



# Long-Term Bridge Performance Program Status Update

National Bridge Preservation Partnership - April 2018 – Orlando FL

**Robert Zobel, Ph.D., P.E.**

LTBP Program Coordinator  
Federal Highway Administration

The image displays two screenshots of the LTBP InfoBridge website. The left screenshot shows the homepage with a large bridge image and three circular icons labeled 'Search', 'Library', and 'Help'. The right screenshot shows the search interface with a map of the Northeast United States and various search options.

**LTBP InfoBridge** Search

Customer Support | About ▼

Search by State ▼

HOME SEARCH LIBRARY HELP

Search

Simple Search Advanced Search

Map

Summary Results Map 1-D Chart 2-D Chart Map Chart Statistics

Map data ©2018 Google Terms of Use

U.S. Department of Transportation Long-Term Bridge Performance Program

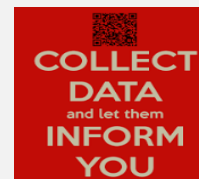
Long-Term Bridge Performance Program

# Long Term Bridge Performance Program



Bridge Performance Data Leading to

- Improved understanding of bridge performance
- Improved design, construction, preservation, and management practices
- Improved condition forecasting and life cycle analysis resulting in better asset management
- Data-driven decisions



Need more detailed data to really understand bridge performance  
***LTBP Will Deliver***



