



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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Federal Highway Administration (FHWA)

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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.**



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⁾



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.



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



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



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⁾

Help ▾



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.



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



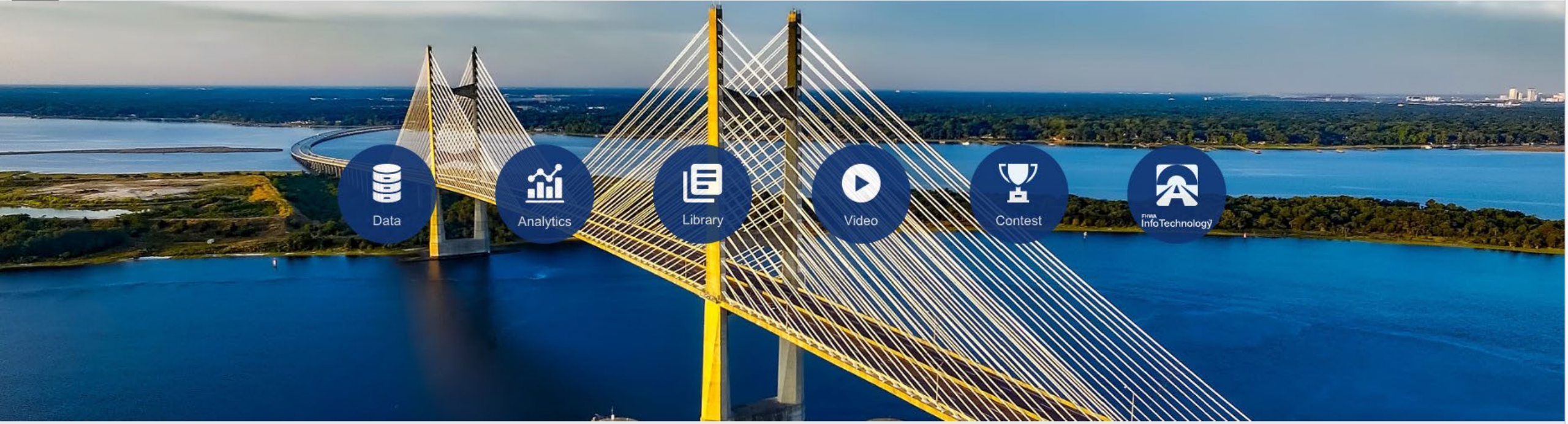
Provides access, visualization, and synthesizing of FHWA's infrastructure research and materials testing data.



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

Source: FHWA.⁽¹⁾





Select Data ?

- 2022 NBI Data
- 2020 NBI Data
- All Data

Find Bridges ?

NBI

- 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

Bridge Selection and Data Presentation

About

Show Bridges 620,669 of 620,669 bridges

Advanced Find Map Find Chart Find Clear "Find" Options

Selected Bridges Map Performance History Performance Forecast

Selected Bridges

Table Options

1 - State Name	8 - Structure Number	22 - Owner Agency	3 - County Name	4 - Place Code	City (InfoBridge Place Code-Name)	27 - Year Built	29 - Average Daily Traffic	43A - Main Span Material	43B - Main Span Design	45 - Number of Spans in Main Unit
1 - Alabama	018445	County Highway A	103 - Morgan Co	0	0 - No Place Code	2002	1,750	Concrete	Channel Beam	3
1 - Alabama	018444	County Highway A	005 - Barbour Co	0	0 - No Place Code	2001	73	Steel	Culvert	3
1 - Alabama	018439	County Highway A	001 - Autauga Co	0	46600 - Marbury CDP	2001	10	Concrete	Channel Beam	2
1 - Alabama	018437	County Highway A	099 - Monroe Co	0	0 - No Place Code	2000	100	Wood or Timber	Stringer/Multi-beam or C	2
1 - Alabama	018435	County Highway A	015 - Calhoun Co	56472	0 - No Place Code	2002	42	Concrete	Culvert	3
1 - Alabama	018434	County Highway A	015 - Calhoun Co	38272	01180 - Alexandria CDP	2002	602	Concrete	Culvert	3
1 - Alabama	018433	County Highway A	117 - Shelby Cou	34024	34024 - Helena city	2001	10,766	Concrete	Culvert	2
1 - Alabama	018432	County Highway A	065 - Hale Count	0	0 - No Place Code	2002	140	Concrete	Channel Beam	5
1 - Alabama	018431	State Highway Age	119 - Sumter Cou	0	24256 - Epes town	2001	1,340	Prestressed Concrete	Stringer/Multi-beam or C	1
1 - Alabama	018428	County Highway A	039 - Covington C	0	0 - No Place Code	2001	210	Concrete	Channel Beam	1
1 - Alabama	018427	County Highway A	121 - Talladega C	14464	0 - No Place Code	2000	508	Concrete	Culvert	4
1 - Alabama	018426	County Highway A	057 - Fayette Cou	25840	0 - No Place Code	1940	20	Steel	Truss - Thru	1
1 - Alabama	018425	County Highway A	057 - Fayette Cou	25840	0 - No Place Code	1980	30	Steel	Stringer/Multi-beam or C	1
1 - Alabama	018176	State Highway Age	083 - Limestone C	2956	02956 - Athens city	2005	16,400	Prestressed Concrete	Stringer/Multi-beam or C	6
1 - Alabama	018356	County Highway A	005 - Barbour Co	0	0 - No Place Code	2005	60	Concrete	Channel Beam	2

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Source: FHWA.⁽⁵⁾

Select Data ?

Bridge Selection and Data Presentation About

- 2022 NBI Data
- 2020 NBI Data
- All Data

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

Find Bridges ?

- NBI
- 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

Advanced Find ?

Category	Field	Operator	Value
NBI	Please type to filter fields	Include	Type multiple options
NBE	Highway Agency District (2)	Exclude	
MPO, Political Districts, and Cities	County Name (3)		
Special Projects	Place Code (4)		
Timber Bridges	Record Type (5A)		
UHPC	Route Signing Prefix (5B)		
UWS	Designated Level of Service (5C)		

Add Criteria Close

1 - Alabama	018432	County Highway A	065 - Hale Count	0	0 - No Place Code	2002	140	Concrete	Channel Beam	5
1 - Alabama	018431	State Highway Age	119 - Sumter Cou	0	24256 - Epes town	2001	1,340	Prestressed Concrete	Stringer/Multi-beam or C	1
1 - Alabama	018428	County Highway A	039 - Covington C	0	0 - No Place Code	2001	210	Concrete	Channel Beam	1
1 - Alabama	018427	County Highway A	121 - Talladega C	14464	0 - No Place Code	2000	508	Concrete	Culvert	4
1 - Alabama	018426	County Highway A	057 - Fayette Cou	25840	0 - No Place Code	1940	20	Steel	Truss - Thru	1
1 - Alabama	018425	County Highway A	057 - Fayette Cou	25840	0 - No Place Code	1980	30	Steel	Stringer/Multi-beam or C	1
1 - Alabama	018176	State Highway Age	083 - Limestone C	2956	02956 - Athens city	2005	16,400	Prestressed Concrete	Stringer/Multi-beam or C	6
1 - Alabama	018356	County Highway A	005 - Barbour Co	0	0 - No Place Code	2005	60	Concrete	Channel Beam	2

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Source: FHWA.⁽⁵⁾ 11

Select Data

- 2022 NBI Data
- 2020 NBI Data
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Find Bridges

NBI

- State Name (1)
- Structure Number (8)
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NBE

