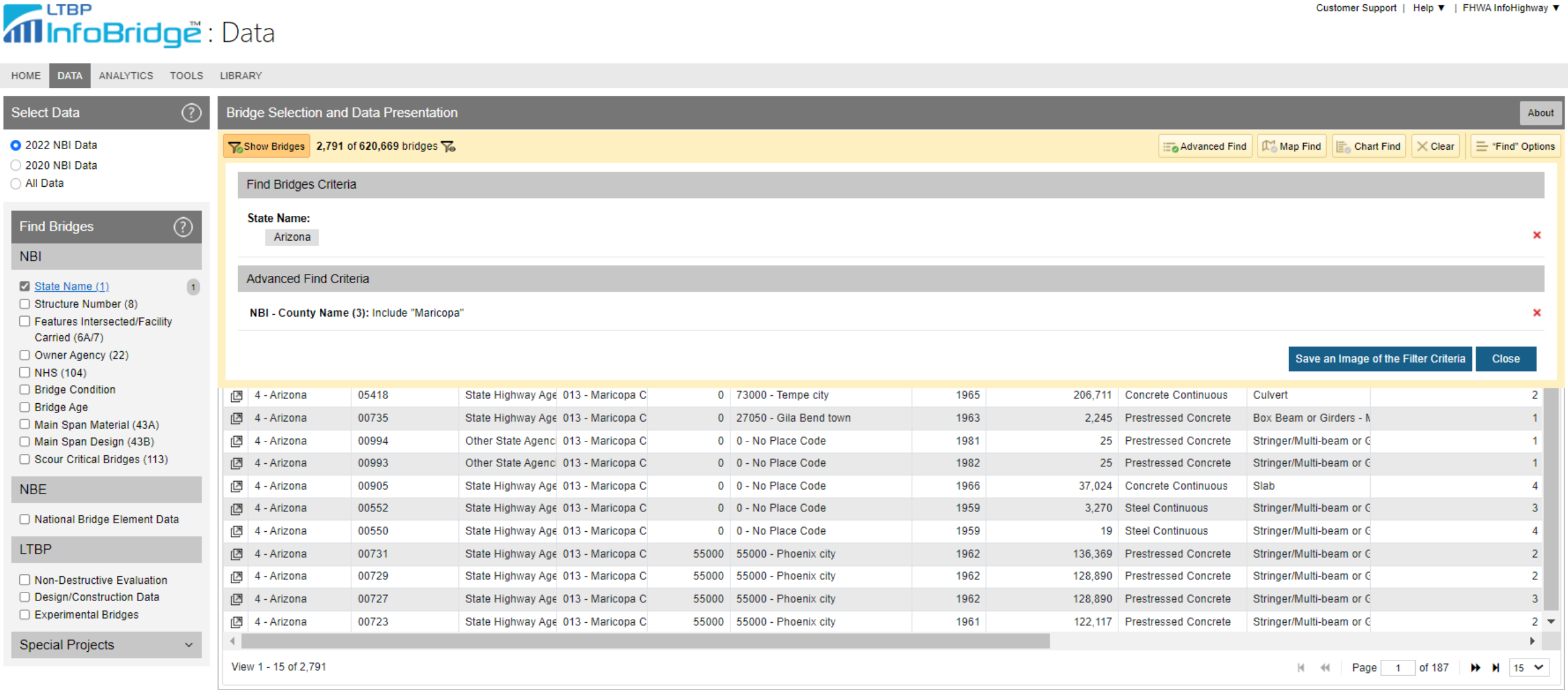
Source: FHWA.[5]

U.S. Department of Transportation
Federal Highway Administration

Turner-Fairbank Highway Research Center



Source: FHWA.[5]



Source: FHWA.[5]

- [ ] Non-Destructive Evaluation
- [ ] Design/Construction Data
- [ ] Experimental Bridges

Special Projects

4 - Arizona	00729	State Highway Age	013 - Maricopa C	55000	55000 - Phoenix city	1962	128,890	Prestressed Concrete	Stringer/Multi-beam or G	2
4 - Arizona	00727	State Highway Age	013 - Maricopa C	55000	55000 - Phoenix city	1962	128,890	Prestressed Concrete	Stringer/Multi-beam or G	3
4 - Arizona	00723	State Highway Age	013 - Maricopa C	55000	55000 - Phoenix city	1961	122,117	Prestressed Concrete	Stringer/Multi-beam or G	2

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Bridge Information

State Name (1):
Arizona

Structure Number (8):
00727

Previous Structure Number(s):
0727 (2016)

Data | Condition Forecast

Overview
NBI
NBE
Climate

Bridge Location

Data Availability

			2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Data	NBI													
	NBE													
	Climate Data													
	LTBP	NDE												
		Design/ Construction												
	Special Projects	Timber												
		UHPC												
		UWS												
		GRS-IBS												

Source: FHWA.[5]

Bridge Information

State Name (1): Arizona

Structure Number (8): 00727

Previous Structure Number(s): 0727 (2016)

Data | Condition Forecast

Overview
NBI
NBE
Climate

National Bridge Inventory (NBI) - 2022 ⓘ Bridge Summary Report

All | Identification and Location | Structure Type and Materials | Dimensions and Clearances | Inspection | Condition Rating and Evaluation | Load Rating and Posting | Traffic and Roadway Data | MPO, Political Districts, and Cities

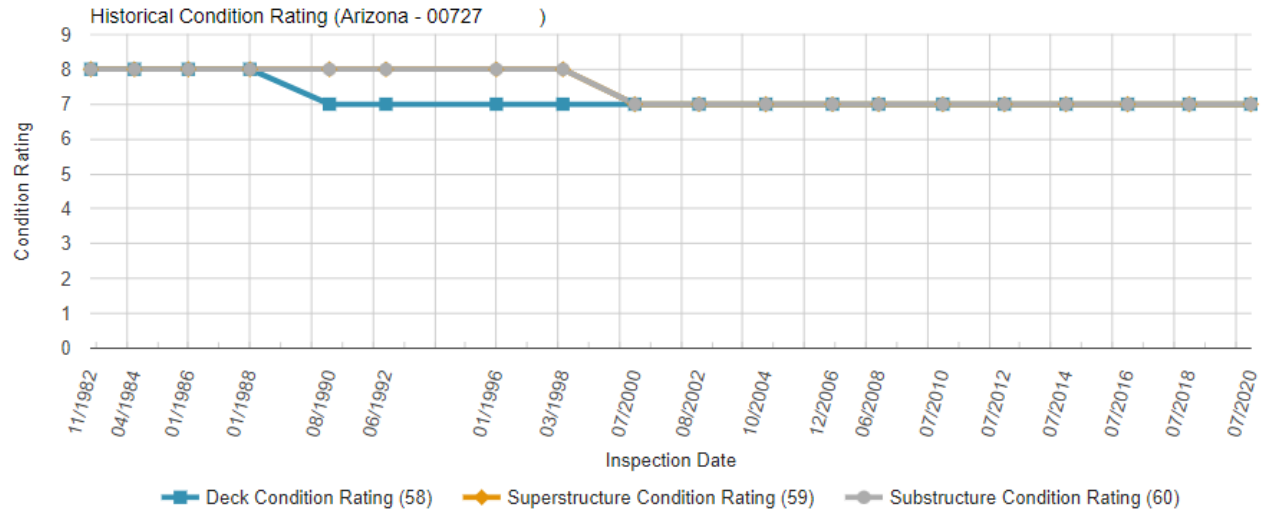
Select Year: 2022, 2021, 2020, 2019, 2018, 2017, 2016, 2015

Attribute	Value
State Name (1)	4 - Arizona
Highway Agency District (2)	78 - Central
County Name (3)	013 - Maricopa County
Place Code (4)	55000
Record Type (5A)	1 - On Structure
Route Signing Prefix Code (5B)	1 - Interstate Highway
Designated Level of Service Code (5C)	1 - Mainline
Route Number (5D)	00017
Directional Suffix Code (5E)	0 - Not Applicable
Features Intersected (6A)	SPRR
Facility Carried By Structure (7)	I 17
Structure Number (8)	00727
Location (9)	2.4 mi W Jct I 10
Inventory Route - Minimum Vertical Clearance, ft. (10)	"9999"
Mile Point, miles (11)	196.38
Base Highway Network (12)	0 - Not on Base Network
LRS Inventory Route (13A)	