Gearing up to ***Accelerate*** and ***Expand*** Data Collection Efforts



# Long Term Bridge Performance Program

## Major Objectives

Collect, Manage, and Provide  
Easy Access to Data

**Current  
Program  
Focus**



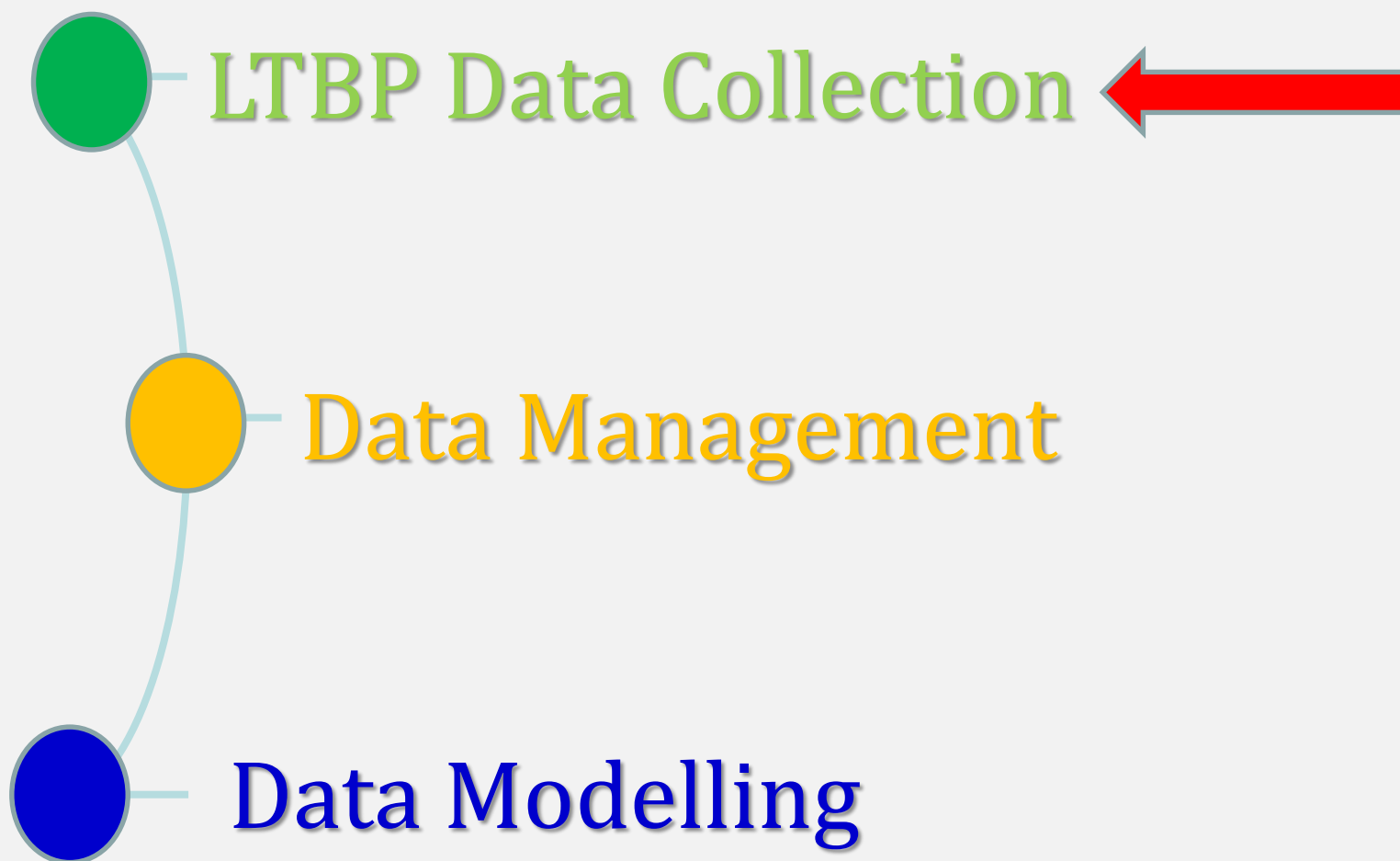
Perform Data Analysis

Develop Tools/Products

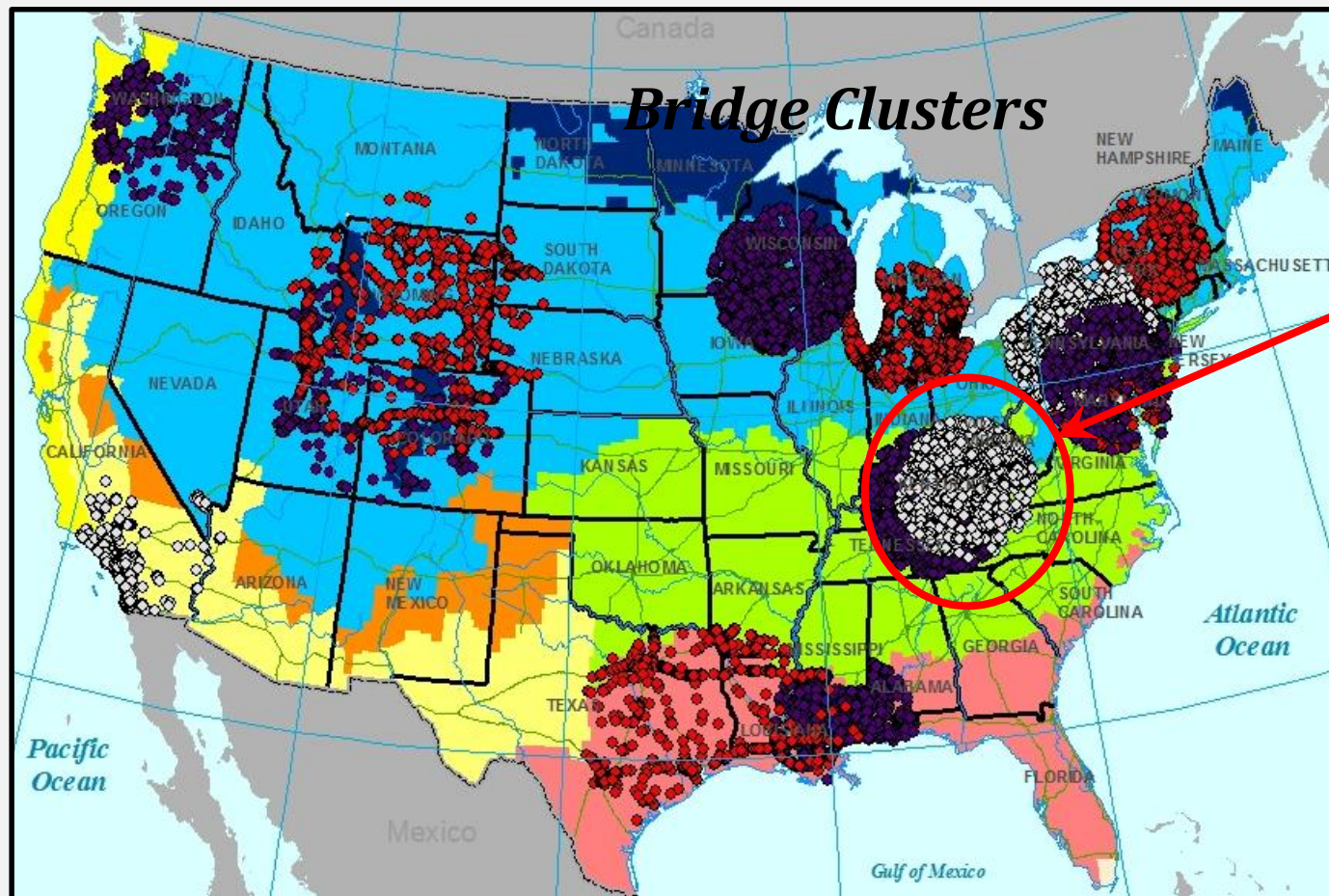




# Long Term Bridge Performance Program



# LTBP Data Collection Approach



**Bridge Cluster:**  
*Specific Environment  
Varied Truck Traffic  
Single Bridge Type*

**3 Bridge Types:**  
*Prestressed Concrete Multigirder (**Blue**)  
Steel Multigirder (**Red**)  
Concrete Box Girder (**White**)*

Data Collection

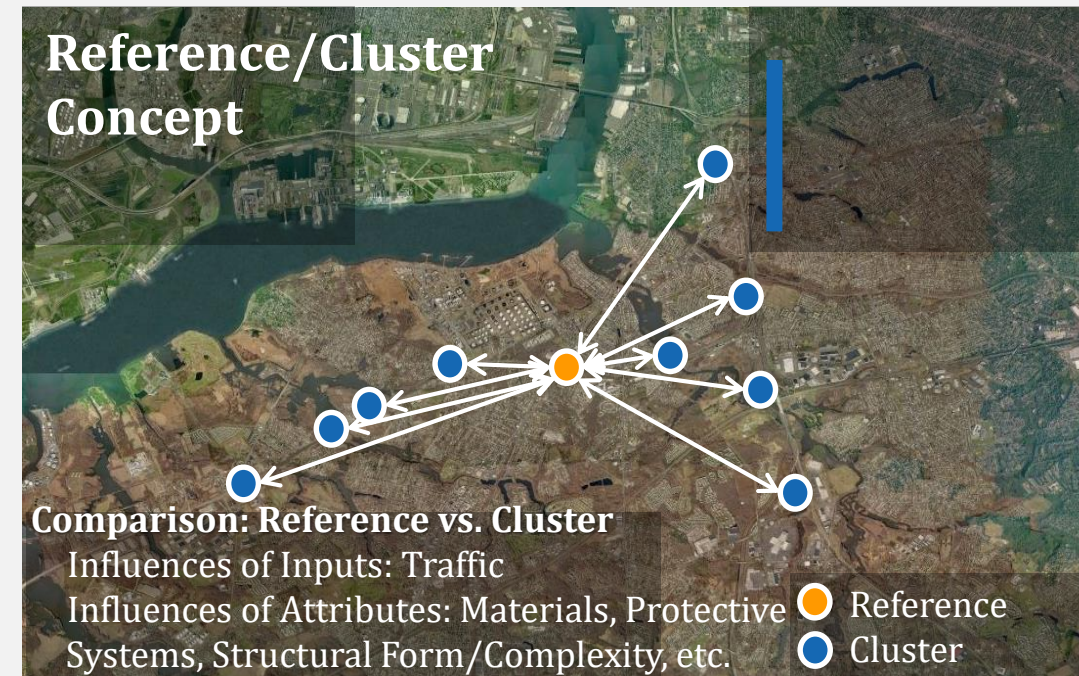
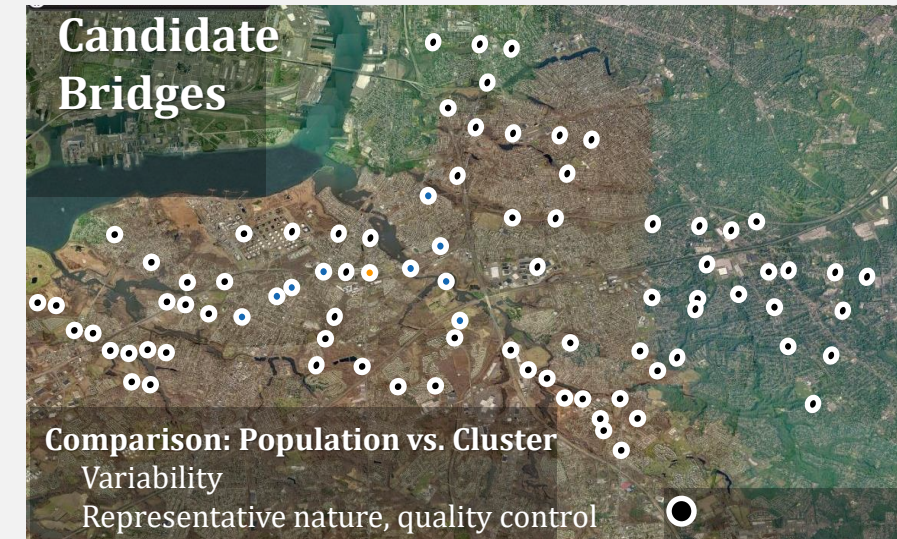
LTBP Program





# LTBP Multi-Tiered Data Collection Model

- ***Candidate Bridges***  
NBI, NBE, and Legacy Data Mining
- ***Cluster Bridges***  
NDE and Imaging
- ***Reference Bridges***  
Detailed Hands-On Visual Inspection,  
NDE, Imaging, Material Sampling, and  
Instrumentation





# Field Data Collection – Untreated Bridge Decks

- **Detailed Hands-On Visual Inspection**
- **Nondestructive Evaluation (NDE)**
  - Ground Penetrating Radar – concrete condition, corrosion, map reinforcement*
  - Impact Echo – delamination assessment*
  - Ultrasonic Surface Waves – concrete quality, concrete modulus*
  - Electrical Resistivity – corrosion*
- **Deck Imaging and Surface Crack Mapping**
- **Instrumentation and WIM**
- **Material Sampling (As Approved by Owner)**