- National Bridge Element Data

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- Non-Destructive Evaluation
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Special Projects

Bridge Selection and Data Presentation

Show Bridges 2,791 of 620,669 bridges

Advanced Find Map Find Chart Find Clear "Find" Options

Find Bridges Criteria

State Name:

Arizona

Advanced Find Criteria

NBI - County Name (3): Include "Maricopa"

Save an Image of the Filter Criteria Close

4 - Arizona	05418	State Highway Age 013 - Maricopa C	0	73000 - Tempe city	1965	206,711	Concrete Continuous	Culvert	2
4 - Arizona	00735	State Highway Age 013 - Maricopa C	0	27050 - Gila Bend town	1963	2,245	Prestressed Concrete	Box Beam or Girders - M	1
4 - Arizona	00994	Other State Agenc 013 - Maricopa C	0	0 - No Place Code	1981	25	Prestressed Concrete	Stringer/Multi-beam or C	1
4 - Arizona	00993	Other State Agenc 013 - Maricopa C	0	0 - No Place Code	1982	25	Prestressed Concrete	Stringer/Multi-beam or C	1
4 - Arizona	00905	State Highway Age 013 - Maricopa C	0	0 - No Place Code	1966	37,024	Concrete Continuous	Slab	4
4 - Arizona	00552	State Highway Age 013 - Maricopa C	0	0 - No Place Code	1959	3,270	Steel Continuous	Stringer/Multi-beam or C	3
4 - Arizona	00550	State Highway Age 013 - Maricopa C	0	0 - No Place Code	1959	19	Steel Continuous	Stringer/Multi-beam or C	4
4 - Arizona	00731	State Highway Age 013 - Maricopa C	55000	55000 - Phoenix city	1962	136,369	Prestressed Concrete	Stringer/Multi-beam or C	2
4 - Arizona	00729	State Highway Age 013 - Maricopa C	55000	55000 - Phoenix city	1962	128,890	Prestressed Concrete	Stringer/Multi-beam or C	2
4 - Arizona	00727	State Highway Age 013 - Maricopa C	55000	55000 - Phoenix city	1962	128,890	Prestressed Concrete	Stringer/Multi-beam or C	3
4 - Arizona	00723	State Highway Age 013 - Maricopa C	55000	55000 - Phoenix city	1961	122,117	Prestressed Concrete	Stringer/Multi-beam or C	2

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Source: FHWA.⁽⁵⁾

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

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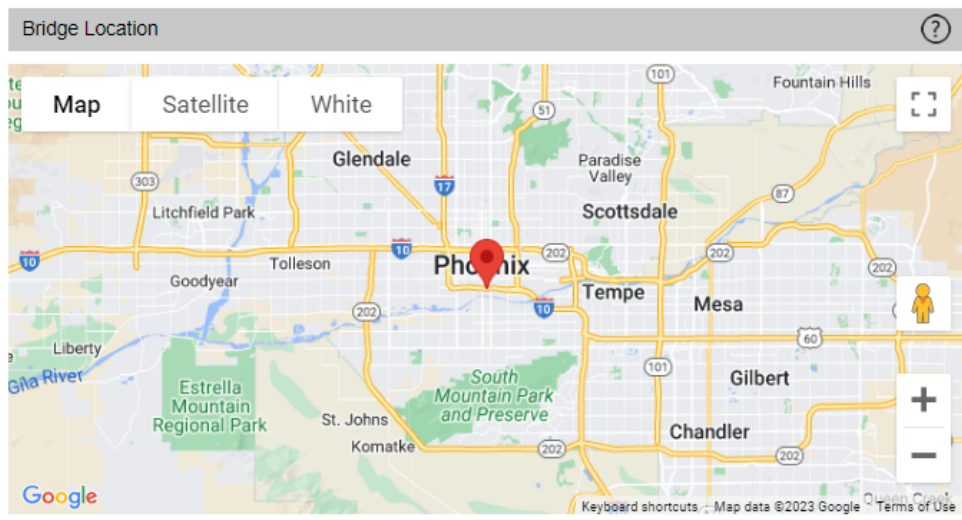
Bridge Information

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

Data Condition Forecast

Overview

- NBI
- NBE
- Climate



Data Availability

		Year	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													

National Bridge Inventory (NBI) - 2022 ? [Bridge Summary Report](#)

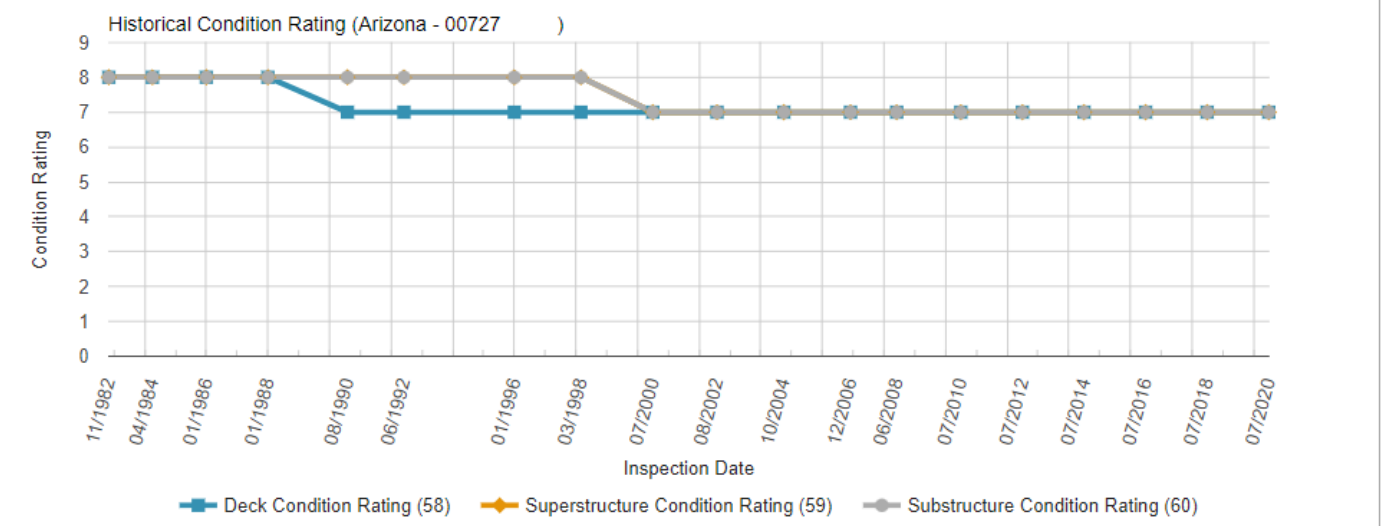
- All
- Identification and Location
- Structure Type and Materials
- Dimensions and Clearances
- Inspection
- Condition Rating and Evaluation
- Load Rating and Posting
- Traffic and Roadway Data
- MPO, Political Districts, and Cities

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)	