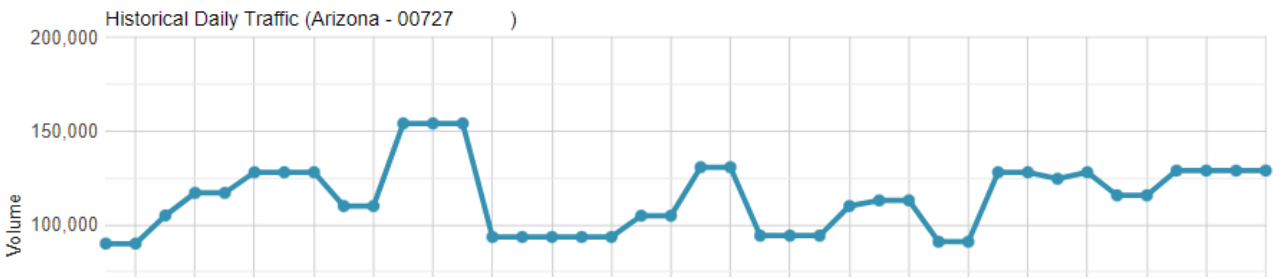
Select NBI Attributes

Condition Rating ✖ | Daily Traffic ✖ | Channel and Channel Protection Condition Rating ✖ | Load Rating ✖ | Structural Evaluation Appraisal ✖

Historical Condition Rating Graph ⓘ Save as CSV Save as Image



Historical Daily Traffic Graph Save as CSV Save as Image



Source: FHWA.[5]

Bridge Information

State Name (1): Arizona

Structure Number (8): 00727

Previous Structure Number(s): 0727 (2016)

Data | Condition Forecast

Overview
NBI
NBE
Climate

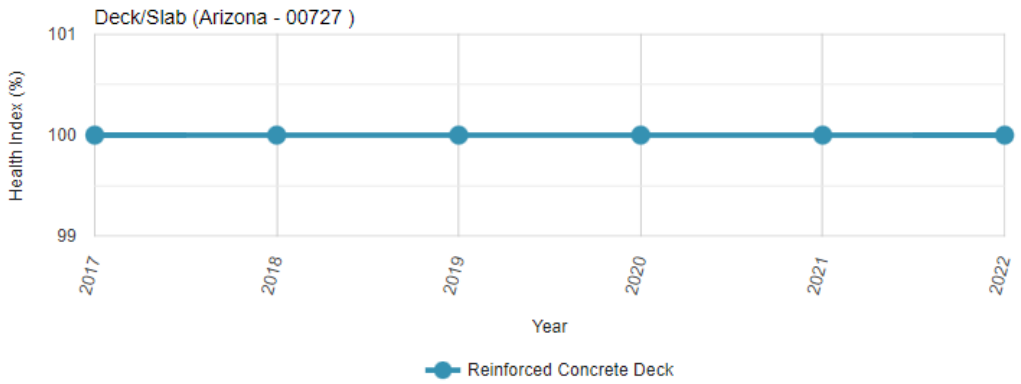
National Bridge Elements (NBE) - 2022

Select Year: 2022, 2021, 2020, 2019, 2018, 2017

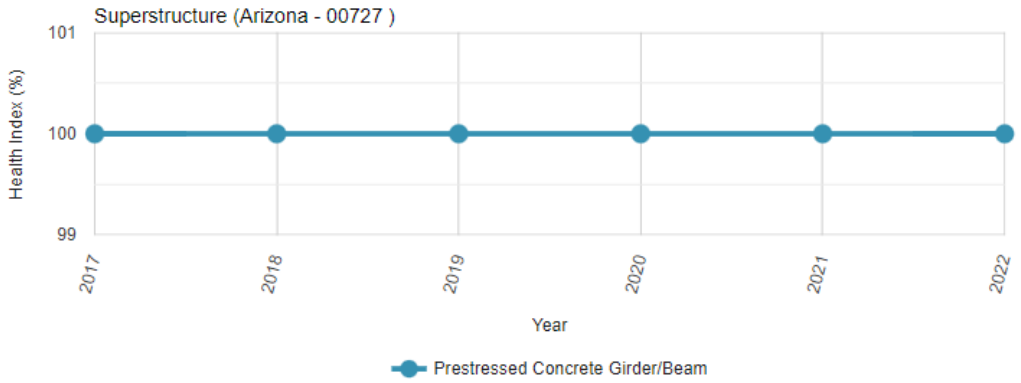
Element #	Element Name	Unit	Total Quantity	CS1	CS2	CS3	CS4	HI
Please enter a search term								
Deck/Slab								
12	Reinforced Concrete Deck	SF	14,786	14,785 (99%)	1	0	0	100.00
Superstructure								
109	Prestressed Concrete Girder/Beam	LF	2,000	2,000 (100%)	0	0	0	100
Substructure								
205	Reinforced Concrete Column	EA	26	26 (100%)	0	0	0	100
215	Reinforced Concrete Abutment	LF	250	250 (100%)	0	0	0	100
234	Reinforced Concrete Pier Cap	LF	115	115 (100%)	0	0	0	100
Bearing								
310	Elastomeric Bearings	EA	102	102 (100%)	0	0	0	100
Bridge Rail								
330	Steel Bridge Rail	LF	244	169 (69%)	0	75 (30%)	0	79.41
331	Reinforced Concrete Bridge Rail	LF	366	366 (100%)	0	0	0	100
Wearing Surfaces and Protective Coatings								
510	Wearing Surfaces	SF	14,786	14,786 (100%)	0	0	0	100

Historical NBE Health Index (HI) Graphs

Deck/Slab — Save as Image



Superstructure — Save as Image



Source: FHWA.[5]

Bridge Information

State Name (1): Arizona

Structure Number (8): 00727

Previous Structure Number(s): 0727 (2016)

Data | Condition Forecast

Overview
NBI
NBE
Climate

Climate Data - 2021

Climatic data is based on the location (latitude and longitude) as stored in the NBI database.

Select Year: 2021, 2020, 2019, 2018, 2017, 2016, 2015, 2014

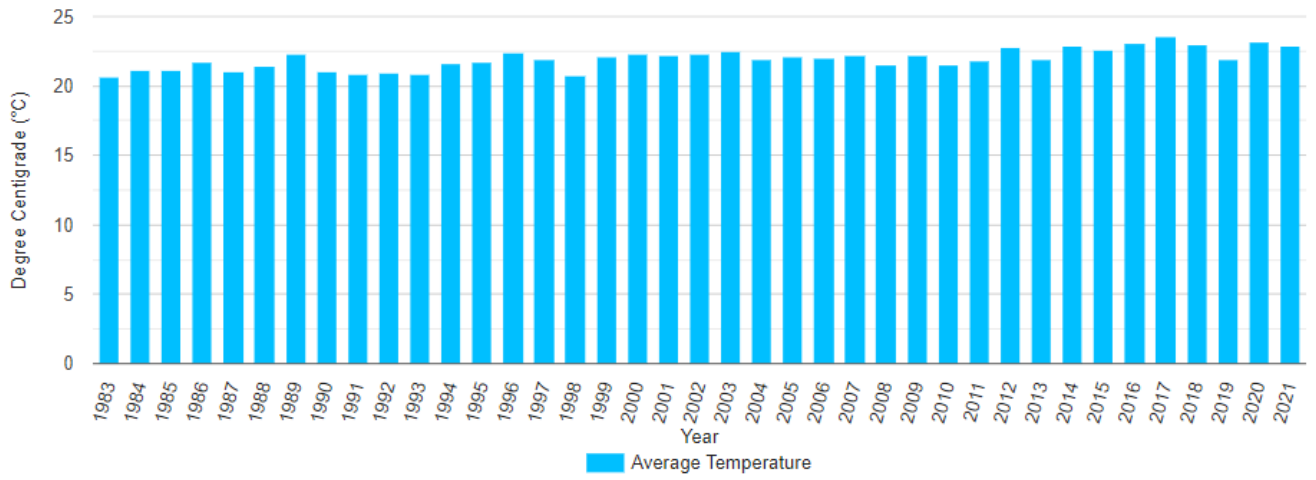
Annual | Monthly

Attribute	Value
Average Relative Humidity, (%)	31.58
Average Temperature, °C	22.88
Maximum Temperature, °C	47.3
Mean Wind Speed, miles per hour (mph)	2
Minimum Temperature, °C	-0.2
Number of Freeze-Thaw Cycles, days	1
Number of Snowfall Days, days	0
Number of Days with Measurable Precipitation, days	28
Number of Days with Temperature Below 0°C, days	1
Prevailing Wind Direction, degrees	153.34
Time of Wetness, hours/year	258
Total Precipitation, mm	275.59