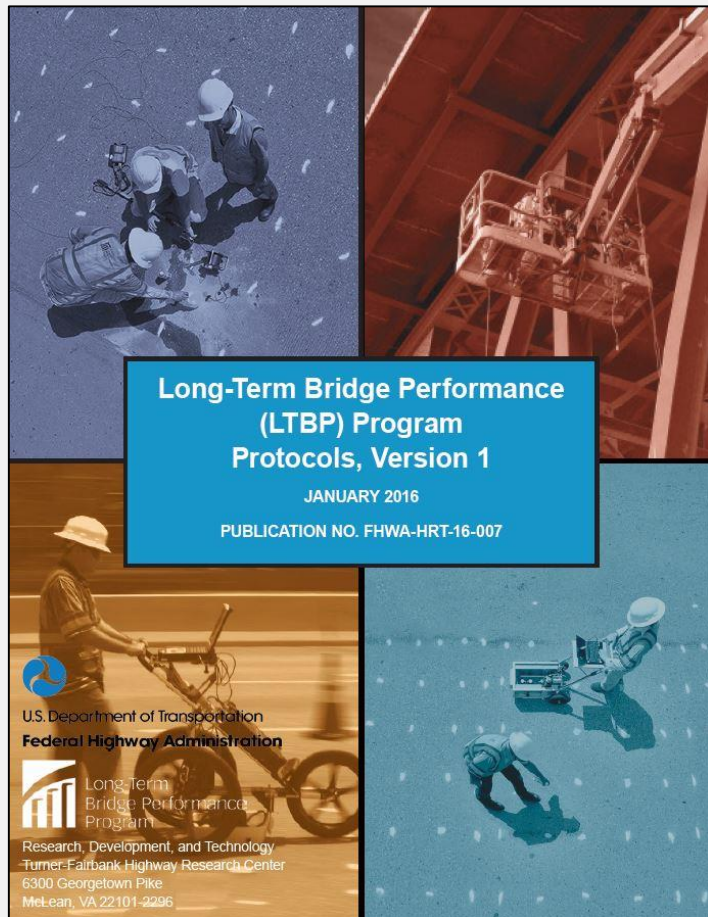
# LTBP Program Protocols

## Objective

- To ensure consistency in data collection, processing, and storage

## Status

- First edition of the LTBP Program protocols were published in January 2016 (FHWA-HRT-16-007) – **51 Protocols**
- Future protocols (>130) are drafted and undergoing review for publication.





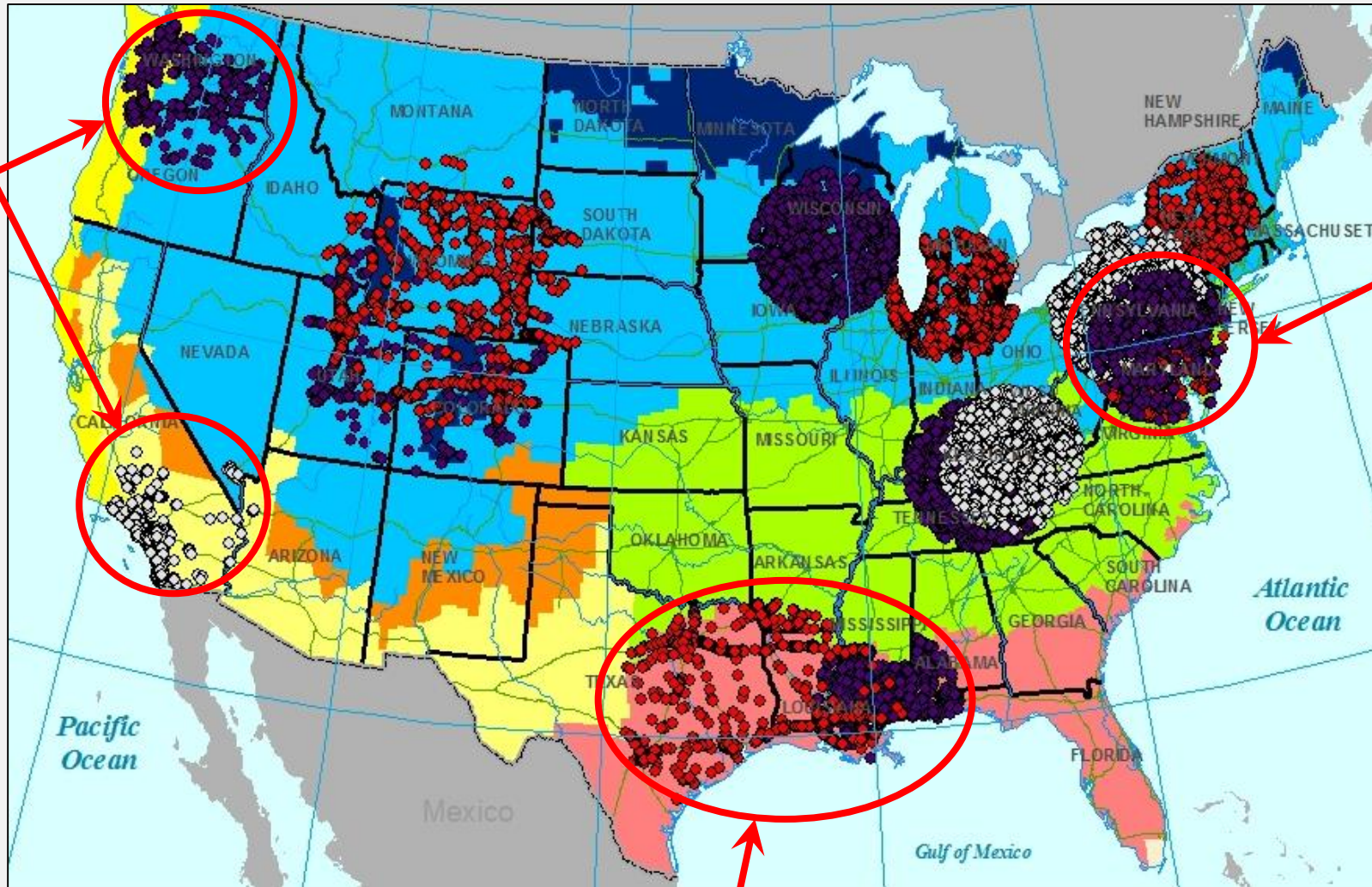
# Field Data Collection - To Date

*NW Prestressed Concrete Cluster;  
SW Concrete Box Cluster  
(Visual)*

AZ, CA, NV, OR, WA  
24 bridges completed

*Mid-Atlantic Steel;  
Mid-Atlantic Prestressed Concrete  
(Visual/NDE/RABIT™)*

DE, NJ, MD, PA, VA,  
WV  
24 bridges  
3 rounds completed



*Gulf Steel Cluster;  
Gulf Prestressed Concrete Cluster  
(Visual & Material Sampling)*

AL, AR, FL, LA, MS, TX  
24 bridges completed



# LTBP Data Collection – Legacy Data Mining (LDM)

**Objective** – *Utilize currently available data to assess potential correlations:*

- *of bridge condition within a single bridge cluster;*
- *of bridge condition between bridge clusters of the same type;*
- *of bridge performance between bridge clusters of different types*