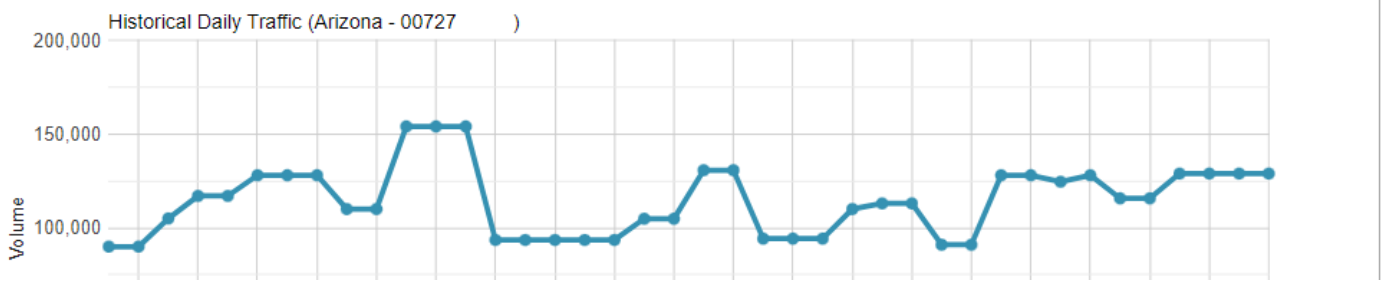
Select NBI Attributes ▾

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⁾ 14

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

Data Condition Forecast

Overview

National Bridge Elements (NBE) - 2022

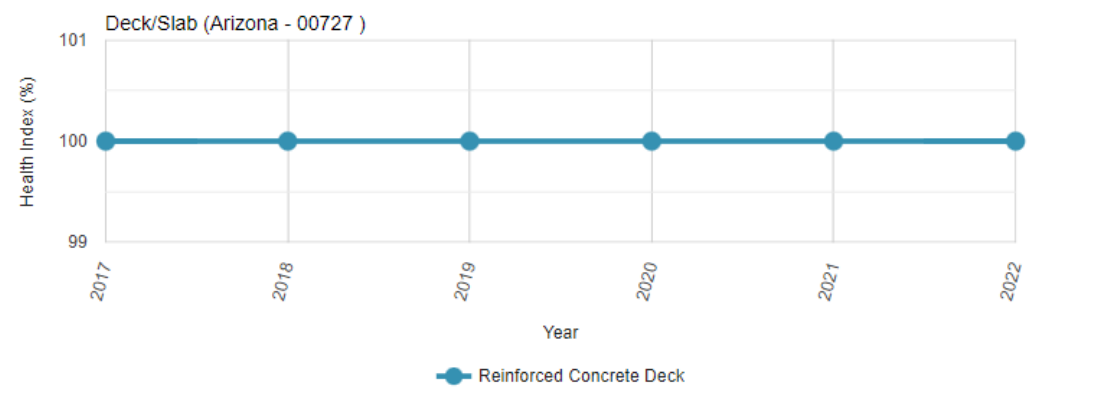
NBI
NBE
Climate

- Select Year
- 2022
 - 2021
 - 2020
 - 2019
 - 2018
 - 2017

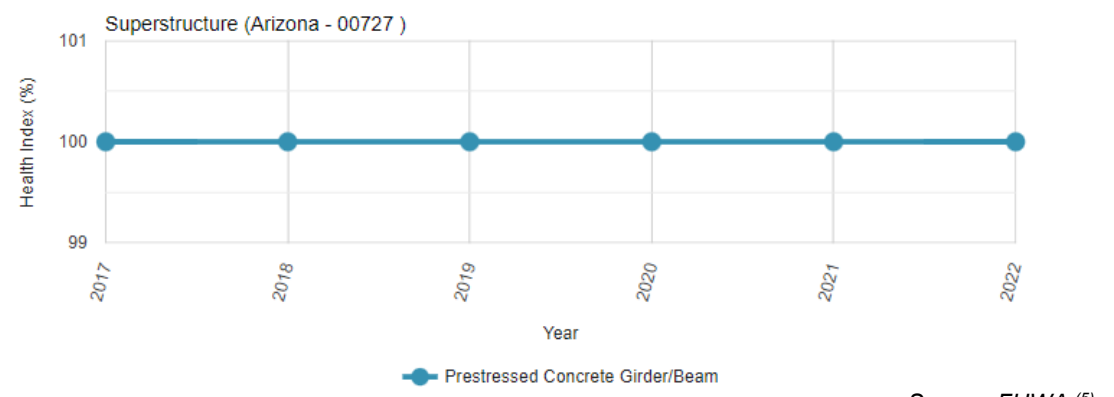
Element #	Element Name	Unit	Total Quantity	CS1	CS2	CS3	CS4	HI
Please enter a search term								
Deck/Slab								
12	Reinforced Concrete Deck	SF	14,786	14,785 (99%)	1	0	0	100.00
Superstructure								
109	Prestressed Concrete Girder/Beam	LF	2,000	2,000 (100%)	0	0	0	100
Substructure								
205	Reinforced 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⁾ 15

Bridge Information

State Name (1):
Arizona

Structure Number (8):
00727

Previous Structure Number(s):
0727 (2016)