Climate Graph

Save as Image

Select Attribute: Average Temperature, °C



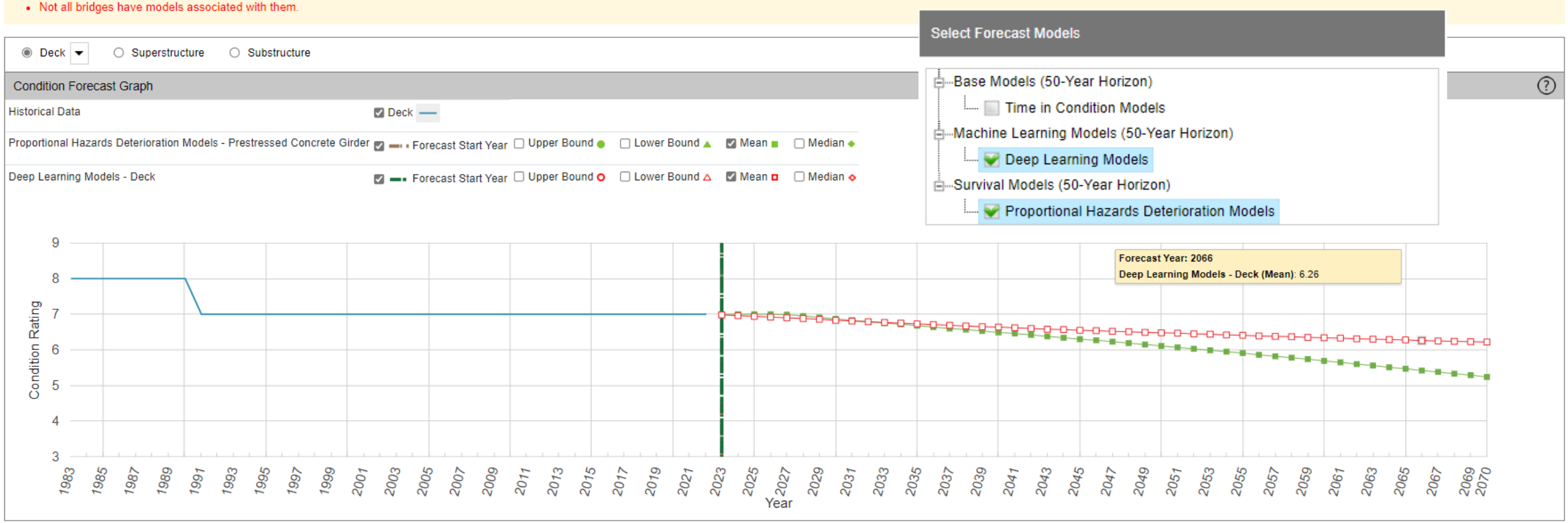
Source: FHWA.[5]

Bridge Information

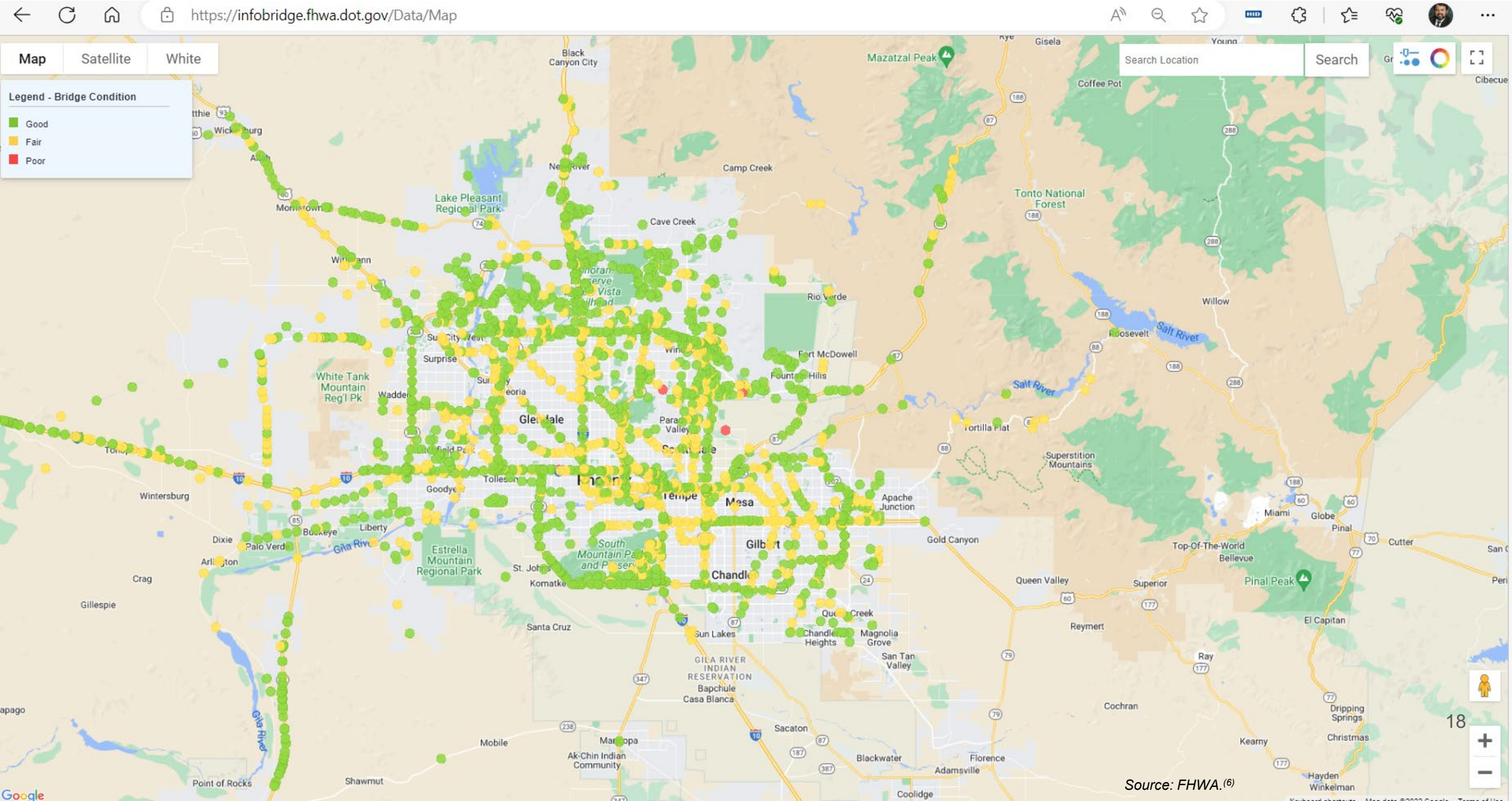
State Name (1):	Structure Number (8):	Previous Structure Number(s):
Arizona	00727	0727 (2016)

Data | Condition Forecast

- InfoBridge condition forecast models are the results of research performed by FHWA's Long-Term Bridge Performance Program. The Base Model is a statistical deterministic model. Survival and Machine Learning models are probabilistic. All three models are based on National Bridge Inventory items. InfoBridge users should not develop their bridge preservation/replacement program relying directly on models' output. Bridge owners are advised to consider additional site- and bridge-specific data when developing their bridge programs.
- Not all bridges have models associated with them.



Source: FHWA.[5]



18

Source: FHWA.[6]

HOME | DATA | ANALYTICS | TOOLS | LIBRARY

Select Data

- (•) 2022 NBI Data
- ( ) 2020 NBI Data
- ( ) All Data

Find Bridges

NBI

- [x] State Name (1)
- [ ] Structure Number (8)
- [ ] Features Intersected/Facility Carried (6A/7)
- [ ] Owner Agency (22)
- [ ] NHS (104)
- [ ] Bridge Condition
- [ ] Bridge Age
- [ ] Main Span Material (43A)
- [ ] Main Span Design (43B)
- [ ] Scour Critical Bridges (113)

NBE

- [ ] National Bridge Element Data

LTBP

- [ ] Non-Destructive Evaluation
- [ ] Design/Construction Data
- [ ] Experimental Bridges

