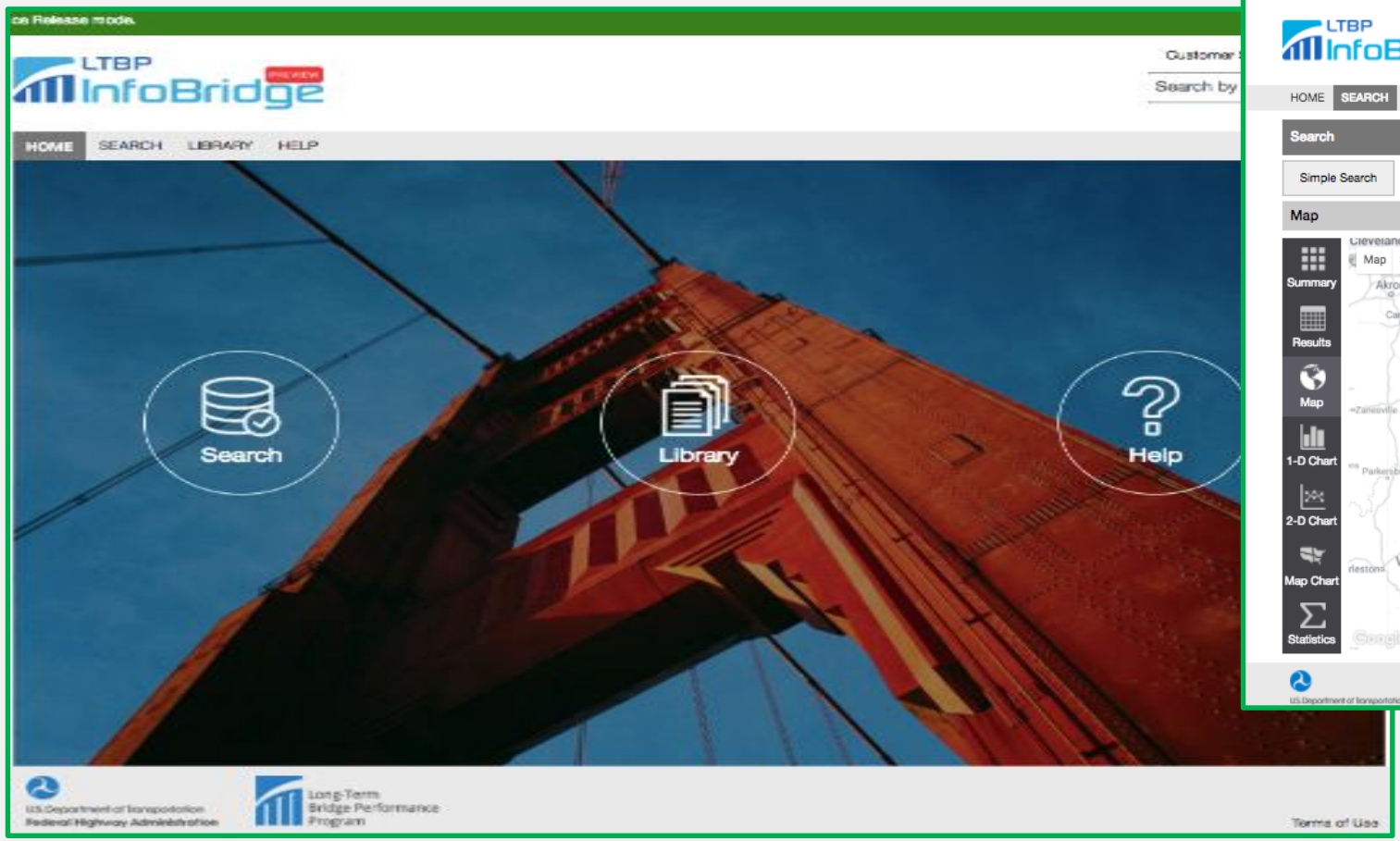
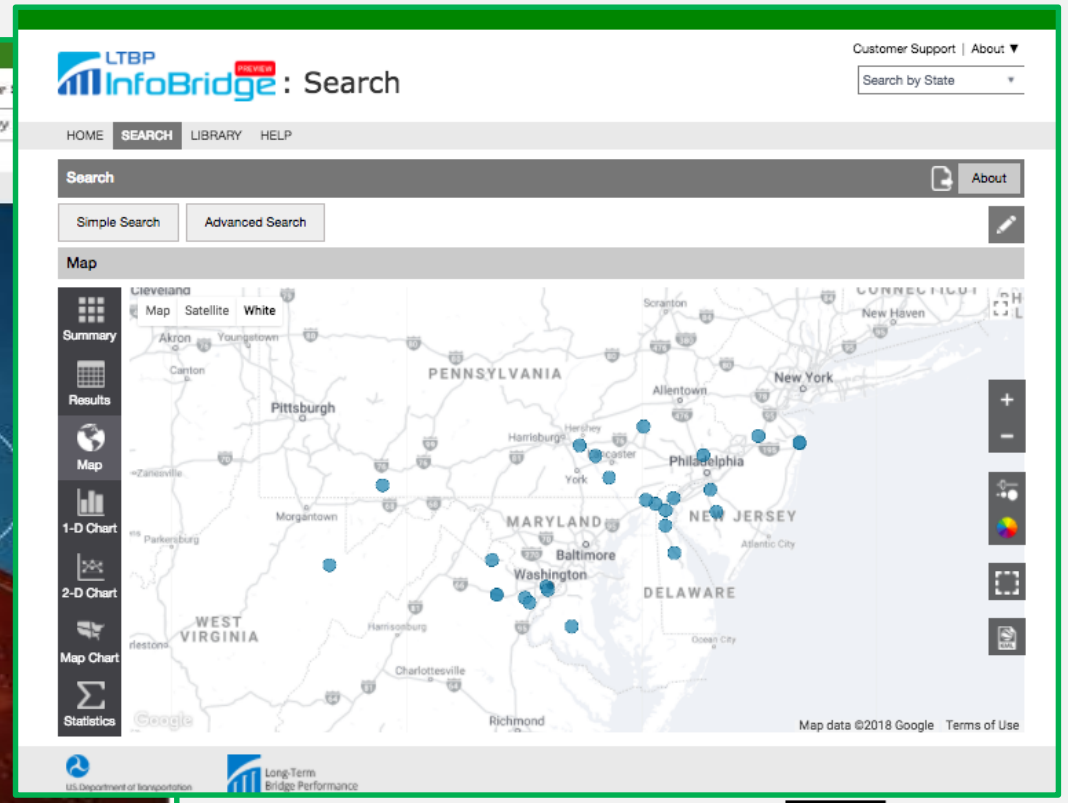
Long-Term Bridge Performance Program Status Update