Data Condition Forecast

Overview

Climate Data - 2021



Climate Graph

Save as Image

NBI
NBE

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

Climate

Select Year

Annual Monthly

2021

2020

2019

2018

2017

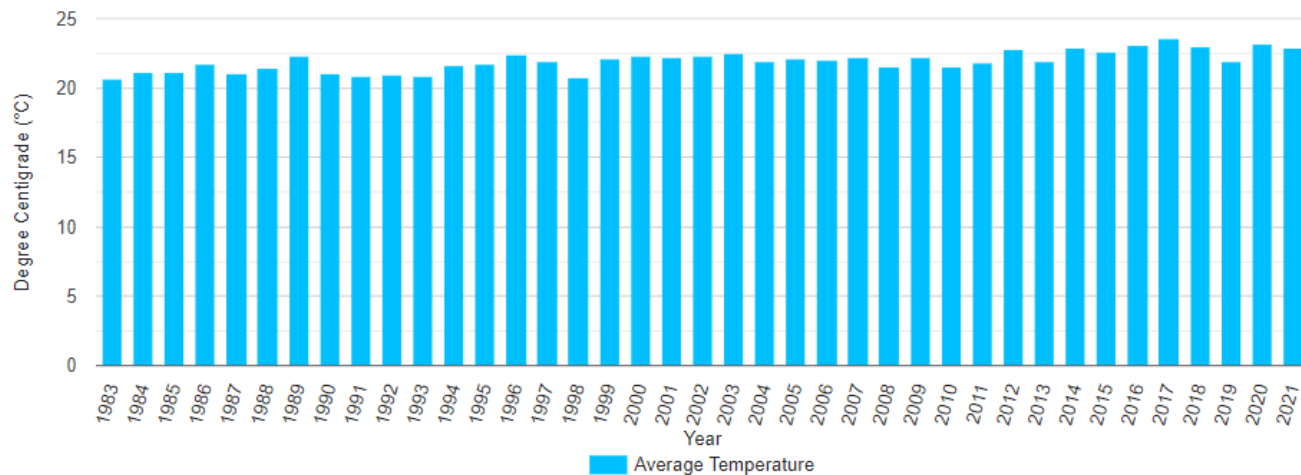
2016

2015

2014

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

Select Attribute: Average Temperature, °C



Source: FHWA.⁽⁵⁾

Bridge Information

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

Deck Superstructure Substructure

Select Forecast Models

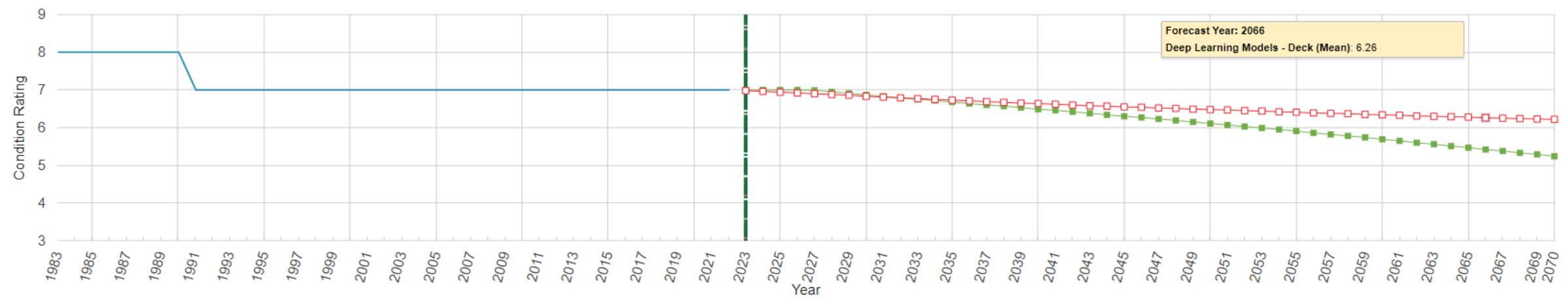
- Base Models (50-Year Horizon)
 - Time in Condition Models
- Machine Learning Models (50-Year Horizon)
 - Deep Learning Models
- Survival Models (50-Year Horizon)
 - Proportional Hazards Deterioration Models

Condition Forecast Graph

Historical Data Deck

Proportional Hazards Deterioration Models - Prestressed Concrete Girder Forecast Start Year Upper Bound Lower Bound Mean Median

Deep Learning Models - Deck Forecast Start Year Upper Bound Lower Bound Mean Median



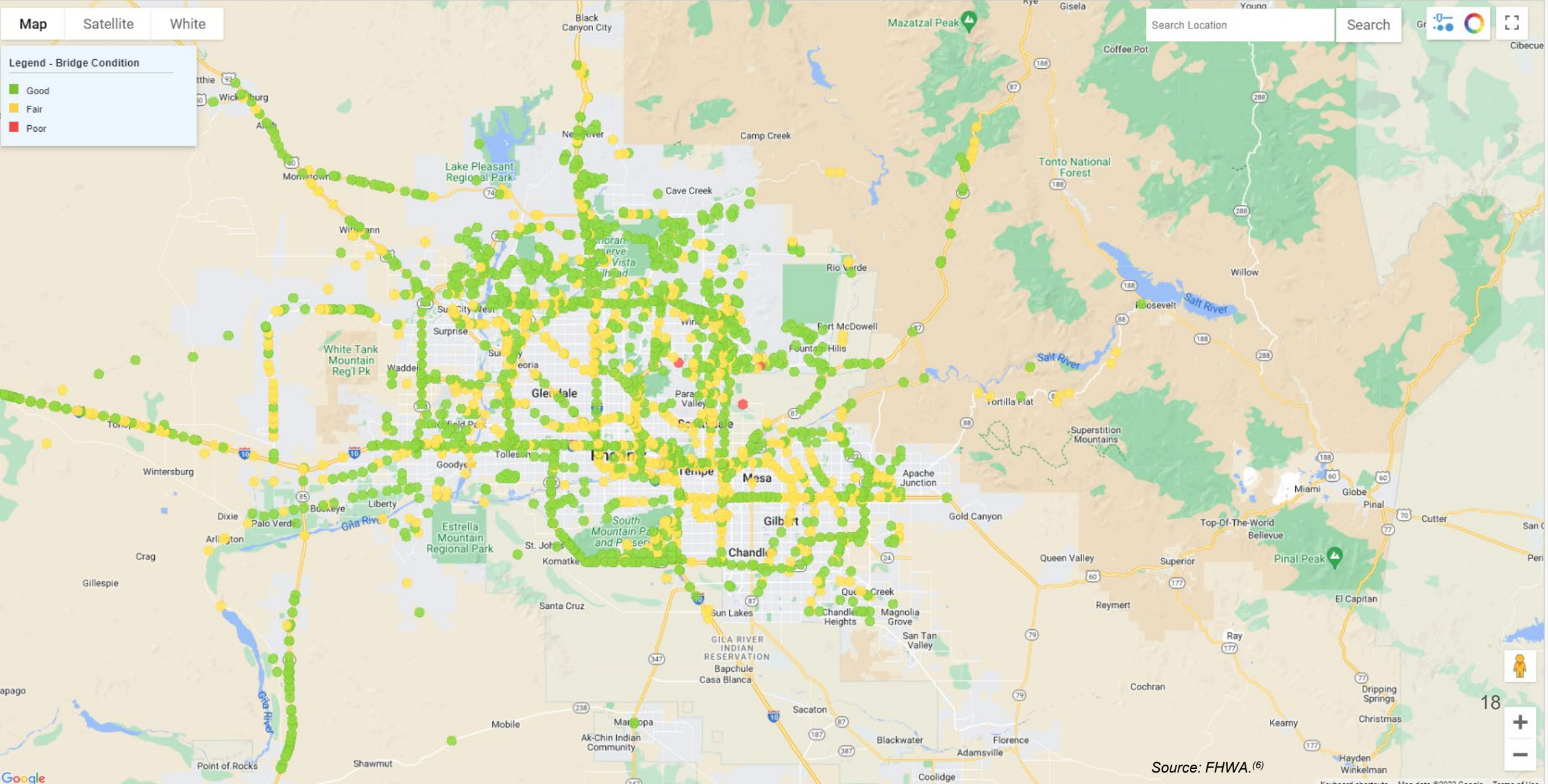
Forecast Year: 2066
Deep Learning Models - Deck (Mean): 6.26

Map Satellite White

Legend - Bridge Condition

- Good
- Fair
- Poor

Search Location Search



Source: FHWA. (6)

Select Data ?

- 2022 NBI Data
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Find Bridges ?

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LTBP

- Non-Destructive Evaluation
- Design/Construction Data
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Special Projects ▼

Performance History

About

Show Bridges 2,791 of 620,669 bridges

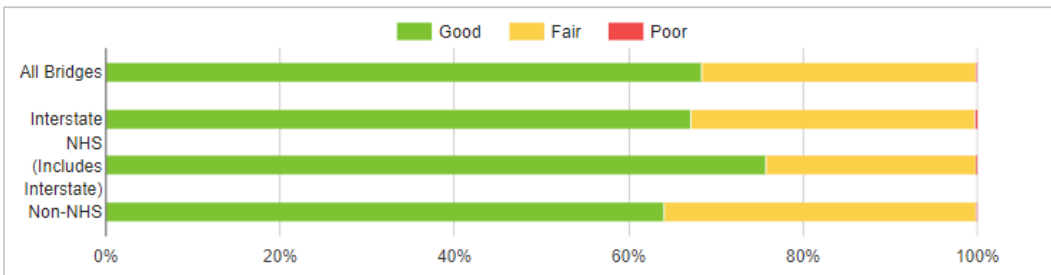
Advanced Find Map Find Chart Find Clear "Find" Options

Selected Bridges Map Performance History Performance Forecast

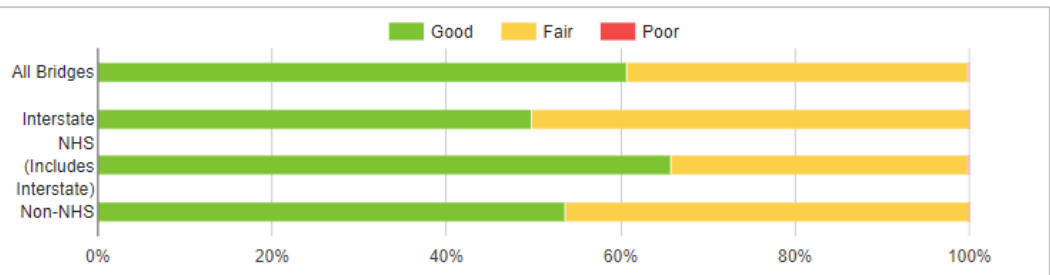
Bridge Performance Measures Bridge Condition Transition History

Bridge Performance Measures for Selected Bridges ?