Special Projects

Performance History — About

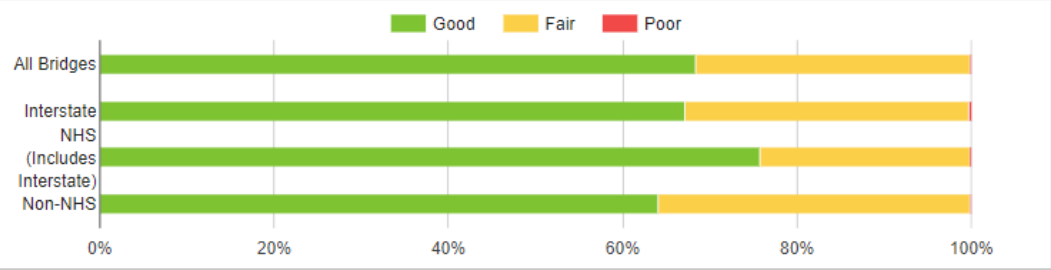
Show Bridges | 2,791 of 620,669 bridges | Advanced Find | Map Find | Chart Find | Clear | "Find" Options

Selected Bridges | Map | Performance History | Performance Forecast

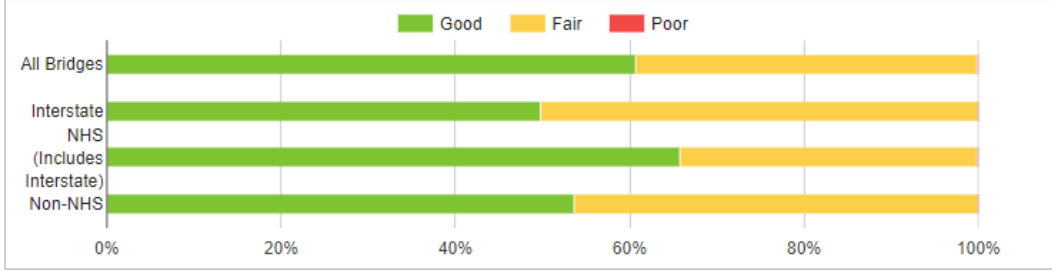
Bridge Performance Measures | Bridge Condition Transition History

Bridge Performance Measures for Selected Bridges

Percentages by Bridge Count



Percentages by Bridge Deck Area

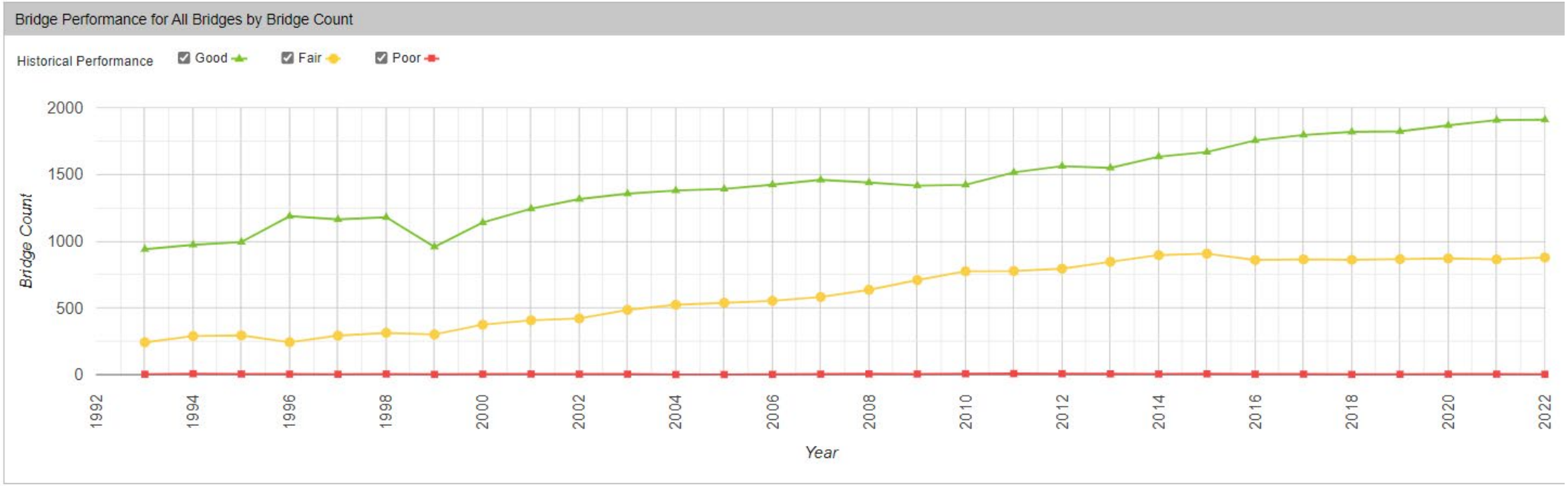


	Good	Fair	Poor
All Bridges	1,909 (68.40%)	878 (31.46%)	4 (0.14%)
	Total: 2,791		
Interstate	231 (67.15%)	112 (32.56%)	1 (0.29%)
	Total: 344 % of Total: 12.33%		
NHS (Includes Interstate)	797 (75.69%)	254 (24.12%)	2 (0.19%)
	Total: 1,053 % of Total: 37.73%		
Non-NHS	1,112 (63.98%)	624 (35.90%)	2 (0.12%)
	Total: 1,738 % of Total: 62.27%		

	Good	Fair	Poor
All Bridges	22,222,463 (60.67%)	14,372,967 (39.24%)	30,369 (0.08%)
	Total (sq. ft.): 36,625,799		
Interstate	3,201,749 (49.85%)	3,219,719 (50.12%)	1,932 (0.03%)
	Total (sq. ft.): 6,423,400 % of Total: 17.54%		
NHS (Includes Interstate)	14,035,866 (65.76%)	7,284,965 (34.13%)	24,807 (0.12%)
	Total (sq. ft.): 21,345,638 % of Total: 58.28%		
Non-NHS	8,186,598 (53.58%)	7,088,002 (46.39%)	5,562 (0.04%)
	Total (sq. ft.): 15,280,162 % of Total: 41.72%		

Source: FHWA.[7]

U.S. Department of Transportation
Federal Highway Administration
Turner-Fairbank Highway Research Center



Source: FHWA.[7]

Performance History

About

Show Bridges 2,791 of 620,669 bridges

Advanced Find | Map Find | Chart Find | Clear | "Find" Options

Selected Bridges | Map | Performance History | Performance Forecast

Bridge Performance Measures | Bridge Condition Transition History

Condition Transitioning From: Good In Year: 2017 To: Fair In Year: 2022 Display Results

Bridge Condition Transition History

Export Table

List of Bridges transitioning from Good Condition In Year 2017 to Fair Condition In Year 2022.

Bridge Condition: G - Good, F - Fair, P - Poor

1 - State Name	8 - Structure Number	22 - Owner Agency	CAT29 - Deck Area (sq. ft.)	27 - Year Built	43A - Main Span Material	43B - Main Span Design	2017	2018	2019	2020	2021	2022
Arizona	11490	County Highway Agency	1,373.5	2014	Concrete Continuous	Culvert	G	G	G	F	F	F
Arizona	02200	State Highway Agency	9,105.6	1991	Concrete Continuous	Slab	G	G	F	F	F	F
Arizona	10102	Town or Township Highway	1,825.6	1997	Concrete Continuous	Culvert	G	F	F	F	F	F
Arizona	09423	City or Municipal Highway A	10,170.2	1977	Prestressed Concrete	Tee Beam	G	F	F	F	F	F
Arizona	08529	City or Municipal Highway A	6,697.3	1979	Concrete Continuous	Girder and Floorbeam System	G	G	G	G	G	F
Arizona	08514	City or Municipal Highway A	6,103.1	1979	Concrete	Girder and Floorbeam System	G	G	G	G	G	F
Arizona	09599	City or Municipal Highway A	18,954.0	1978	Concrete Continuous	Slab	G	G	G	G	G	F
Arizona	11424	City or Municipal Highway A	1,551.1	1994	Steel Continuous	Culvert	G	G	G	G	F	F
Arizona	11198	City or Municipal Highway A	1,602.1	2010	Concrete Continuous	Culvert	G	G	G	G	G	F
Arizona	02487	State Highway Agency	12,361.8	1997	Prestressed Concrete Continuous	Box Beam or Girders - Single or Sp	G	G	G	G	F	F

View 1 - 10 of 60

Page 1 of 6 10

Source: FHWA.[7]