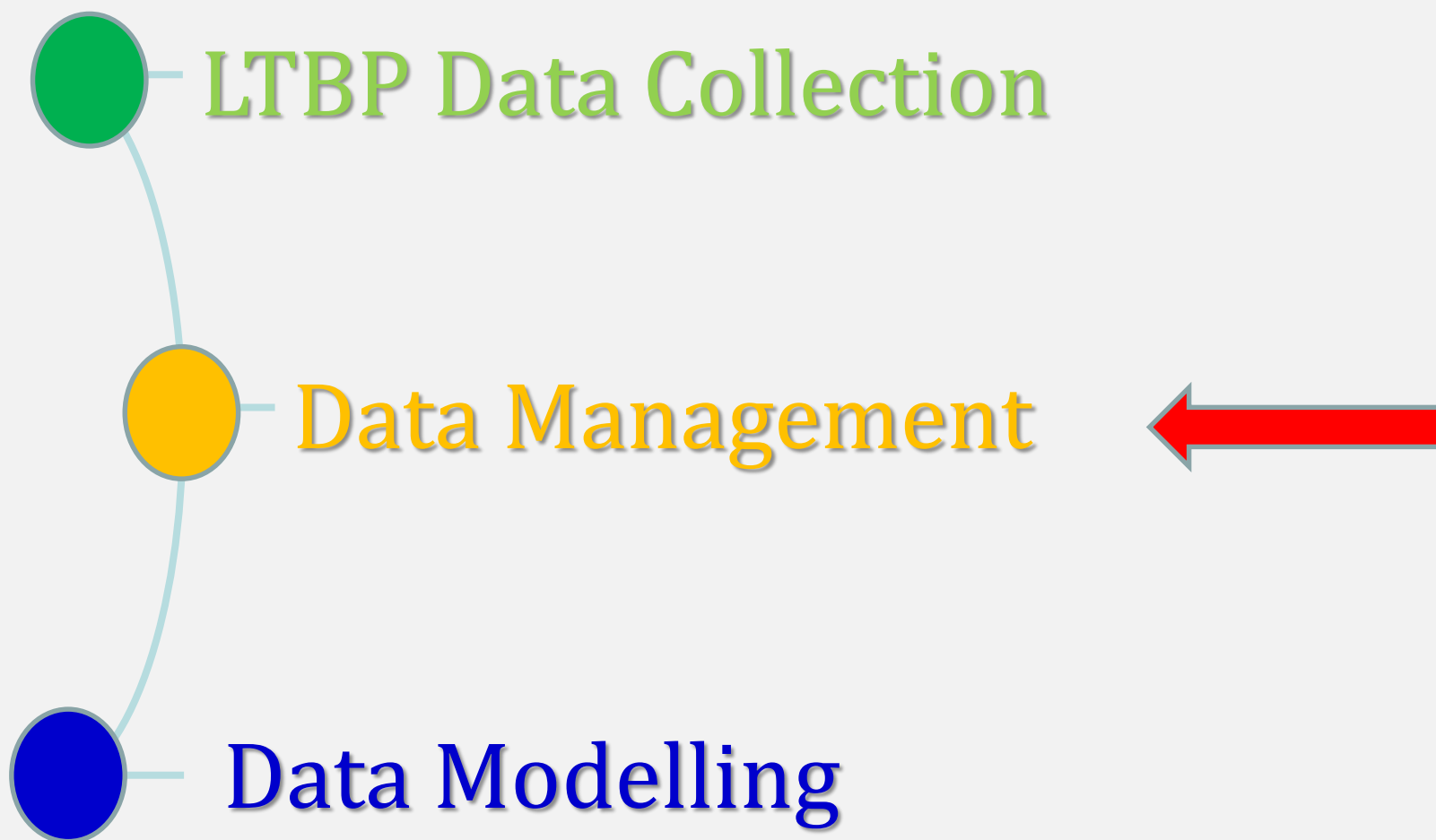
***Approximately 350 data items per bridge!***







# Long Term Bridge Performance Program





# LTBP - Bridge Portal

- *Centralized, national-level repository for efficiently and quickly accessing and querying bridge performance-related data and information*

*(NBI, NBE, LTBP, Climate, Others)*

## ***Combined With***

- *Data-driven deterioration modeling, GIS mapping, and other data and statistical analysis tools*







# Near Future – In The Cloud

**InfoHighway**

**InfoPave**

**InfoBridge**

(Migration of Bridge Portal to Cloud)

Improved Access (No Login Required)





# Currently Available Data



## *LTBP Field Data*

- *Reference Bridges - NDE data, Hands-On Visual Inspection, Material Sampling, LDM*
- *Cluster Bridges – NDE data, LDM*

## *National Bridge Inventory (NBI)*

- *1983-2016*

## *National Bridge Elements (NBE)*

- *California 2015, and Oregon 1999-2015*

## *Environmental Data – Source NOAA*

- *Number of Snowfalls, Number of F/T Cycles*







Status: This feature/page is currently in Acceptance Release mode.

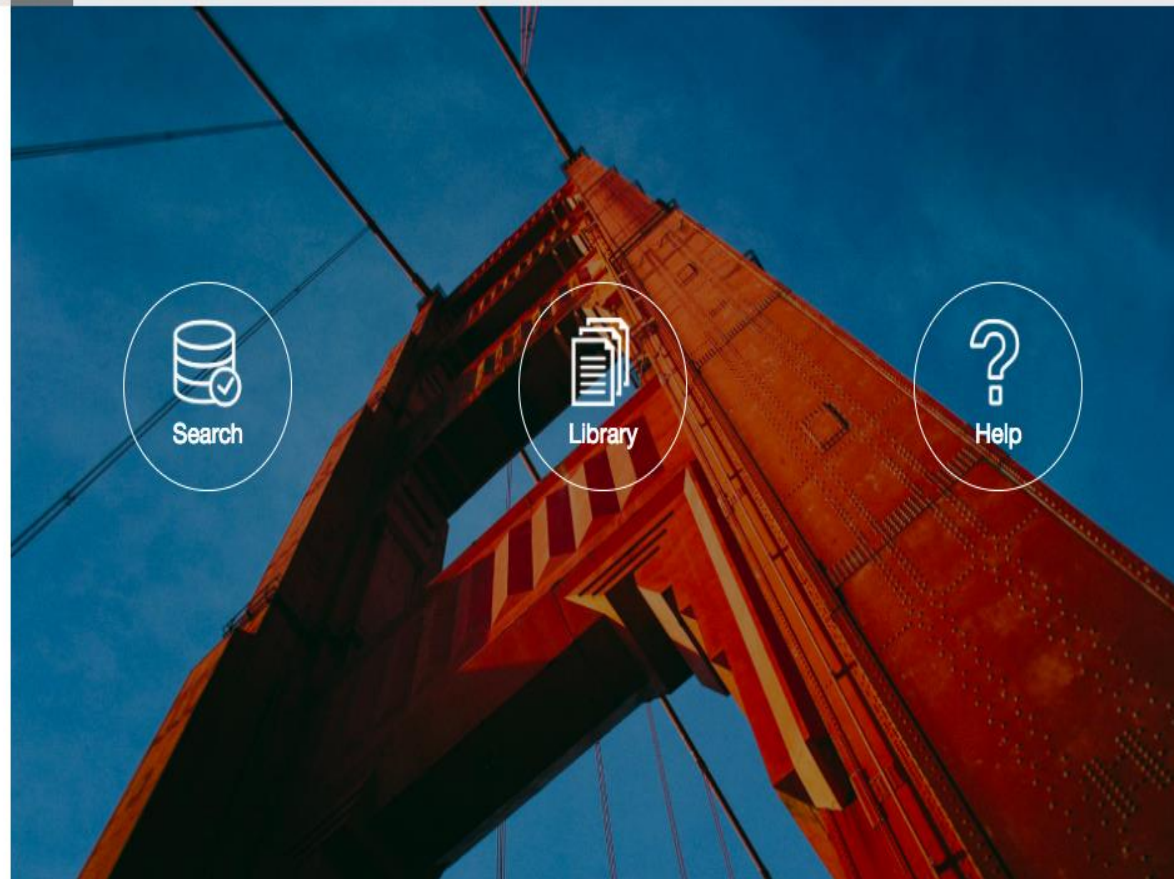
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***Preview of InfoBridge - Available Within Next Month***  
***Official Rollout of InfoBridge - January 2019***