Percentages by Bridge Count



Percentages by Bridge Deck Area



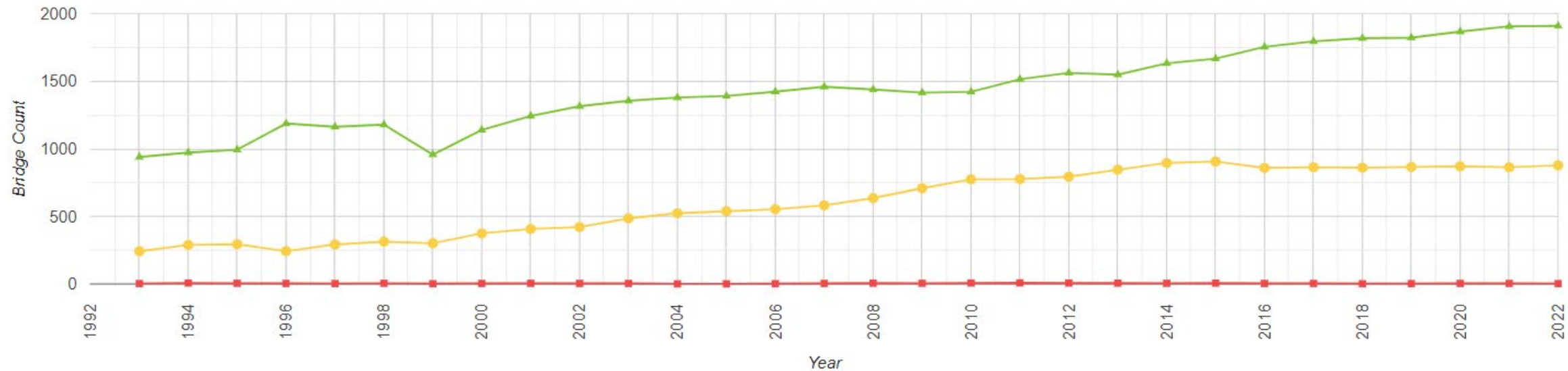
	Good	Fair	Poor
All Bridges	1,909 (68.40%)	878 (31.46%)	4 (0.14%)
Total: 2,791			
Interstate	231 (67.15%)	112 (32.56%)	1 (0.29%)
Total: 344			
% of Total: 12.33%			
NHS (Includes Interstate)	797 (75.69%)	254 (24.12%)	2 (0.19%)
Total: 1,053			
% of Total: 37.73%			
Non-NHS	1,112 (63.98%)	624 (35.90%)	2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

Bridge Performance for All Bridges by Bridge Count

Historical Performance

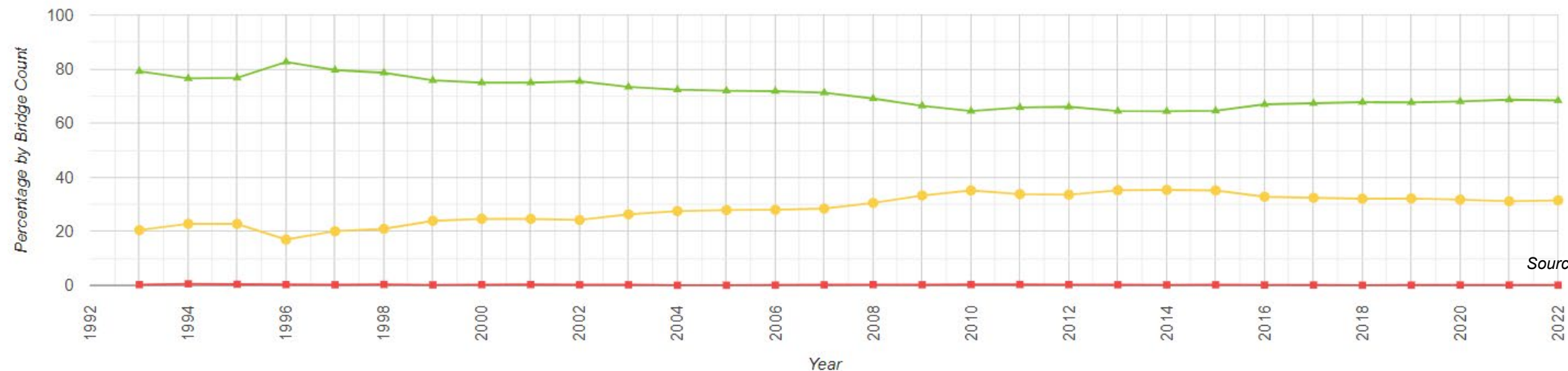
- Good ▲
- Fair ●
- Poor ■



Bridge Performance for All Bridges by Percentage Bridge Count

Historical Performance

- Good ▲
- Fair ●
- Poor ■



Source: FHWA.⁽⁷⁾

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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

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Source: FHWA.⁽⁷⁾

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.

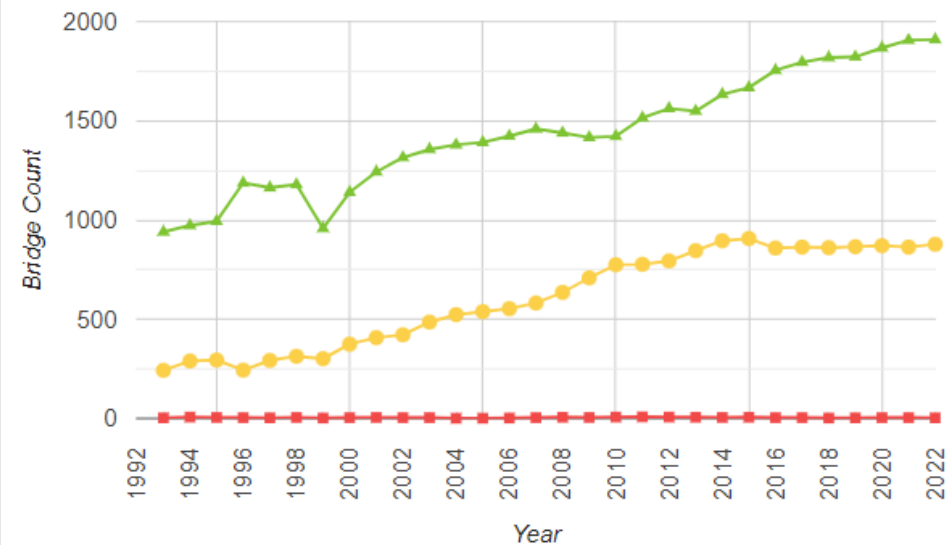
Show Series: All Bridges Interstate NHS (Includes Interstate) Non-NHS