Performance Forecast

About

Show Bridges 2,791 of 620,669 bridges

Advanced Find | Map Find | Chart Find | Clear | "Find" Options

Selected Bridges | Map | Performance History | Performance Forecast

Forecast Performance Measures for Current Bridge Selection

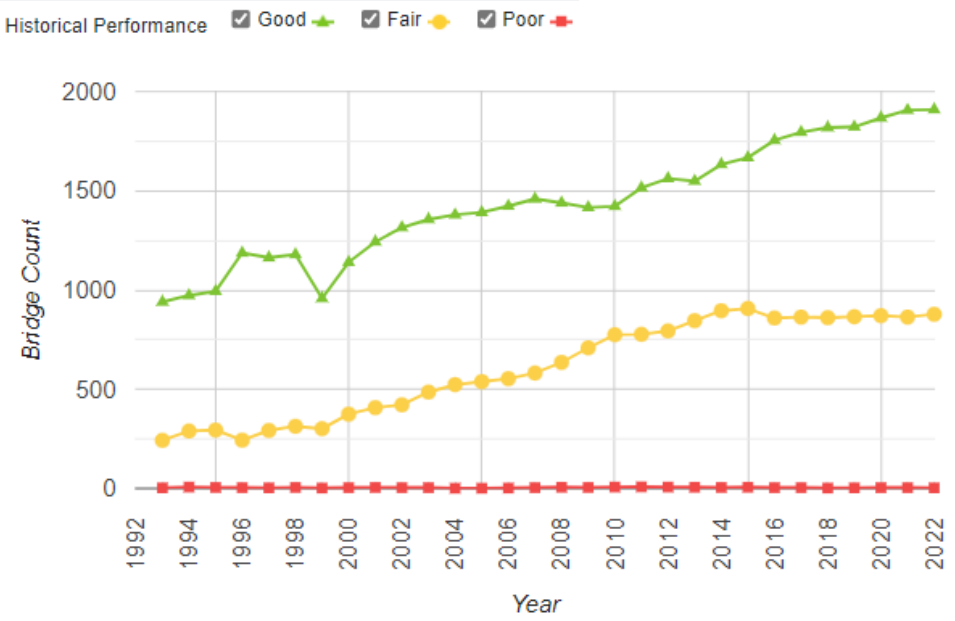
- Survival and Machine Learning condition forecast models are the results of research performed by FHWA's Long-Term Bridge Performance Program. These are probabilistic models based on National Bridge Inventory items. Preservation Levels are not based on historical preservation actions and expenditures; rather they are based on reported historical bridge condition (Good-Fair-Poor) trends. InfoBridge users should not develop their bridge preservation/replacement program relying directly on models' output. Bridge owners are advised to consider additional site- and bridge-specific data when developing their bridge programs.
- Not all bridges have models associated with them.

Show Series: (•) All Bridges ( ) Interstate ( ) NHS (Includes Interstate) ( ) Non-NHS

Network Performance Forecast | Bridge Condition Transition Forecast

Network Performance Forecast Models

Bridge Performance for All Bridges by Bridge Count



Source: FHWA.[8]

Bridge Performance for All Bridges by Percentage Bridge Count

Historical Performance ☑ Good ☑ Fair ☑ Poor

Performance Forecast

About

Show Bridges 2,791 of 620,669 bridges

Advanced Find | Map Find | Chart Find | Clear | "Find" Options

Selected Bridges | Map | Performance History | Performance Forecast

Forecast Performance Measures for Current Bridge Selection

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- Not all bridges have models associated with them.

Show Series: (•) All Bridges ( ) Interstate ( ) NHS (Includes Interstate) ( ) Non-NHS

Network Performance Forecast | Bridge Condition Transition Forecast

Network Performance Forecast Models

Select Network Forecast Models

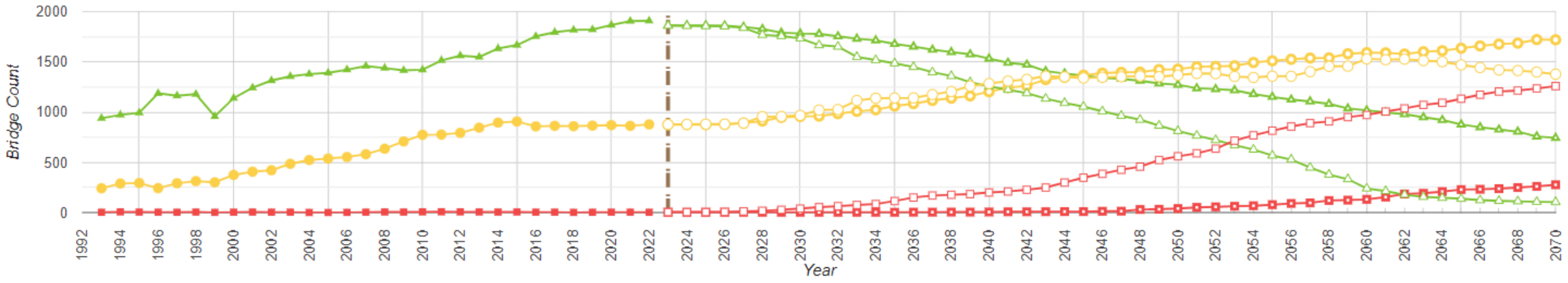
- Survival Models (50-Year Horizon)
  - Proportional Hazards Deterioration Models
    - [x] Limited Preservation
    - [ ] Moderate Preservation
    - [x] Maximum Preservation
- Machine Learning Models (50-Year Horizon)
  - Deep Learning Models
    - [ ] Level 1
    - [ ] Level 2

Bridge Performance for All Bridges by Bridge Count

Historical Performance — [x] Good [x] Fair [x] Poor

Proportional Hazards Deterioration Models - Maximum Preservation — [x] Good [x] Fair [x] Poor

Proportional Hazards Deterioration Models - Limited Preservation — [x] Good [x] Fair [x] Poor



Bridge Performance for All Bridges by Percentage Bridge Count

Historical Performance — [x] Good [x] Fair [x] Poor

Proportional Hazards Deterioration Models - Maximum Preservation — [x] Good [x] Fair [x] Poor

Source: FHWA.[8]

Performance Forecast

About

Show Bridges 2,791 of 620,669 bridges

Advanced Find | Map Find | Chart Find | Clear | "Find" Options

Selected Bridges | Map | Performance History | Performance Forecast

Forecast Performance Measures for Current Bridge Selection

- Survival and Machine Learning condition forecast models are the results of research performed by FHWA's Long-Term Bridge Performance Program. These are probabilistic models based on National Bridge Inventory items. Preservation Levels are not based on historical preservation actions and expenditures; rather they are based on reported historical bridge condition (Good-Fair-Poor) trends. InfoBridge users should not develop their bridge preservation/replacement program relying directly on models' output. Bridge owners are advised to consider additional site- and bridge-specific data when developing their bridge programs.
- InfoBridge "Bridge Condition Transition Forecast" tool builds on the portal's condition forecast models. The tool is intended to assist users in assembling a preliminary list of bridges that may transition from a given condition to another for a user specified period of time. Additional site specific and historical preservation actions must be taken into account when finalizing the list. The generated list of bridges is highly dependent on the user selected "Probability of Occurrence".
- Not all bridges have models associated with them.

Network Performance Forecast | Bridge Condition Transition Forecast

Performance Forecast Models

Transitioning From: Good | In Year: 2022 | To: Fair | In Year: 2032 | Probability of Occurence (%) Greater Than Or Equal To: 50 | Display Results