National Bridge Preservation Partnership - April 2018 – Orlando FL

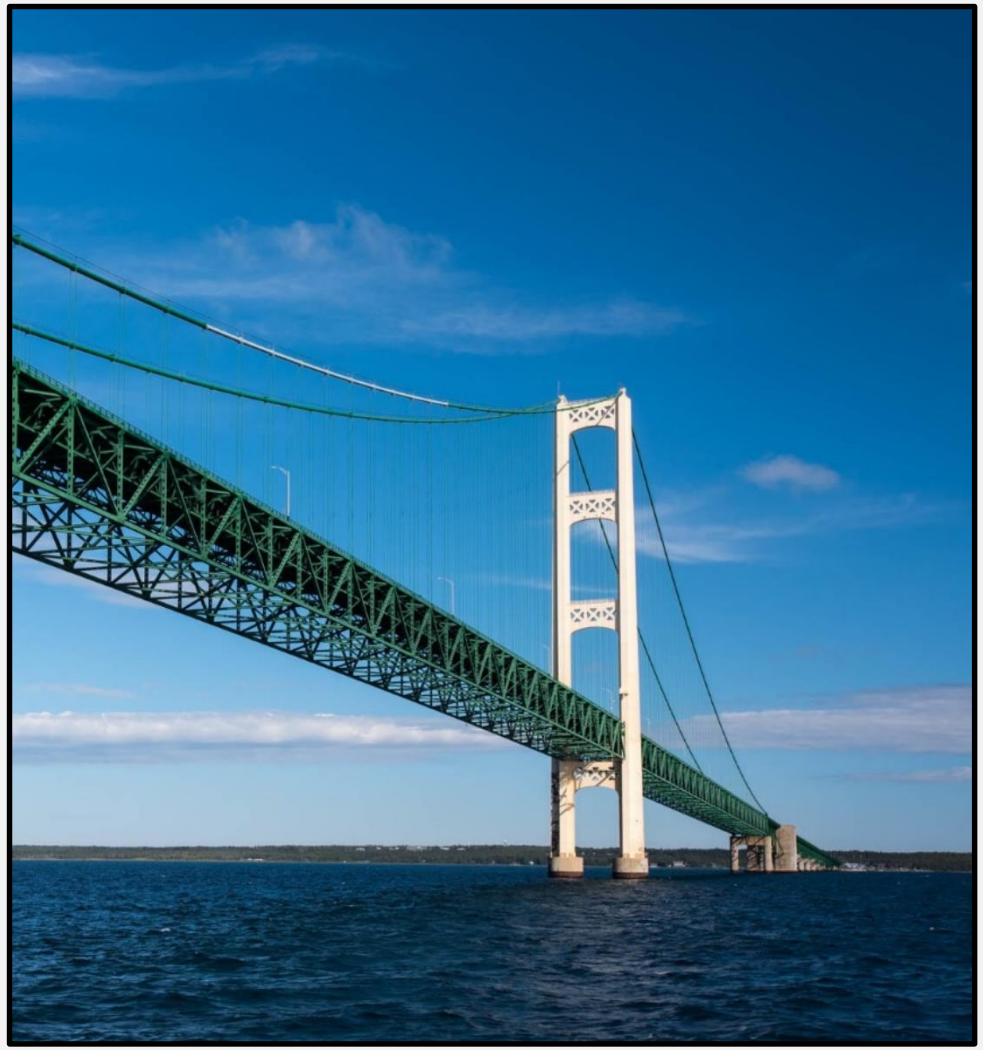
Robert Zobel, Ph.D., P.E.
LTBP Program Coordinator
Federal Highway Administration