Network Performance Forecast Bridge Condition Transition Forecast

Network Performance Forecast Models

Bridge Performance for All Bridges by Bridge Count

Historical Performance Good Fair Poor



Source: FHWA.⁽⁸⁾

Bridge Performance for All Bridges by Percentage Bridge Count

Historical Performance Good Fair Poor

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

Select Network Forecast Models

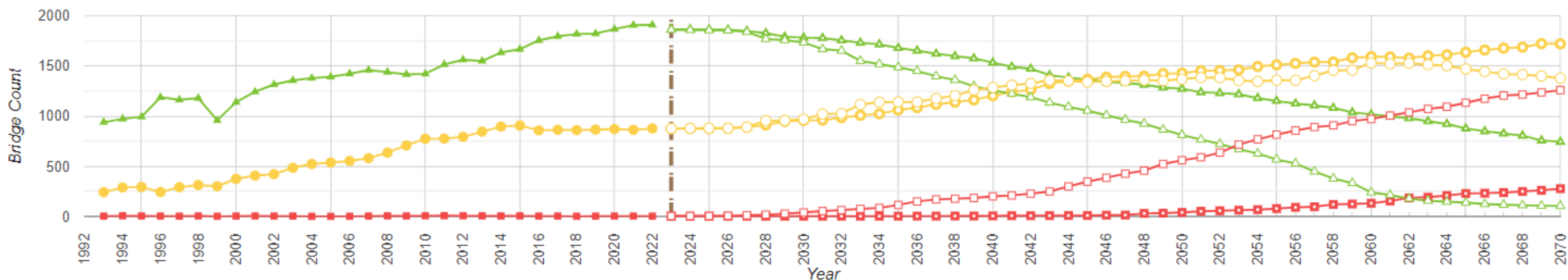
- Survival Models (50-Year Horizon)
 - Proportional Hazards Deterioration Models
 - Limited Preservation
 - Moderate Preservation
 - Maximum Preservation
 - Machine Learning Models (50-Year Horizon)
 - Deep Learning Models
 - Level 1
 - Level 2

Bridge Performance for All Bridges by Bridge Count

Historical Performance Good Fair Poor

Proportional Hazards Deterioration Models - Maximum Preservation Good Fair Poor

Proportional Hazards Deterioration Models - Limited Preservation Good Fair Poor



Bridge Performance for All Bridges by Percentage Bridge Count

Historical Performance Good Fair Poor

Proportional Hazards Deterioration Models - Maximum Preservation Good Fair Poor

Source: FHWA.(8)

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

Probability of Occurrence (%) Greater Than Or Equal To

Transitioning From: Good In Year: 2022 To: Fair In Year: 2032 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⁾

Select Data

- 2022 NBI Data
- 2020 NBI Data
- All Data

Charts

Show Bridges 2,791 of 620,669 bridges

Advanced Find Map Find Chart Find Clear Find Options

Single Variable Chart Two Variable Chart

Select Data

- 2022 NBI Data
- 2020 NBI Data

- Charts
- Bridge Condition by State
- Asset Valuation by State

Selected Attribute:

Bridge Age (Years)

Find Bridges

NBI

- 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

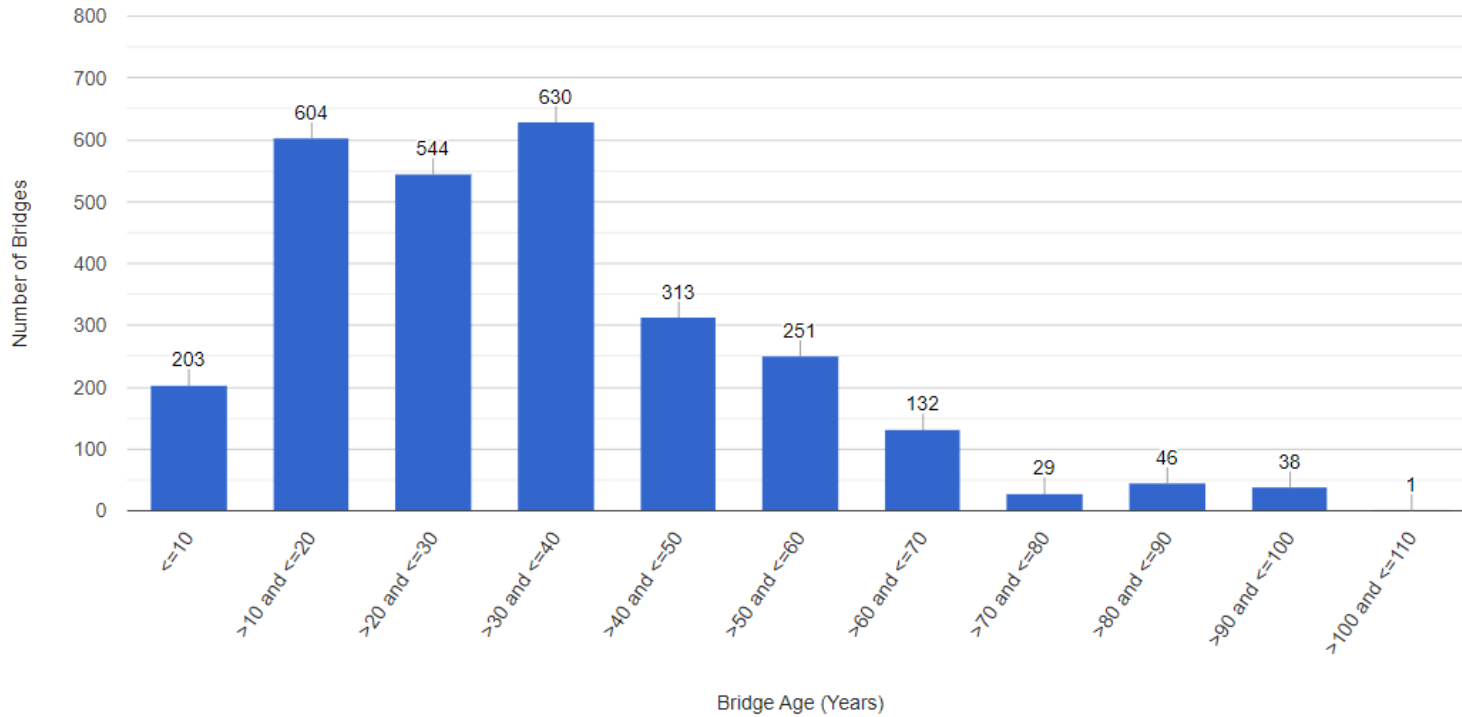
LTBP

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

Special Projects

Bridge Age (Years) Graph

Save as Image



Available Attributes

NBI NBE

Search...

- Bridge Condition
- Deck Area (sq. ft.)
- Average Daily Truck Traffic
- City - InfoBridge Place Code-Name
- 1 - State Name
- 2 - Highway Agency District
- 3 - County Name
- 5B - Route Signing Prefix
- 5C - Designated Level of Service
- 5E - Directional Suffix
- 10 - Inventory Route, Minimum Vertical Clearance (ft.)
- 12 - Base Highway Network
- 19 - Bypass/Detour Length (miles)
- 20 - Toll
- 21 - Maintenance Responsibility
- 22 - Owner
- 26 - Functional Class of Inventory Rte.
- 27 - Year Built