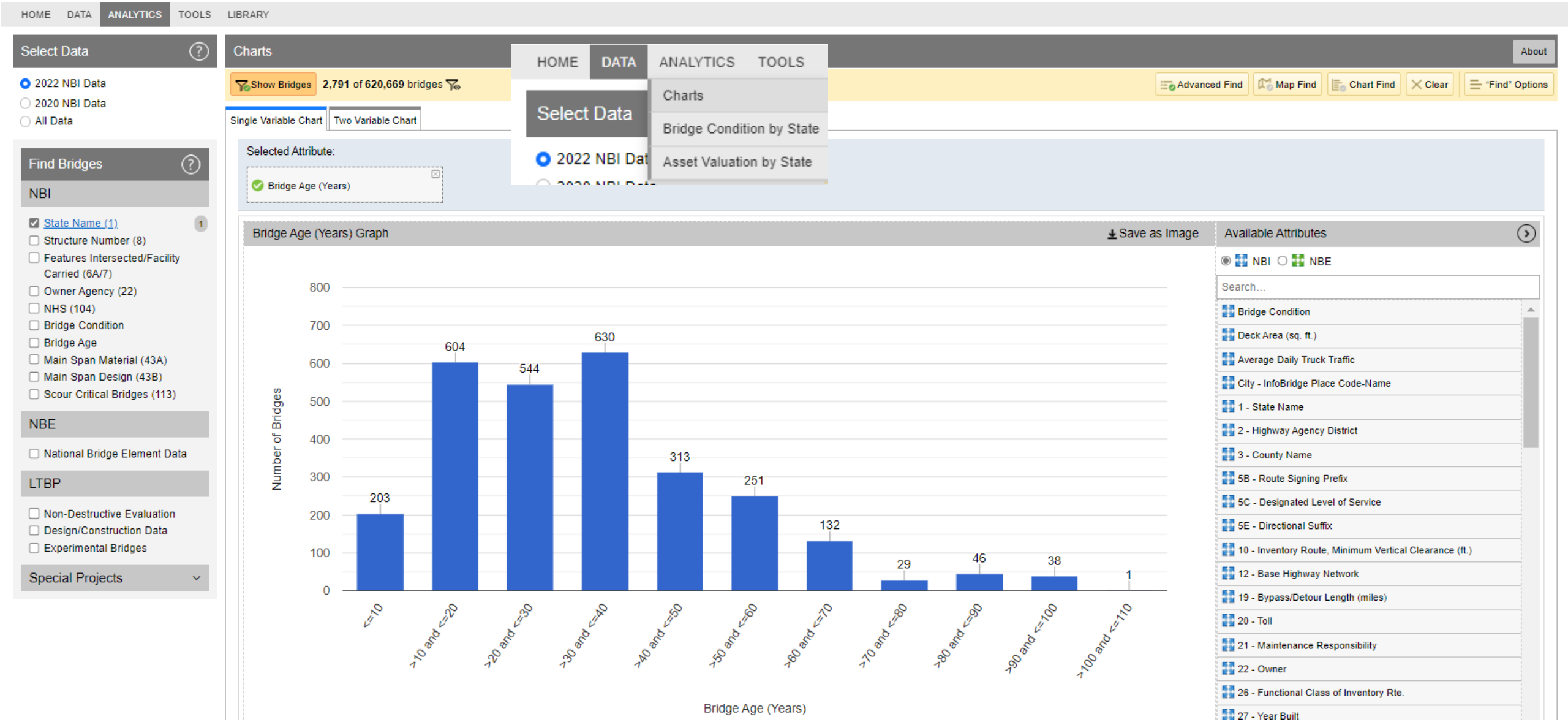
Bridge Condition Transition Forecast

Export Table

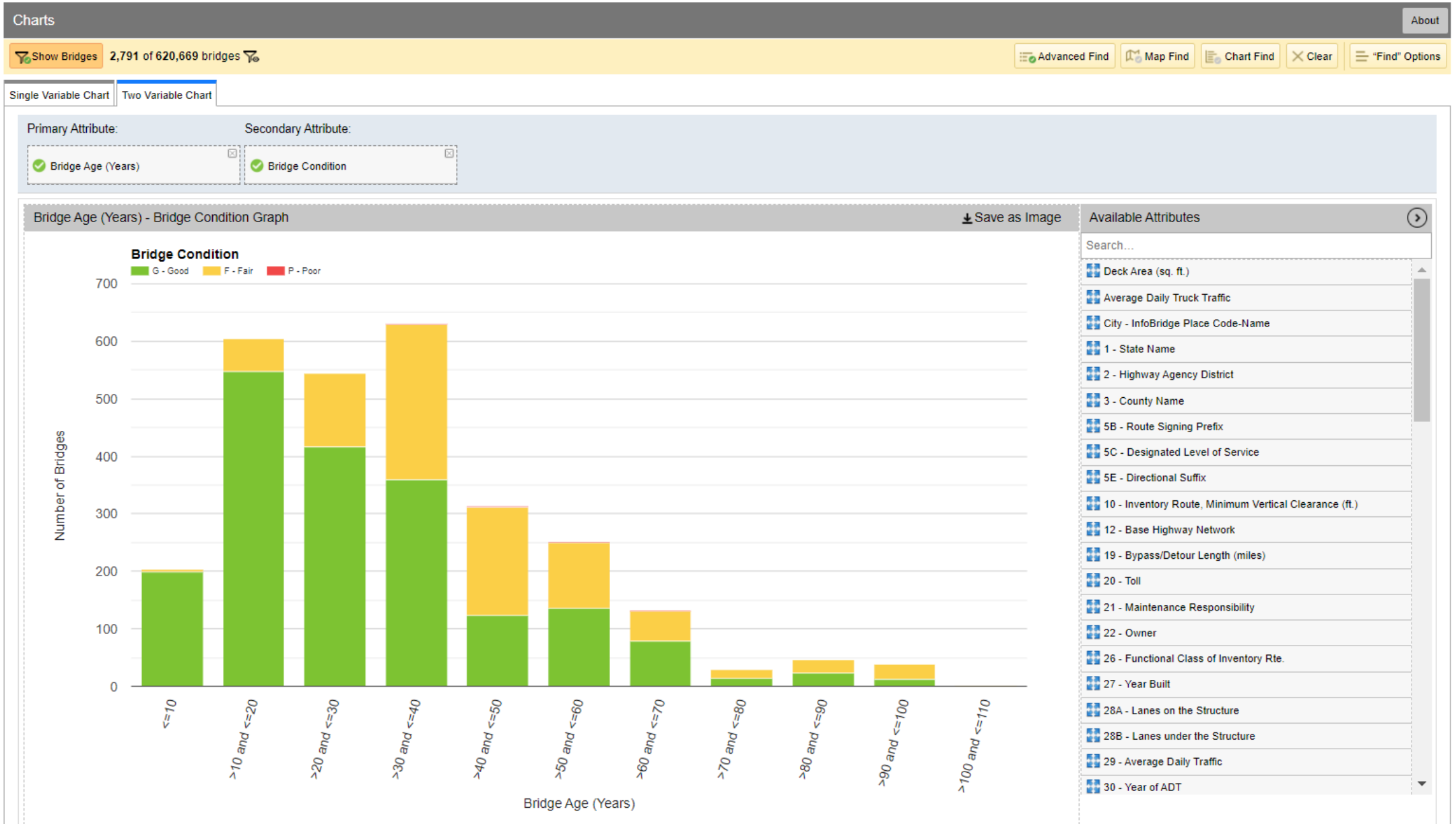
List of Bridges transitioning from Good Condition In Year 2022 to Fair Condition In Year 2032. Performance Forecast is based on Proportional Hazards Deterioration Models - Limited Preservation

1 - State Name	8 - Structure Number	22 - Owner Agency	CAT29 - Deck Area (sq. ft.)	27 - Year Built	43A - Main Span Material	43B - Main Span Design	Probability of Occurrence (%)
Arizona	09192	City or Municipal Highway Ag	3,229.5	1952	Concrete Continuous	Slab	51
Arizona	09701	City or Municipal Highway Ag	68,974.1	1980	Prestressed Concrete	Box Beam or Girders - Multiple	50
Arizona	09882	City or Municipal Highway Ag	3,202.3	1970	Prestressed Concrete	Box Beam or Girders - Multiple	52
Arizona	10011	City or Municipal Highway Ag	15,888.7	1986	Prestressed Concrete	Box Beam or Girders - Multiple	57
Arizona	10674	City or Municipal Highway Ag	8,610.9	1979	Prestressed Concrete	Box Beam or Girders - Multiple	53

Source: FHWA.[8]



Source: FHWA.[9]



Source: FHWA.[9]

HOME DATA ANALYTICS TOOLS LIBRARY

TOOLS LIBRARY

Asset Valuation | Selected Bridges

Bridge Condition Transition | By State

Bridge Network Performance | 2,791 of 620,669 bridges

Historical Spec Changes

Select Data

- (•) 2022 NBI Data
- ( ) 2020 NBI Data
- ( ) All Data

Find Bridges

NBI

- [x] State Name (1) 1
- [ ] Structure Number (8)
- [ ] Features Intersected/Facility Carried (6A/7)
- [ ] Owner Agency (22)
- [ ] NHS (104)
- [ ] Bridge Condition
- [ ] Bridge Age
- [ ] Main Span Material (43A)
- [ ] Main Span Design (43B)
- [ ] Scour Critical Bridges (113)

NBE

- [ ] National Bridge Element Data

LTBP

- [ ] Non-Destructive Evaluation
- [ ] Design/Construction Data
- [ ] Experimental Bridges

Special Projects

Asset Valuation

About

Show Bridges 2,791 of 620,669 bridges

Advanced Find | Map Find | Chart Find | Clear | "Find" Options

Enter a Replacement Unit Cost ($/ sq. ft. of Deck Area) or select it from the list.