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

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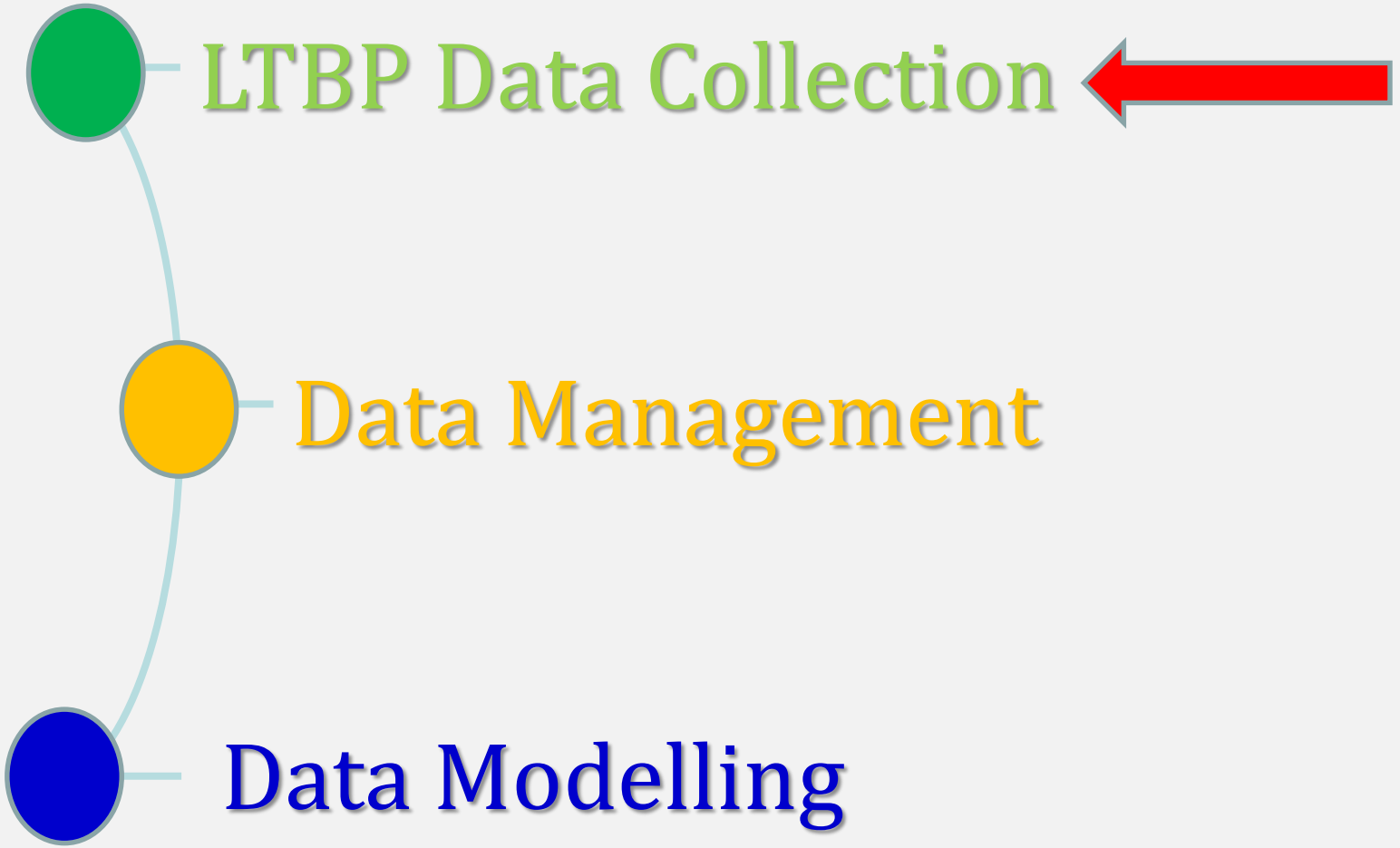
Long Term Bridge Performance Program



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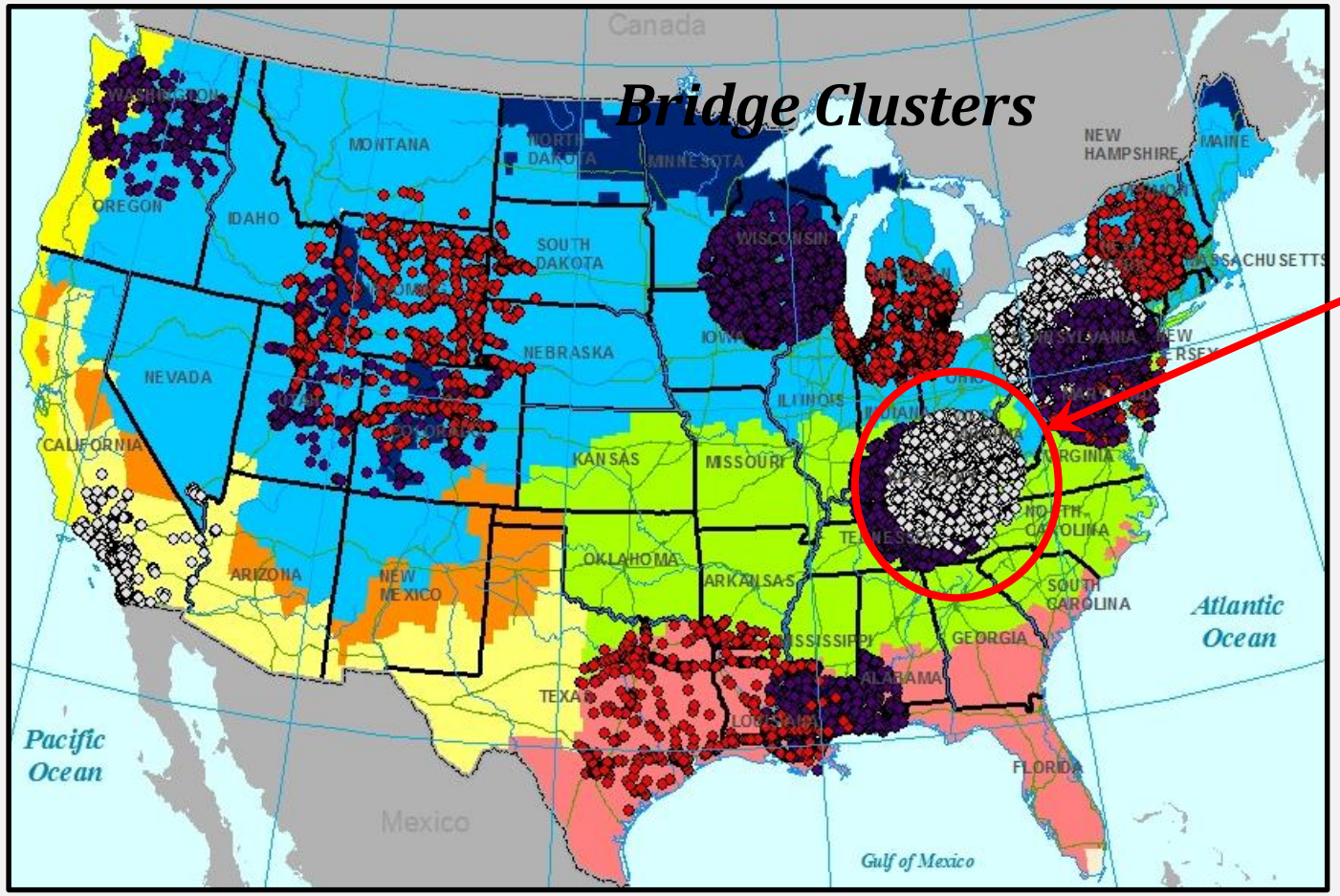
LTBP Data Collection Approach