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Search



About

Simple Search

Advanced Search

### Advanced Search

Type to filter menu

- 1 - State Name
- 8 - Structure Number
- 5A - Record Type
- 5B - Route Signing Prefix
- 5C - Designated Level of Service
- 5D - Route Number
- 5E - Directional Suffix
- 2 - Highway Agency District
- 3 - County (Parish) Name
- 6A - Features Intersected
- 6B - Critical Facility Indicator
- 7 - Facility Carried By Structure
- 9 - Location

### Selected Result Columns

- 1 - State Name ✕
- 8 - Structure Number ✕
- 45 - Number Of Main Spans ✕
- 49 - Total Length ✕

Search

Search Via Excel

Search is based on

LTBP Testing

Include

And

- 1 - Pilot Bridges
- 2 - Mid-Atlantic
- 3 - Gulf
- 4 - Southwest
- 5 - Northwest

Release mode.

LTBP InfoBridge: Search

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Search by State

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Search

Simple Search Advanced Search

Map

Map Satellite White

Summary Results Map 1-D Chart 2-D Chart Map Chart Statistics

United States

Map data ©2018 Google, INEGI Terms of Use

U.S. Department of Transportation Federal Highway Administration Long-Term Bridge Performance Program

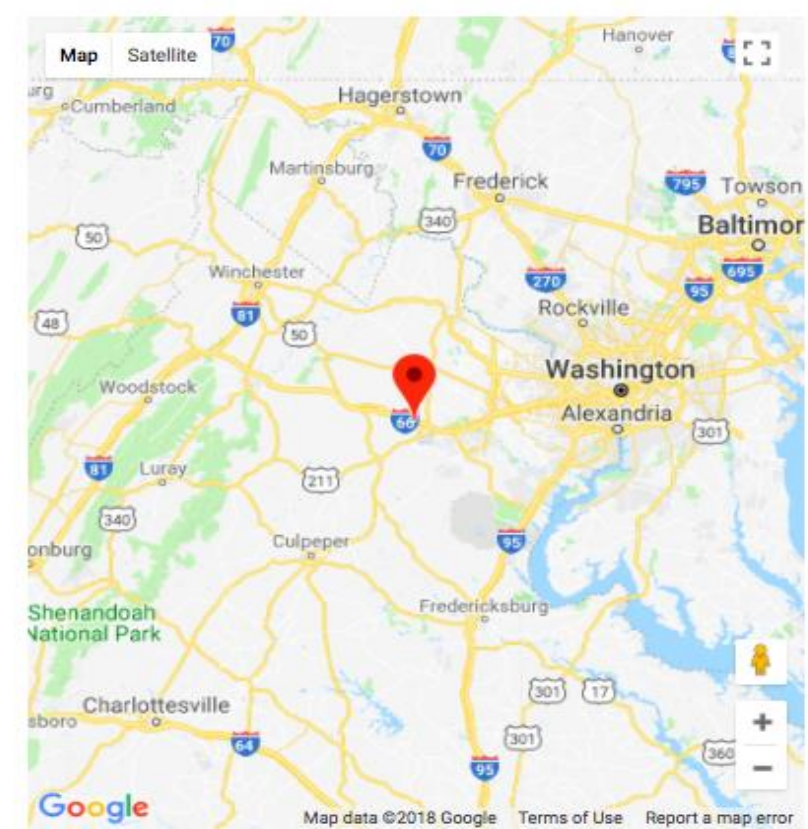
- Main Span Design ✕





Important NBI Attributes

1 - State Name	Virginia
8 - Structure Number	000000000014218
Bridge Name	WBL ROUTE 0066 over THOROUGHFARE ROAD
26 - Functional Class Of Inventory Rte.	1 - Rural Principal Arterial - Int...
48 - Length Of Largest Span(m)	12.2
49 - Total Length(m)	34.4
52 - Deck Width(m)	13.4
34 - Skew	2
22 - Owner	1 - State Highway Agency
27 - Year Built	1980
37 - Historic Significance	5 - Bridge is not eligible for the NRHP.
31 - Design Load	6 - MS 18+Mod / HS 20+Mod
45 - Number Of Main Spans	3
43A - Main Span Materials	5 - Prestressed concrete *
43B - Main Span Design	2 - Stringer/Multi-beam or girder





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Individual Bridge View

Summary

NBI

NBE

Historical Data

LTBP Data

Deterioration

Environmental Data

Life Expectancy Data

LDM

search LTBP data

Inspection Type	File Type	File Size	Team	Date	Description	Actions
Raw Data(6)						
Electrical Resistivity	XML	172.59 KB	Rutgers	09/2013		Download
Impact Echo Testing	XML	271.48 MB	Rutgers	09/2013		Download
Ultrasonic Surface Waves Testing (Concrete)	xml	15.75 MB	Rutgers	09/2013		Download
Electrical Resistivity	XML	234.39 KB	Rutgers	09/2015		Download
Impact Echo Testing	XML	47.71 MB	Rutgers	09/2015		Download
Ultrasonic Surface Waves Testing (Concrete)	XML	47.16 MB	Rutgers	09/2015		Download
Report(4)						
Visual Inspection Report	pdf	7.07 MB	PB	09/2013		Download
Non-destructive Testing Report	pdf	627.13 KB	Rutgers	09/2013		Download
Non-destructive Testing Report	pdf	1.22 MB	Rutgers	09/2015		Download
Visual Inspection Report	pdf	31.11 MB	Arora	09/2015		Download

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# Visual Inspection Report

## Long-Term Bridge Performance Program

Structure No. 00000000014218

Visual Inspection (Defect level)