Replacement Unit Cost ($/sq. ft.): 263 List

Total Bridge Count for Selected Bridges: 2,791
Total Deck Area for Selected Bridges (sq. ft.): 36,625,799.8
Total Replacement Value for Selected Bridges ($): 9,632,585,327
Total Existing Value for Selected Bridges ($): 9,106,666,536
Remaining Value for Selected Bridges (%): 94.5

Show Bridge Component Condition and Operating Ratings: Show | Do Not Show

Selected Bridges

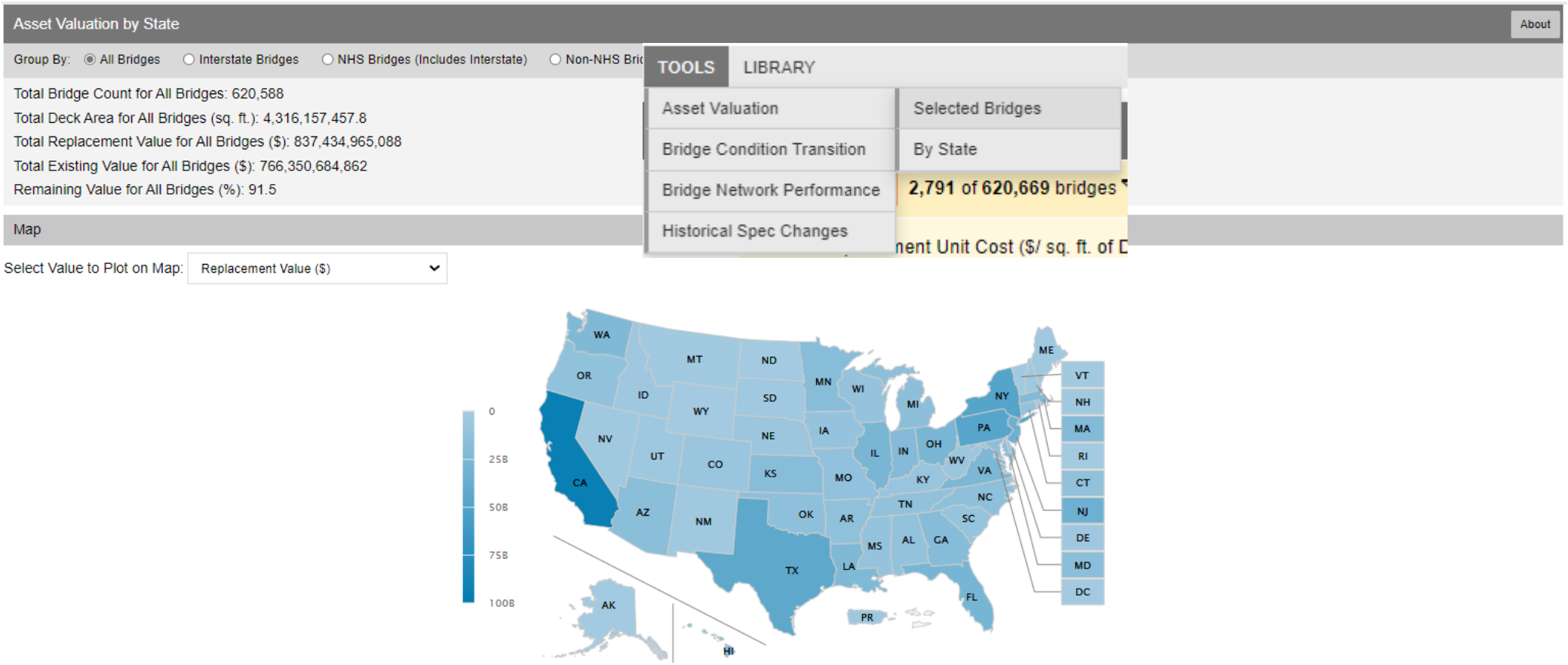
Export Table

1 - State Name	8 - Structure Number	22 - Owner Agency	CAT29 - Deck Area (sq. ft.)	Replacement Value ($)	Existing Value ($)	Remaining Value (%)
4 - Arizona	00027	State Highway Agency	1,192.0	313,495	295,155	94.1
4 - Arizona	00028	State Highway Agency	847.0	222,764	205,667	92.3
4 - Arizona	00015	State Highway Agency	538.0	141,489	129,462	91.5
4 - Arizona	07148	State Highway Agency	1,037.4	272,843	259,201	95.0
4 - Arizona	00221	State Highway Agency	2,047.7	538,552	497,218	92.3
4 - Arizona	00031	State Highway Agency	2,423.2	637,294	591,090	92.7
4 - Arizona	06906	State Highway Agency	924.4	243,118	230,962	95.0
4 - Arizona	02164	State Highway Agency	7,232.0	1,902,029	1,822,619	95.8
4 - Arizona	07263	State Highway Agency	2,310.1	607,569	592,380	97.5
4 - Arizona	11504	City or Municipal Highway Agency	9,492.8	2,496,604	2,434,189	97.5

View 1 - 10 of 2,791 Page 1 of 280 10

Source: FHWA.[10]

U.S. Department of Transportation
Federal Highway Administration
Turner-Fairbank Highway Research Center



All Bridges

Export Table

1 - State Name	Total Bridge Count	Total Deck area (sq. ft.)	Replacement Value ($)	Replacement Unit Cost ($)	Existing Value ($)	Remaining Value (%)
1 - Alabama	16,162	107,893,487.3	11,760,390,101	109	10,787,560,959	91.7
2 - Alaska	1,626	8,231,520.5	2,461,224,616	299	2,274,408,108	92.4
4 - Arizona	8,497	65,837,007.4	17,315,132,920	263	16,288,786,485	94.1
5 - Arkansas	12,955	74,155,559.7	13,570,467,411	183	12,484,591,902	92.0
6 - California	25,810	325,755,754.7	94,794,924,619	291	86,741,967,518	91.5
8 - Colorado	8,917	55,395,943.4	8,420,183,399	152	7,770,567,138	92.3

Source: FHWA.[11]

HOME DATA ANALYTICS TOOLS LIBRARY

Library

- InfoBridge Documentation
- InfoBridge Update Notes
- LTBP Documentation
- Historical Spec Changes
- Student Data Analysis Contest

InfoBridge Documentation

NBI Coding Guide

The Recording and Coding Guide for the Structure Inventory and Appraisal of the Nations Bridges

NBI Recording and Coding Guide Errata

The guide is in metric units. Data in InfoBridge™ is presented in US customary units.

NBE Specification

Specification for National Bridge Inventory Bridge Elements

InfoBridge Brochure

LTBP InfoBridge Brochure

Bridge Component Condition Forecast Models

The bridge component condition forecast models are products of on-going research:

- Base Models
- Survival Models
- Machine Learning Models

The bridge component condition forecast models are only available for bridges matching all the following criteria:

- Length of Maximum Span (NBI Item # 48) < 200 ft, and
- Main Span Materials (NBI Item # 43A)=1 or 2 or 3 or 4 or 5 or 6, and
- Main Span Design (NBI Item # 43B)=1 or 2 or 3 or 4 or 5 or 6 or 22, and
- Deck Structure Type (NBI Item # 107)=1 or 2.

Bridge Network Performance Forecast Models

The bridge network performance forecast models are based on the bridge component condition forecast models, which are products of on-going research:

- Survival Models
- Machine Learning Models

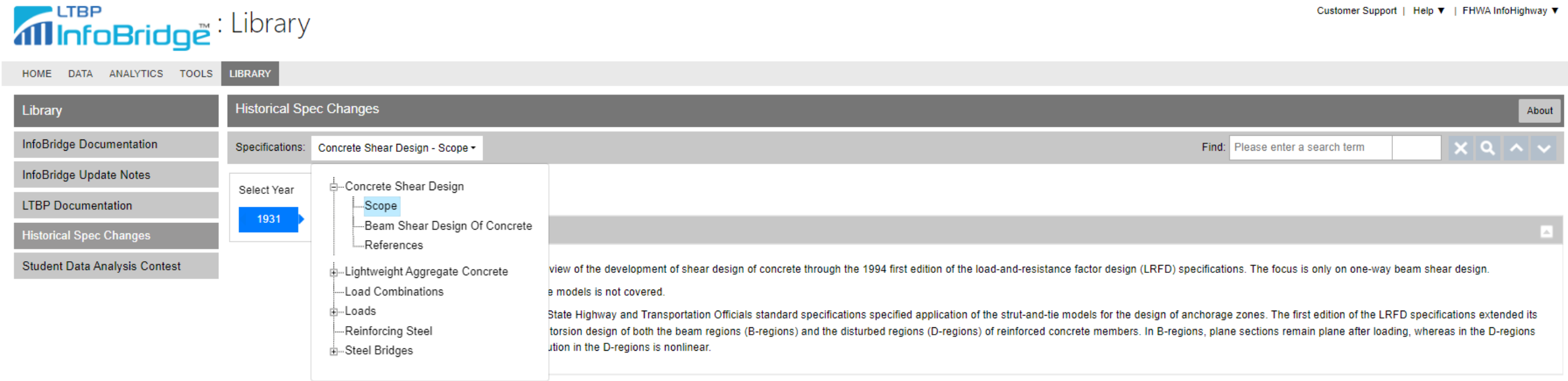
Bridge Condition Transition

- Bridge Condition Transition History
- Bridge Condition Transition Forecast

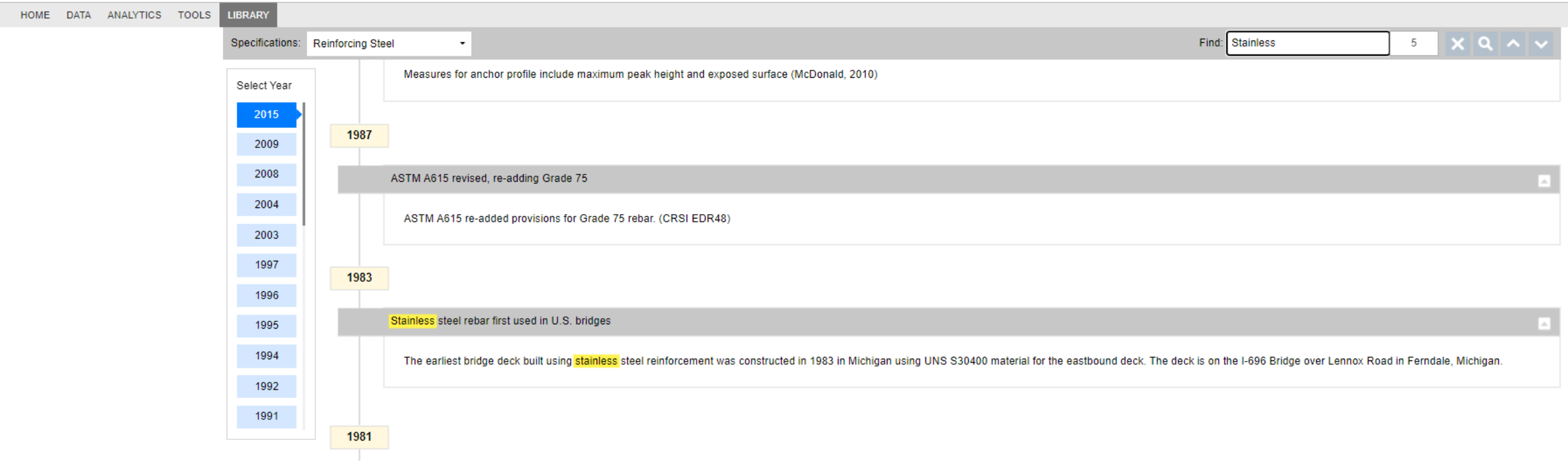
Asset Valuation Calculations

- Asset Valuation Calculations

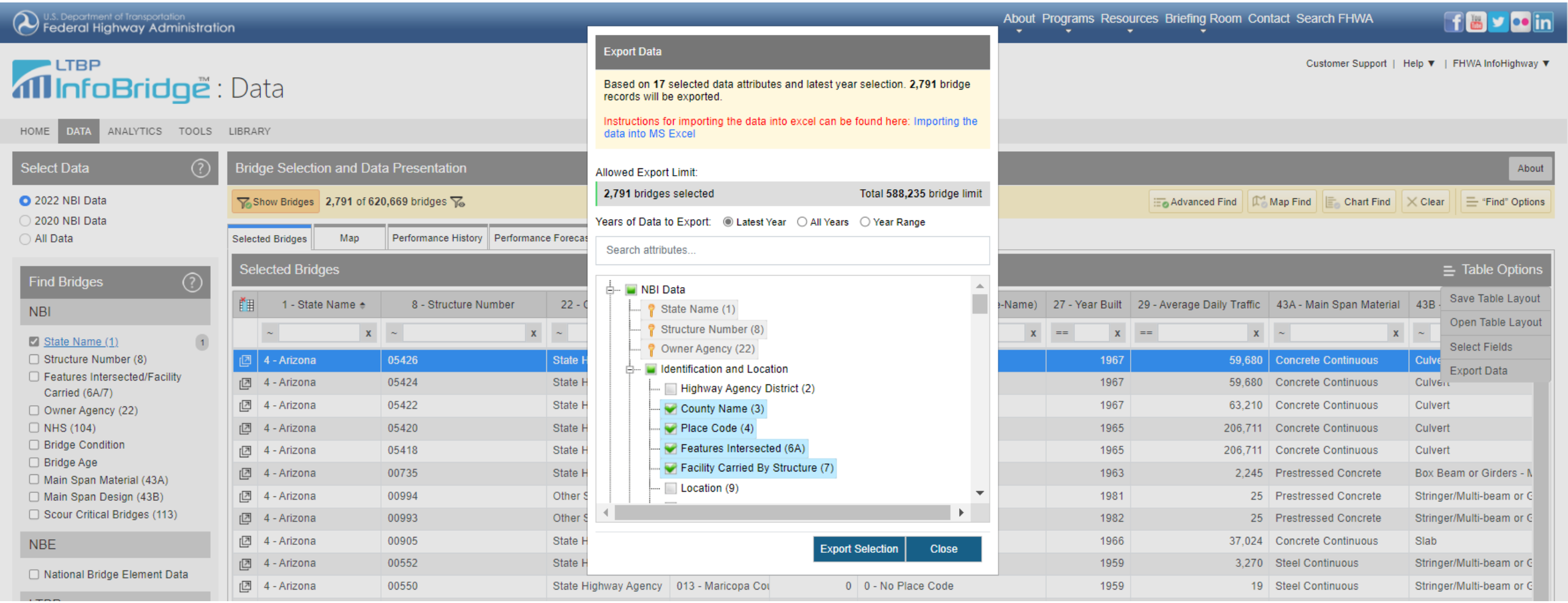
Source: FHWA.[12]



Source: FHWA.[13]



Source: FHWA.[13]



Source: FHWA.[5]

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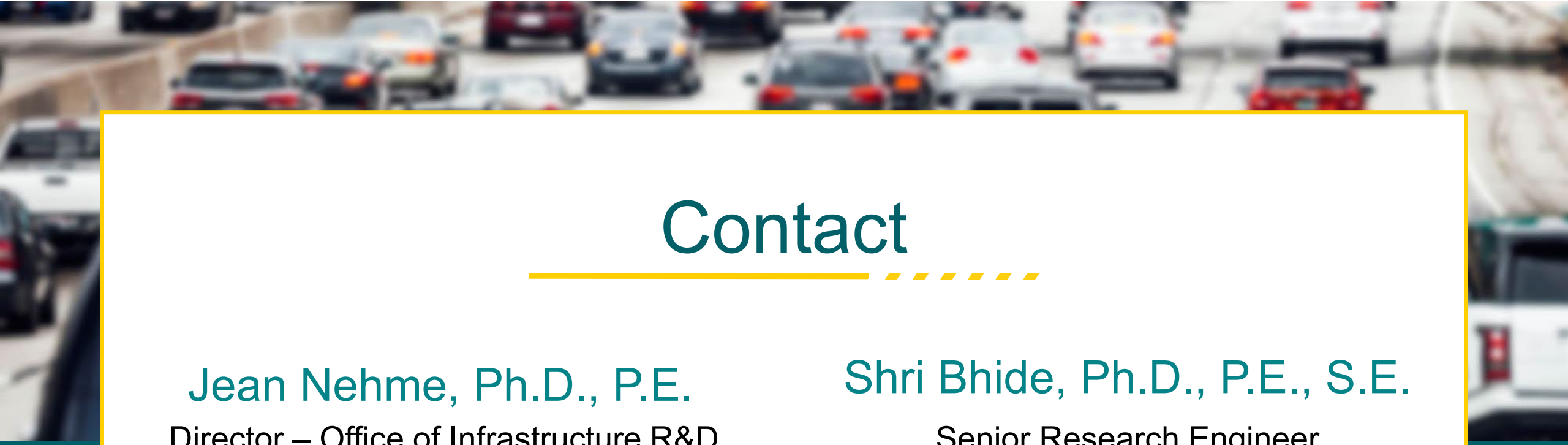
Questions?



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