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

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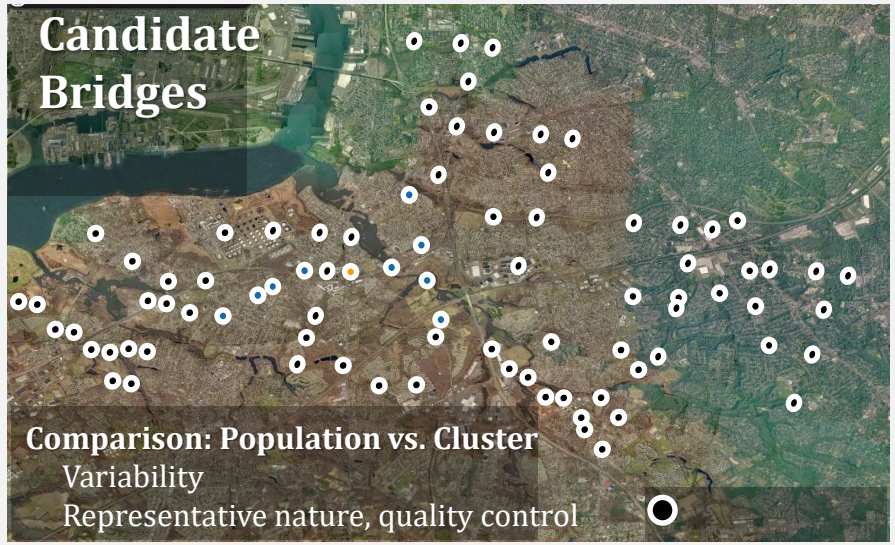
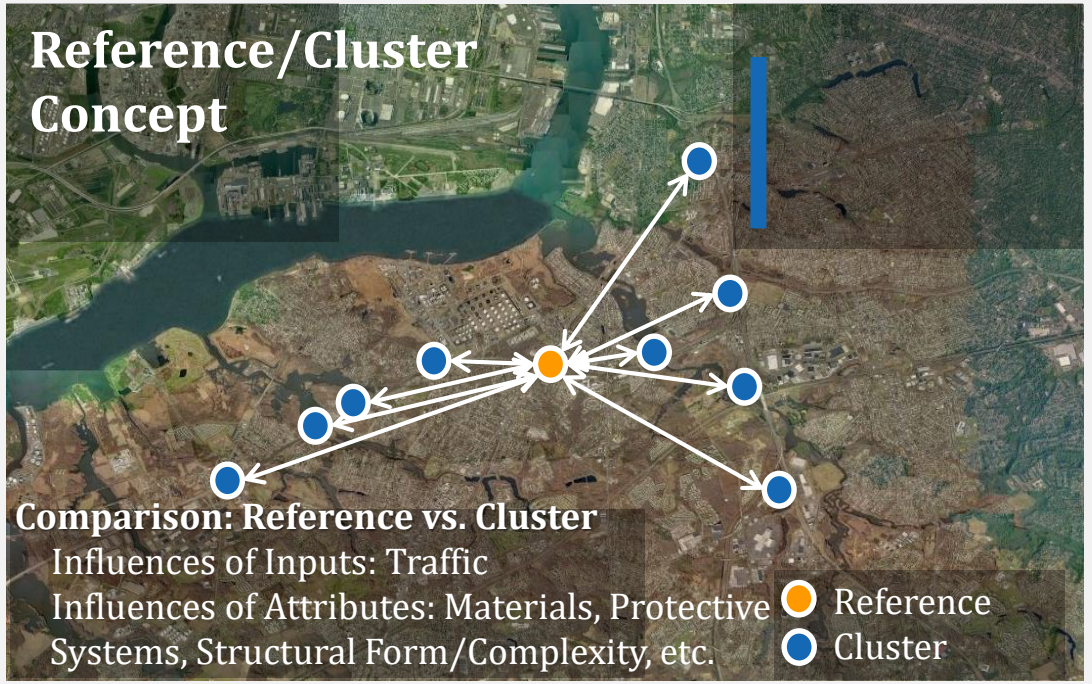
LTBP Multi-Tiered Data Collection Model