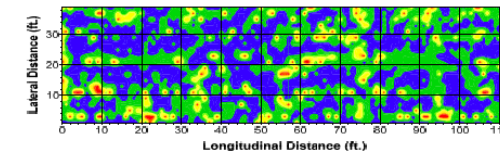
### Report of Non-Destructive Testing

Virginia

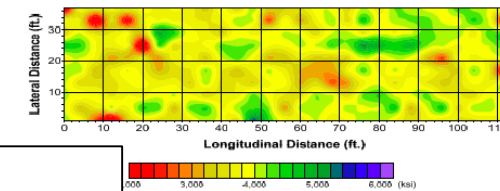
Structure No. 00000000014218

Test Date: 2013-9

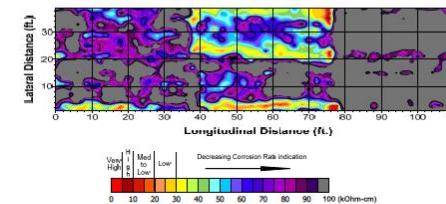
#### IMPACT ECHO



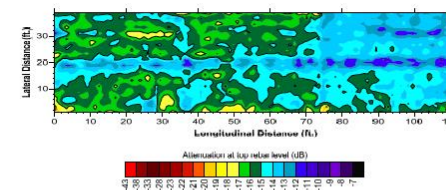
#### ULTRASOUND SURFACE WAVE



#### ELECTRICAL RESISTIVITY



#### GROUND PENETRATING RADAR



## NDE Assessment

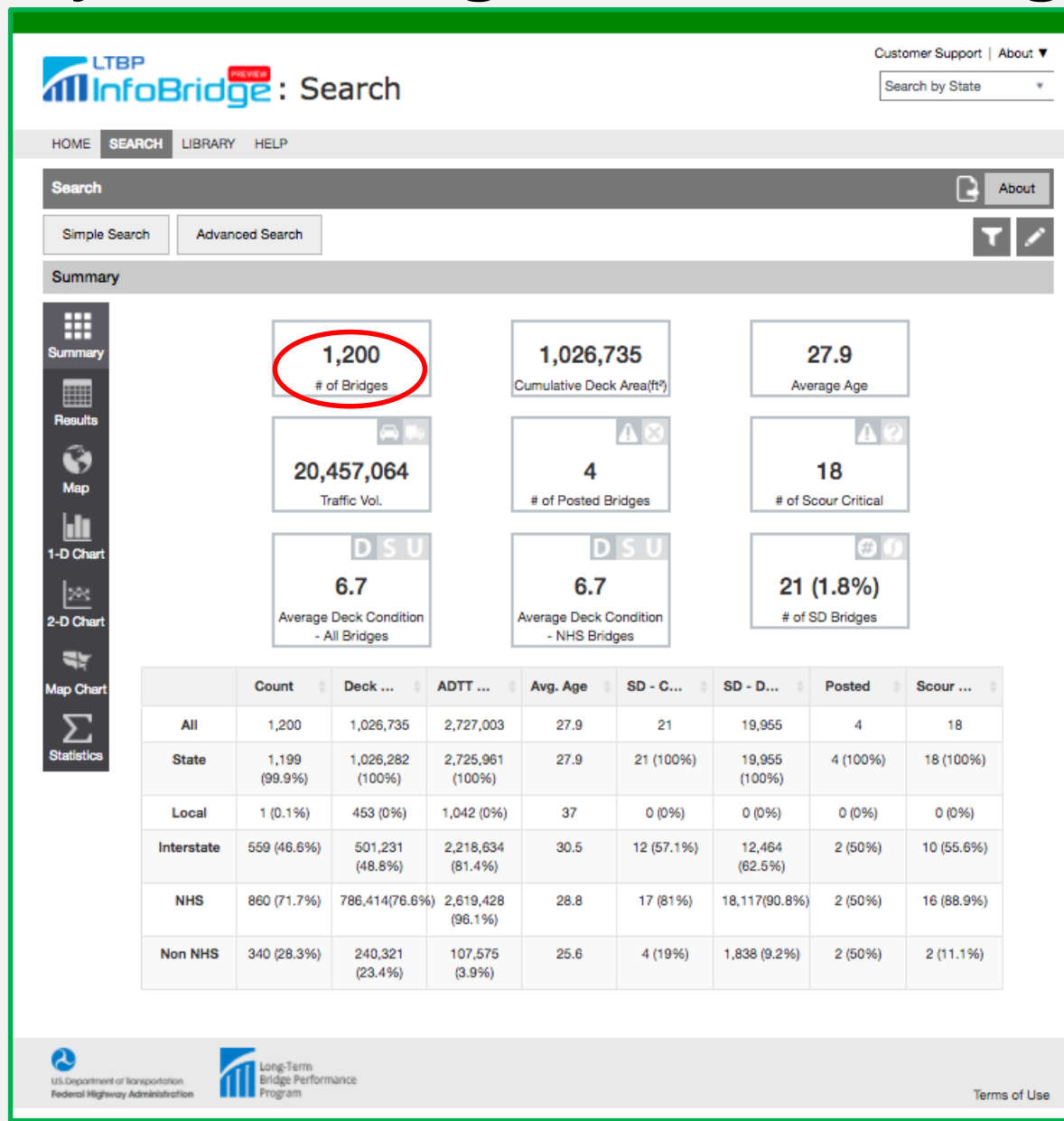
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# Legacy Data Mining – Untreated Bridge Decks





# Legacy Data Mining – Untreated Bridge Decks

Status: This feature/page is currently in Acceptance Release mode. Bug Report

**LTBP**  
**InfoBridge** PREVIEW Search Customer Support | About ▼  
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Advanced Search

Type to filter results

- Has LDM Data
- 301 - LDM Substructure Clear Cover
- 302 - LDM Girder Spacing
- 303 - LDM - Deck Thickness (inch)
- 304 - LDM Intermediate Diaphragm Type
- 305 - LDM Bearing Type
- 306 - LDM Expansion Joint Type Material
- 307 - LDM Barrier Type
- LDM Is Part Of Twin Spans
- LDM Is Continuous Span
- 308 - LDM Deck Specified Top Clear Cover
- 309 - LDM Shear Studs Type

Has LDM Data Include ▼ 1 - Yes ✕ X

And ▼

Selected Result Columns

1 - State Name ✕ 8 - Structure Number ✕ 27 - Year Built ✕ 29 - Average Daily Traffic ✕ 43A - Main Span Materials ✕ 43B - Main Span Design ✕  
45 - Number Of Main Spans ✕ 49 - Total Length ✕ Has LDM Data ✕

Search Search Via Excel Search is based on 2016 NBI submittal data

Extracted LDM data  
is searchable





## Search



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## Individual Bridge View

Summary

NBI

NBE

Historical Data

LTBP Data

Deterioration

Environmental Data

Life Expectancy Data

LDM



General

Span

Deck

General Girder

Steel Girder

Concrete Girder

Bearings, Joints, &amp; Railings

Approach Slab

Substructure

## Deck

Filter Attributes

Deck Drain Type	4" dia
Deck Drain Location	Spaced at 5' o.c
Deck Material	CIP Concrete
Specified deck 28-day design strength (psi)	4000
Actual Deck 28-day design Strength (psi)	5000
Deck Thickness (in)	6.5
Specified deck top clear cover (in)	2
Specified deck bottom clear cover (in)	1
Is top layer of top mat of reinforcement transverse or longitudinal?	Transverse
Top Longitudinal Bar Size	#8
Top Longitudinal Bar Spacing (in)	9
Top Transverse Top Bar Size	#5
Top Transverse Top Bar Spacing (in)	5.5
Bottom Longitudinal Bar Size	#5
Bottom Longitudinal Bar Spacing (in)	8
Bottom Transverse Bar Size	#5
Bottom Transverse Bar Spacing (in)	5.5
Direction of Transverse Reinforcement In Middle Skewed Bridge	Perpendicular to Girder
Direction of Transverse Reinforcement Near End Skewed Bridge	Perpendicular to Girder
Roadway Slope Type	Transverse Crowned
Composite Deck?	Yes







Search



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Life Expectancy Data

LDM



General

Span

Deck

**General Girder**

Steel Girder

Concrete Girder

Bearings, Joints, & Railings

Approach Slab

Substructure

General Girder

Filter Attributes

Span Number	1	2
Girder Material	Concrete	Concrete
Girder Type	AASHTO Type-1 Prestressed Concrete Girder	AASHTO Type-1 Prestressed Concrete Girder...
Number of Girders	6	6
Girder Spacing (ft)	7.00	7.00
Maximum Girder Depth (ft)	2.33	2.33
Variable Depth or Prismatic Girder	Prismatic	Prismatic