Source: FHWA.⁽⁹⁾



Show Bridges 2,791 of 620,669 bridges

Advanced Find Map Find Chart Find Clear "Find" Options

Single Variable Chart Two Variable Chart

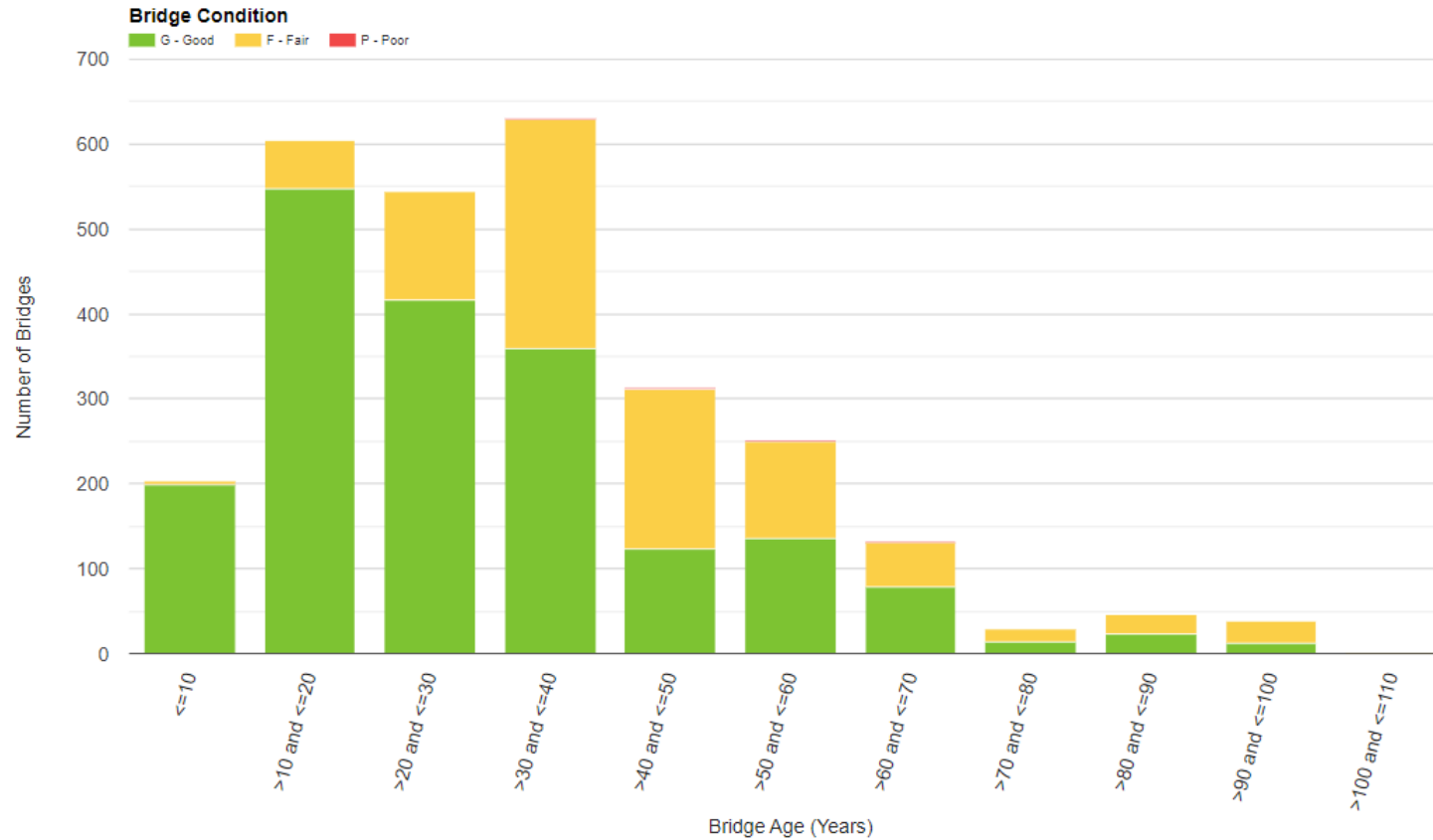
Primary Attribute: Bridge Age (Years)

Secondary Attribute: Bridge Condition

Bridge Age (Years) - Bridge Condition Graph

Save as Image

Available Attributes



- Search...
- Deck Area (sq. ft.)
 - Average Daily Truck Traffic
 - City - InfoBridge Place Code-Name
 - 1 - State Name
 - 2 - Highway Agency District
 - 3 - County Name
 - 5B - Route Signing Prefix
 - 5C - Designated Level of Service
 - 5E - Directional Suffix
 - 10 - Inventory Route, Minimum Vertical Clearance (ft.)
 - 12 - Base Highway Network
 - 19 - Bypass/Detour Length (miles)
 - 20 - Toll
 - 21 - Maintenance Responsibility
 - 22 - Owner
 - 26 - Functional Class of Inventory Rte.
 - 27 - Year Built
 - 28A - Lanes on the Structure
 - 28B - Lanes under the Structure
 - 29 - Average Daily Traffic
 - 30 - Year of ADT

Source: FHWA.⁽⁹⁾

Select Data ?

- 2022 NBI Data
- 2020 NBI Data
- All Data

Find Bridges ?

NBI

- 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

Show Bridges 2,791 of 620,669 bridges

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

Replacement Unit Cost (\$/sq. ft.):

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

TOOLS LIBRARY

- Asset Valuation
- Bridge Condition Transition
- Bridge Network Performance
- Historical Spec Changes
- Selected Bridges
- By State
- 2,791 of 620,669 bridges

About

Advanced Find Map Find Chart Find Clear "Find" Options

Show Bridge Component Condition and Operating Ratings:

Selected Bridges

Export Table

1 - State Name	8 - Structure Number	22 - Owner Agency	CAT29 - Deck Area (sq. ft.)	Replacement Value (\$)	Existing Value (\$)	Remaining Value (%)
~ <input type="text"/> x	~ <input type="text"/> x	~ <input type="text"/> x	== <input type="text"/> x	== <input type="text"/> x	== <input type="text"/> x	== <input type="text"/> x
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⁾

Asset Valuation by State

About

Group By: All Bridges Interstate Bridges NHS Bridges (Includes Interstate) Non-NHS Bridges

Total Bridge Count for All Bridges: 620,588
 Total Deck Area for All Bridges (sq. ft.): 4,316,157,457.8
 Total Replacement Value for All Bridges (\$): 837,434,965,088
 Total Existing Value for All Bridges (\$): 766,350,684,862
 Remaining Value for All Bridges (%): 91.5

TOOLS LIBRARY

- Asset Valuation
- Bridge Condition Transition
- Bridge Network Performance
- Historical Spec Changes

Selected Bridges

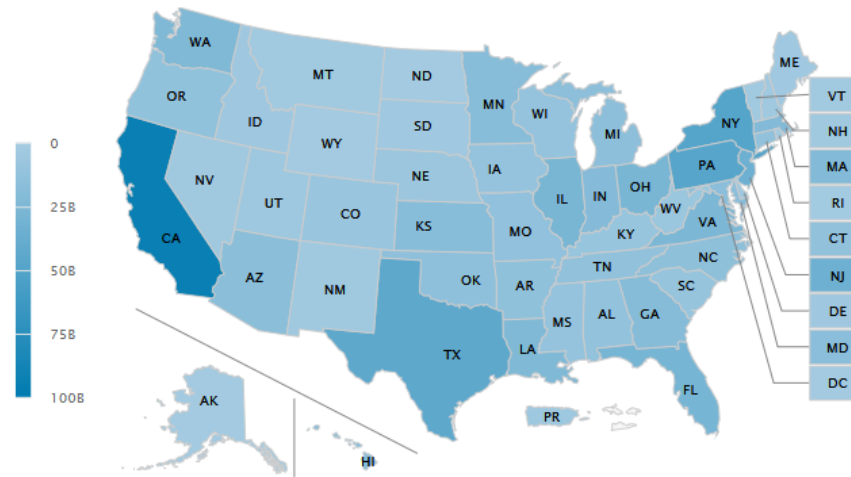
By State

2,791 of 620,669 bridges

Replacement Unit Cost (\$/ sq. ft. of Deck)