- ***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)**

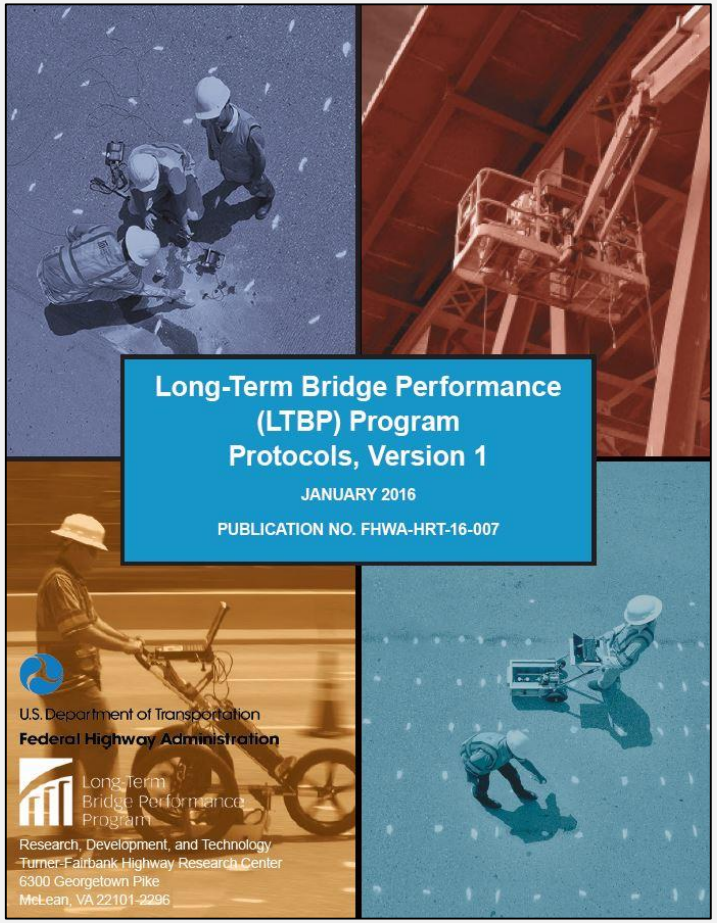
  Ground Penetrating Radar – concrete condition, corrosion, map reinforcement

  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.

Data Collection

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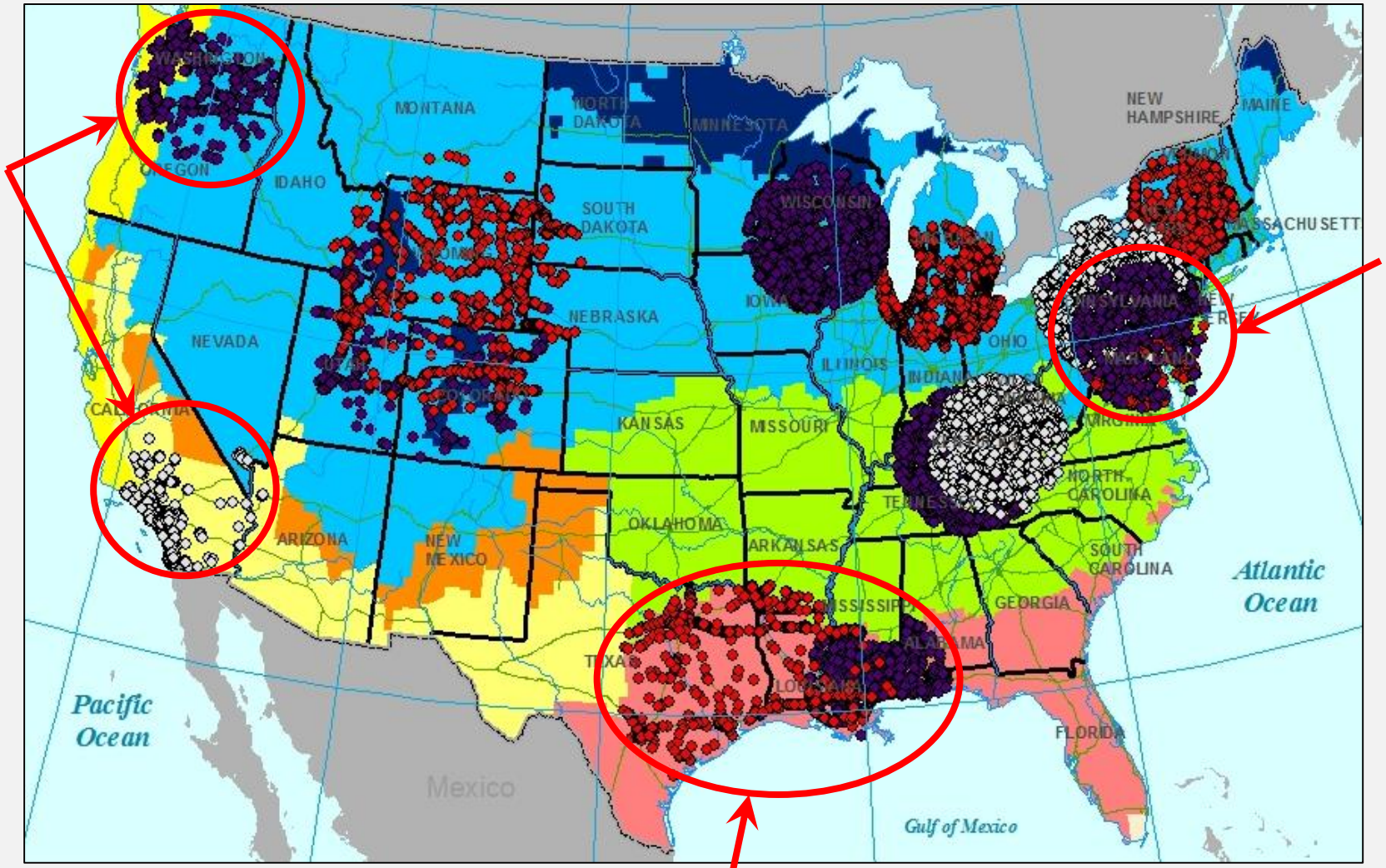
Field Data Collection – To Date