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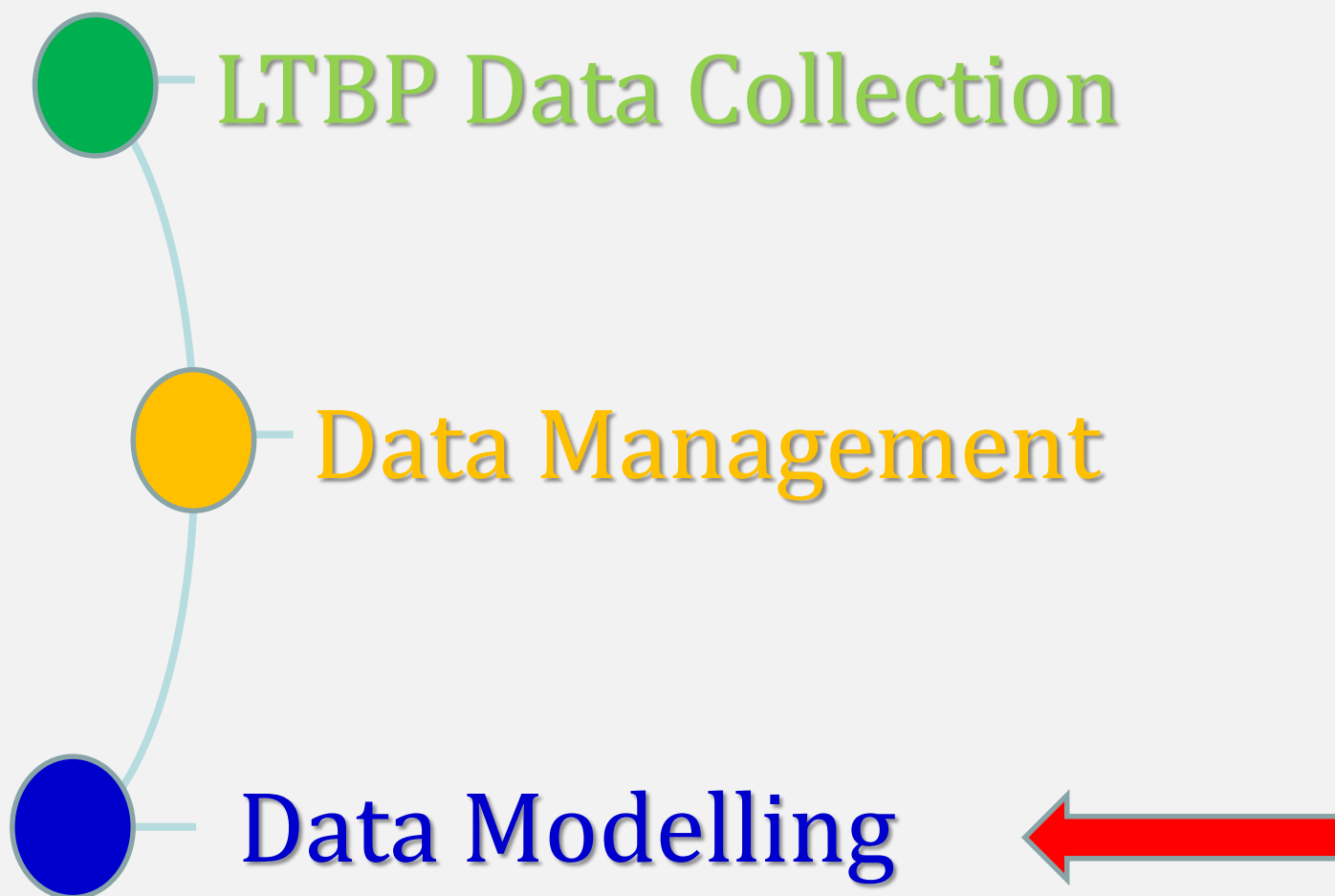
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Individual Bridge View