Map

Select Value to Plot on Map: Replacement Value (\$) ▼



All Bridges Export Table

1 - State Name	Total Bridge Count	Total Deck area (sq. ft.)	Replacement Value (\$)	Replacement Unit Cost (\$)	Existing Value (\$)	Remaining Value (%)
~ [input] x	== [input] x	== [input] x	== [input] x	== [input] x	== [input] x	== [input] x
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⁾

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](#)



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

Historical Spec Changes

About

Specifications: Concrete Shear Design - Scope ▼

Find:



Select Year
1931

- Concrete Shear Design
 - Scope
 - Beam Shear Design Of Concrete
 - References
- Lightweight Aggregate Concrete
- Load Combinations
- Loads
- Reinforcing Steel
- Steel Bridges

view of the development of shear design of concrete through the 1994 first edition of the load-and-resistance factor design (LRFD) specifications. The focus is only on one-way beam shear design. The models is not covered.

State Highway and Transportation Officials standard specifications specified application of the strut-and-tie models for the design of anchorage zones. The first edition of the LRFD specifications extended its torsion design of both the beam regions (B-regions) and the disturbed regions (D-regions) of reinforced concrete members. In B-regions, plane sections remain plane after loading, whereas in the D-regions torsion in the D-regions is nonlinear.

Specifications: Reinforcing Steel

Find: Stainless 5

- Select Year
- 2015
 - 2009
 - 2008
 - 2004
 - 2003
 - 1997
 - 1996
 - 1995
 - 1994
 - 1992
 - 1991

Measures for anchor profile include maximum peak height and exposed surface (McDonald, 2010)

1987

ASTM A615 revised, re-adding Grade 75

ASTM A615 re-added provisions for Grade 75 rebar. (CRSI EDR48)

1983

Stainless steel rebar first used in U.S. bridges

The earliest bridge deck built using **stainless** steel reinforcement was constructed in 1983 in Michigan using UNS S30400 material for the eastbound deck. The deck is on the I-696 Bridge over Lennox Road in Ferndale, Michigan.

1981

Source: FHWA.⁽¹³⁾

LTBP InfoBridge™ : Data

HOME DATA ANALYTICS TOOLS LIBRARY

Select Data

- 2022 NBI Data
- 2020 NBI Data
- All Data

Bridge Selection and Data Presentation

Show Bridges 2,791 of 620,669 bridges

Find Bridges

NBI

- 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

Selected Bridges	Map	Performance History	Performance Forecast
1 - State Name	8 - Structure Number	22 - C	
4 - Arizona	05426	State H	
4 - Arizona	05424	State H	
4 - Arizona	05422	State H	
4 - Arizona	05420	State H	
4 - Arizona	05418	State H	
4 - Arizona	00735	State H	
4 - Arizona	00994	Other S	
4 - Arizona	00993	Other S	
4 - Arizona	00905	State H	
4 - Arizona	00552	State H	
4 - Arizona	00550	State Highway Agency	013 - Maricopa Co

Export Data

Based on 17 selected data attributes and latest year selection. 2,791 bridge records will be exported.

Instructions for importing the data into excel can be found here: [Importing the data into MS Excel](#)

Allowed Export Limit:
2,791 bridges selected Total 588,235 bridge limit

Years of Data to Export: Latest Year All Years Year Range

Search attributes...

- NBI Data
 - State Name (1)
 - Structure Number (8)
 - Owner Agency (22)
- Identification and Location
 - Highway Agency District (2)
 - County Name (3)
 - Place Code (4)
 - Features Intersected (6A)
 - Facility Carried By Structure (7)
 - Location (9)

Export Selection Close

Advanced Find Map Find Chart Find X Clear "Find" Options

Table Options

- Save Table Layout
- Open Table Layout
- Select Fields
- Export Data

Name)	27 - Year Built	29 - Average Daily Traffic	43A - Main Span Material	43B -
x	==	x	==	x
	1967	59,680	Concrete Continuous	Culvert
	1967	59,680	Concrete Continuous	Culvert
	1967	63,210	Concrete Continuous	Culvert
	1965	206,711	Concrete Continuous	Culvert
	1965	206,711	Concrete Continuous	Culvert
	1963	2,245	Prestressed Concrete	Box Beam or Girders - M
	1981	25	Prestressed Concrete	Stringer/Multi-beam or C
	1982	25	Prestressed Concrete	Stringer/Multi-beam or C
	1966	37,024	Concrete Continuous	Slab
	1959	3,270	Steel Continuous	Stringer/Multi-beam or C
	1959	19	Steel Continuous	Stringer/Multi-beam or C

References (1/3)

¹FHWA. n.d. “InfoHighway™” (web page). <https://infohighway.fhwa.dot.gov/>, last accessed July 10, 2023.

²U.S. Government Publishing Office. 2017. Open, Public, Electronic, and Necessary Government Data Act. S. 760. 115th Congress, 1st session, S. Rep. 115-134. Washington, DC: U.S. Government Publishing Office. <https://www.govinfo.gov/app/details/CRPT-115srpt134/CRPT-115srpt134>, last accessed June 28, 2023.

³Congress.gov. n.d. “Current Legislative Activities” (web page). <https://www.congress.gov/>, last accessed June 28, 2023.

⁴FHWA. n.d. “InfoBridge™” (web page). <https://infobridge.fhwa.dot.gov/>, last accessed August 14, 2023.

⁵FHWA. n.d. “InfoBridge™: Data” (web page). [Data - LTBP InfoBridge \(dot.gov\)](#), last accessed July 17, 2023.



References (2/3)

⁶FHWA. n.d. “InfoBridge™: Data – Bridge Selection and Mapping” (web page). [Map - LTBP InfoBridge \(dot.gov\)](#), last accessed July 17, 2023.

⁷FHWA. n.d. “InfoBridge™: Data – Performance History” (web page). <https://infobridge.fhwa.dot.gov/Data/Dashboard>, last accessed July 17, 2023.

⁸FHWA. n.d. “InfoBridge™: Data – Performance Forecast” (web page). <https://infobridge.fhwa.dot.gov/Data/DashboardForecast>, last accessed July 17, 2023.

⁹FHWA. n.d. “InfoBridge™: Analytics” (web page). <https://infobridge.fhwa.dot.gov/BarStackChart>, last accessed July 17, 2023.

¹⁰FHWA. n.d. “InfoBridge™: Tools – Asset Evaluation – Selected Bridges” (web page). <https://infobridge.fhwa.dot.gov/AssetValuation>, last accessed July 17, 2023.



References (3/3)

¹¹FHWA. n.d. “InfoBridge™: Tools – Asset Evaluation By State” (web page).
<https://infobridge.fhwa.dot.gov/AssetValuationByState>, last accessed July 17, 2023.

¹²FHWA. n.d. “InfoBridge™: Library – InfoBridge Documentation” (web page).
https://infobridge.fhwa.dot.gov/Page/infobridge_documentation, last accessed July 17, 2023.

¹³FHWA. n.d. “InfoBridge™: Library – Historical Spec Changes” (web page).
<https://infobridge.fhwa.dot.gov/HistoricalChanges>, last accessed July 17, 2023.



Questions?



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U.S. Department of Transportation
Federal Highway Administration

Turner-Fairbank
Highway Research Center

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