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

Data Collection

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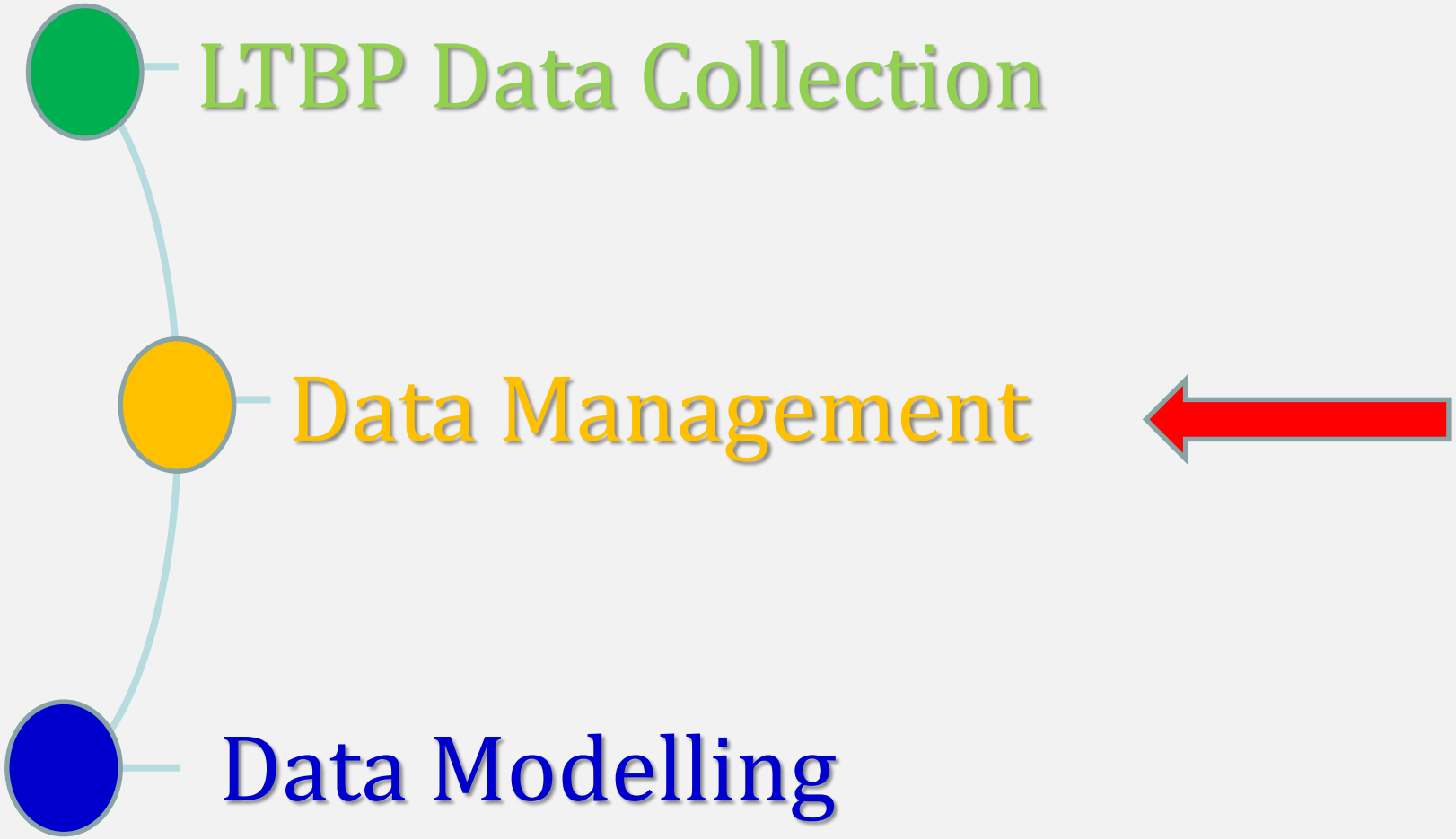
LTBP Data Collection – Legacy Data Mining (LDM)

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



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LTBP - Bridge Portal

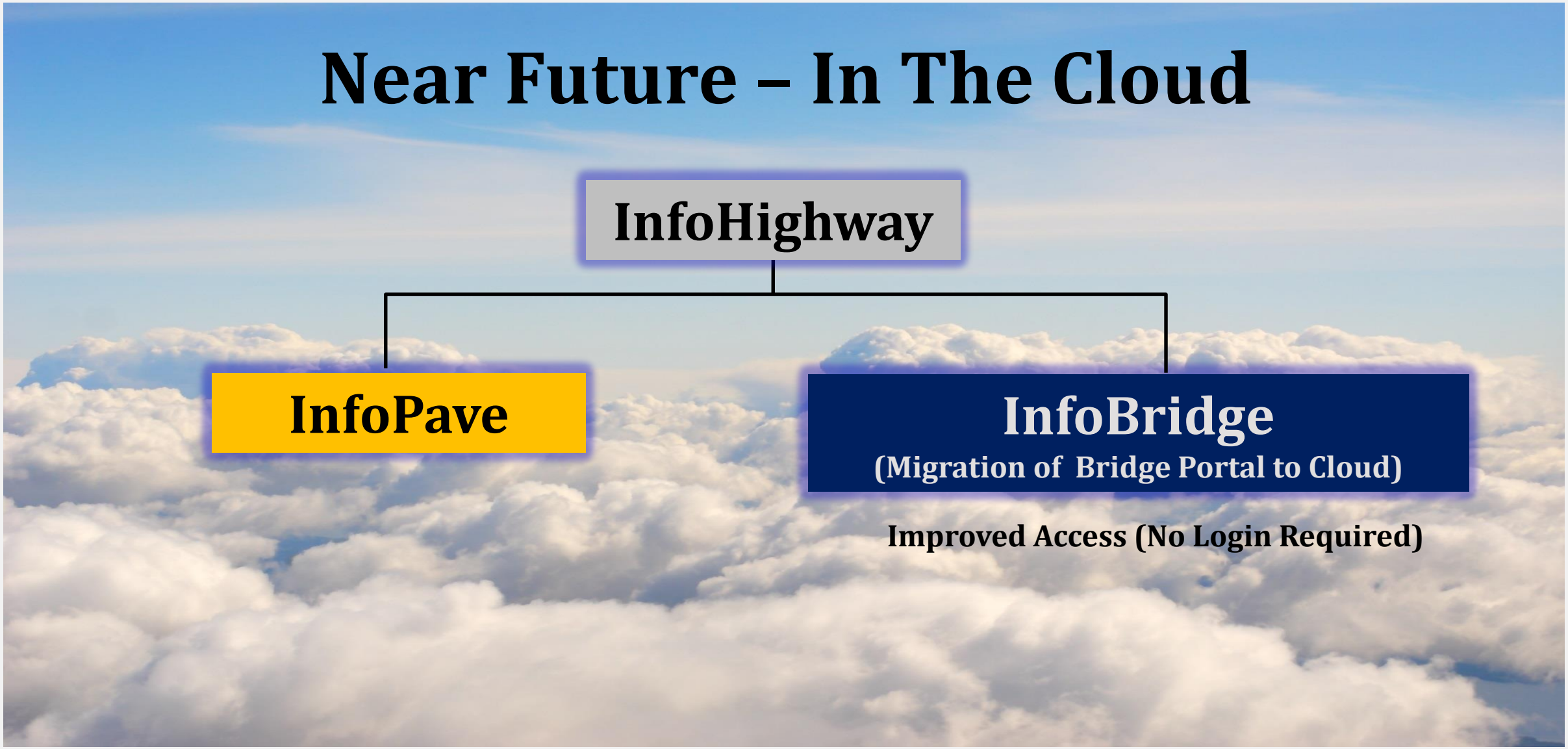
- *Centralized, national-level repository for efficiently and quickly accessing and querying bridge performance-related data and information*