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NBI

NBE

Historical Data

LTBP Data

Deterioration

Environmental Data

Life Expectancy Data

LDM



Modelling Approach Data Driven



Input Data NBI



Data Type Best Quantity



Model Markovian Distribution



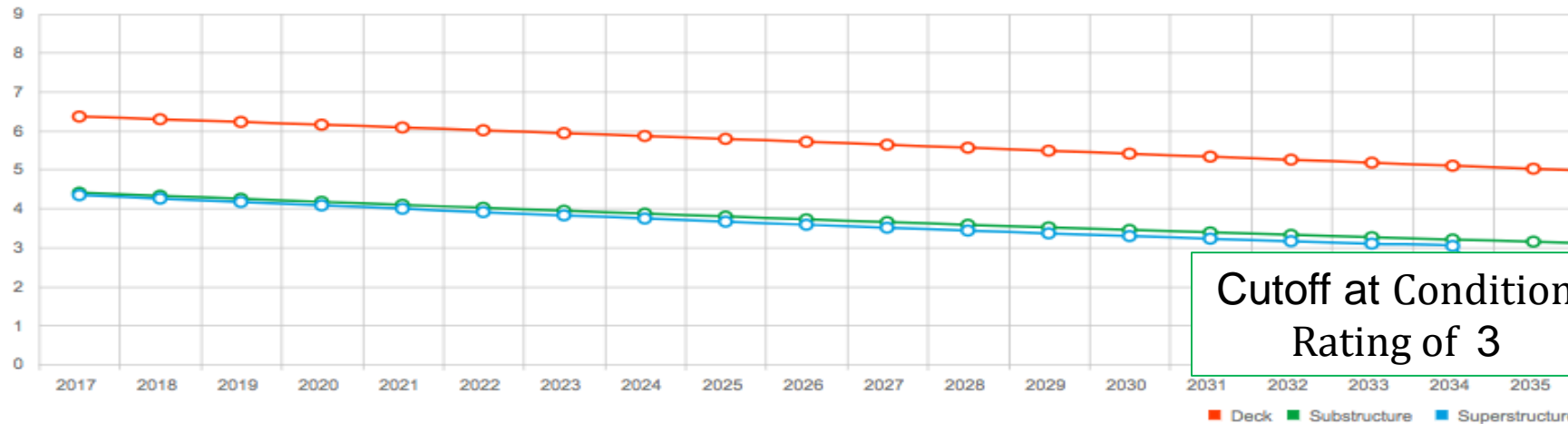
Model Attributes Age



*User-Defined  
Model Parameters*



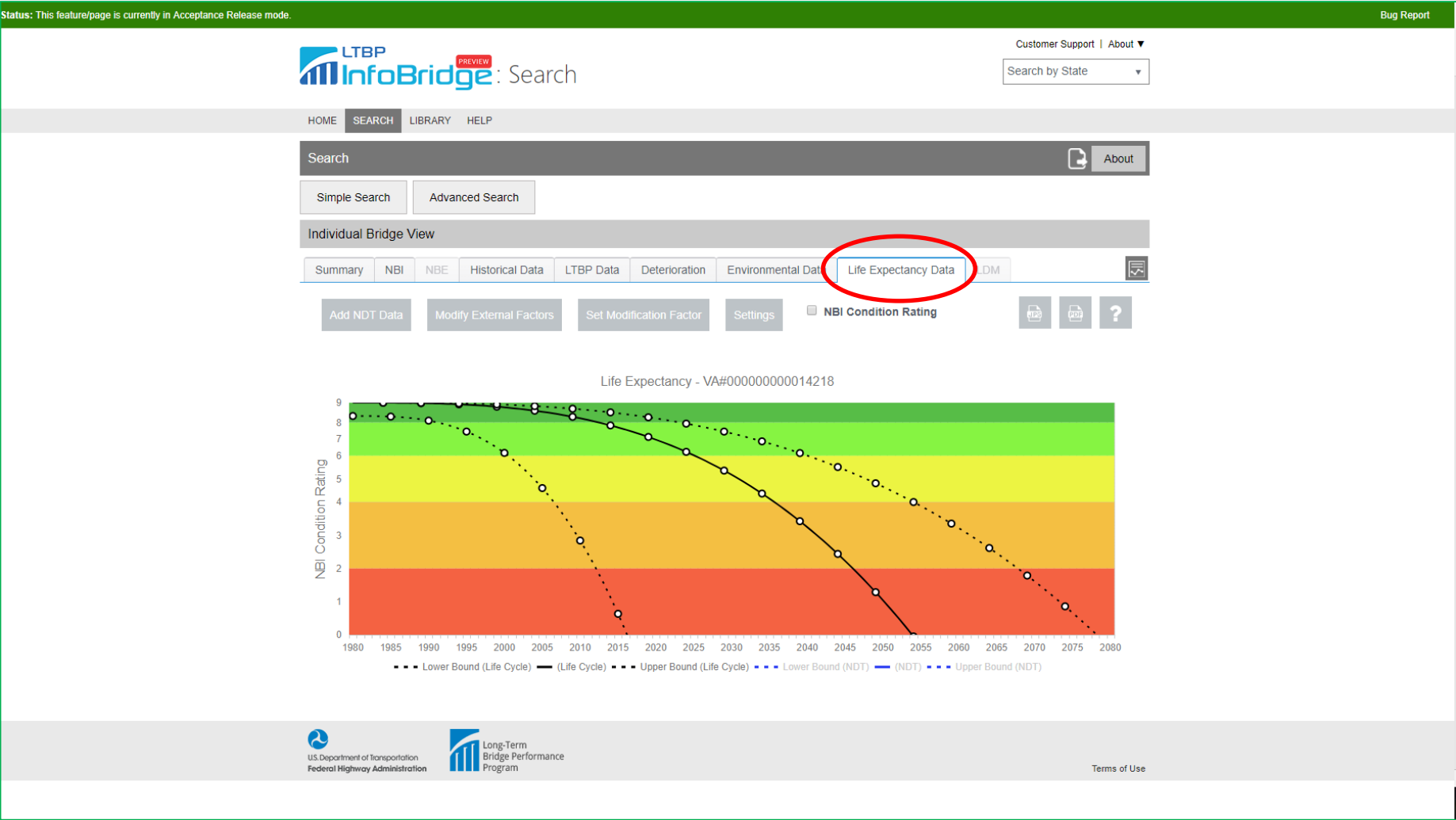
Deterioration (NBI Condition Rating) - VA#0000



Cutoff at Condition  
Rating of 3

Deck Substructure Superstructure

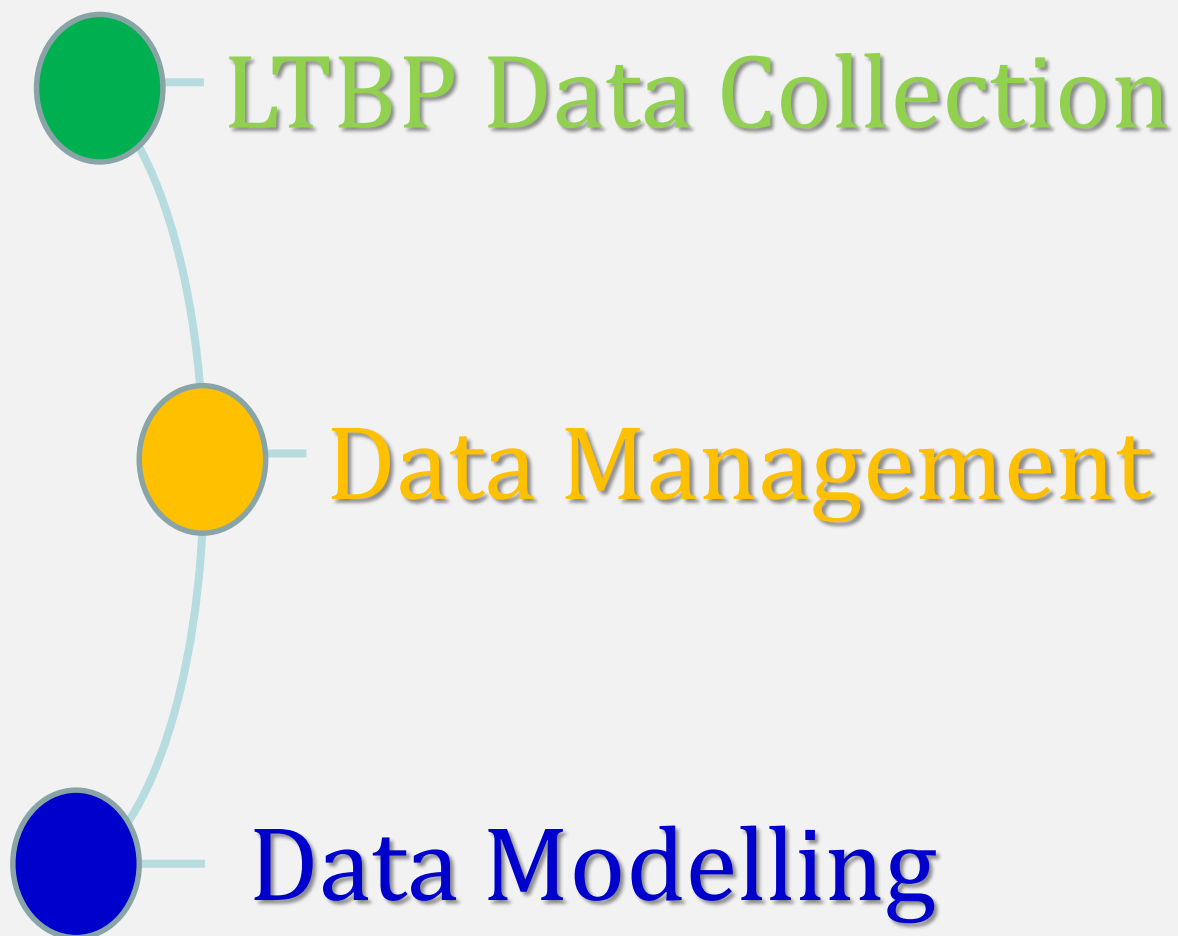








# Long Term Bridge Performance Program




*Next Steps .....*







# LTBP Moving Forward

- Field data collection
  - Hand held NDE + UAS of 3 steel girder bridges (pilot) – Summer 2018
  - 4 RABIT-CE data collection – Fall 2018
  - Pooled-fund study: “Influence of Vehicular Live Loads on Bridge Performance”, led by FHWA
- Strategic Research Matrices
- Students technical paper competition (based on using LTBP data)
- Strategic Plan
-  Cloud Deployment





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on Release mode.

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QUESTIONS?

1-D Chart  
2-D Chart  
Map Chart  
Statistics

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