  (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



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*

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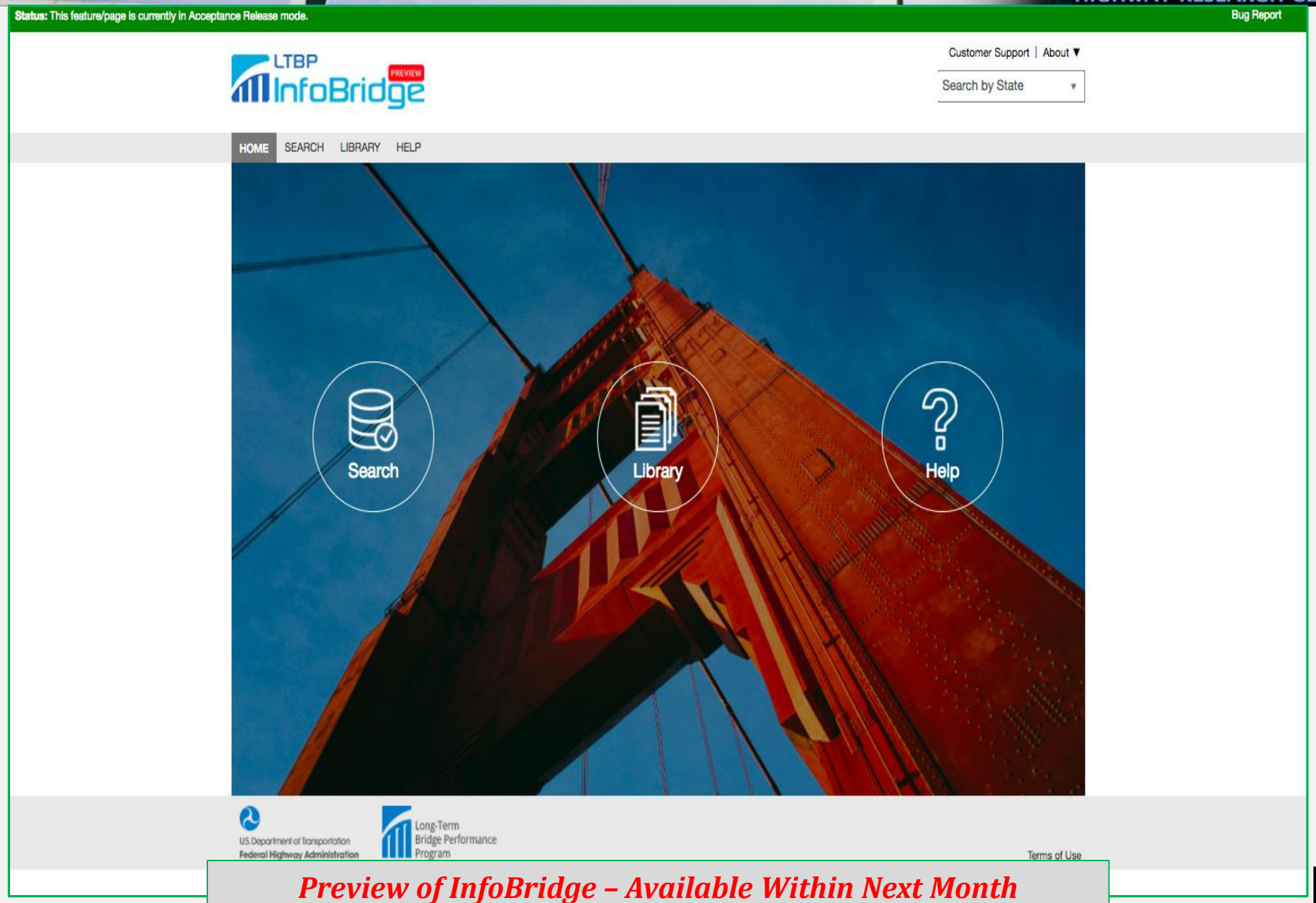

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Preview of InfoBridge – Available Within Next Month

Official Rollout of InfoBridge - January 2019

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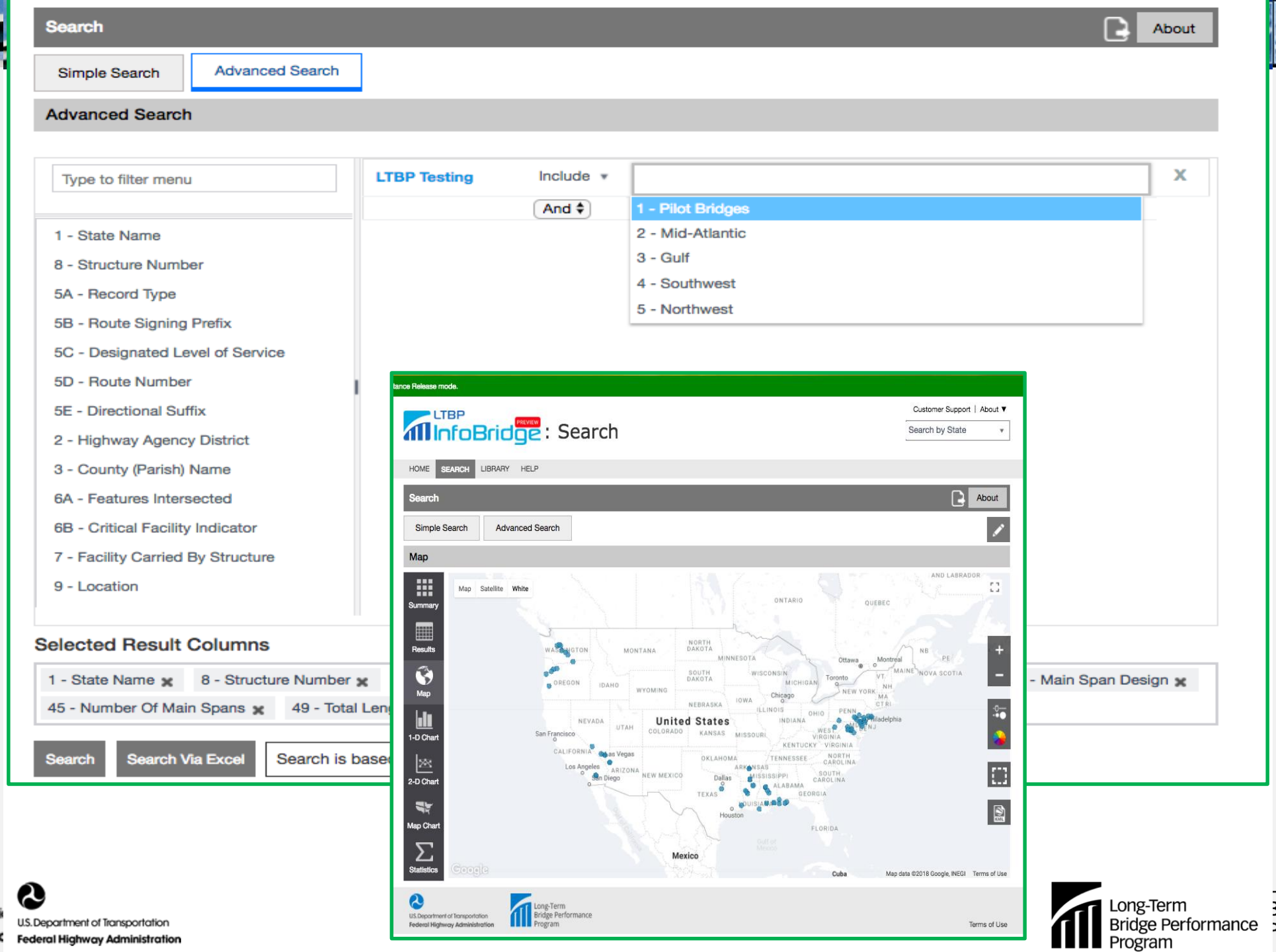

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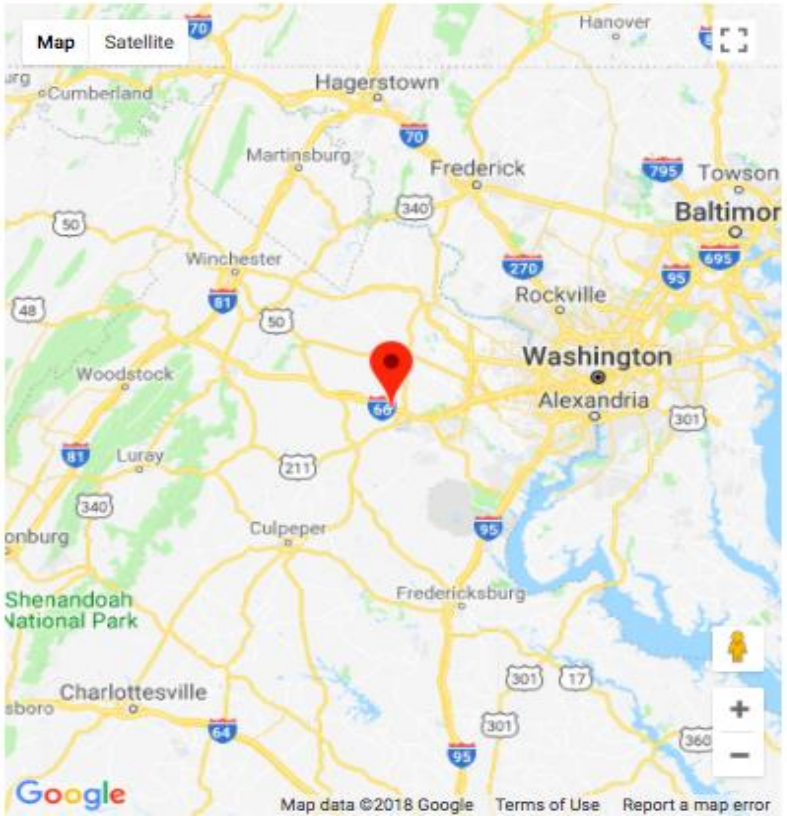
Individual Bridge View

Summary | NBI | NBE | Historical Data | LTBP Data | Deterioration | Environmental Data | Life Expectancy Data | LDM

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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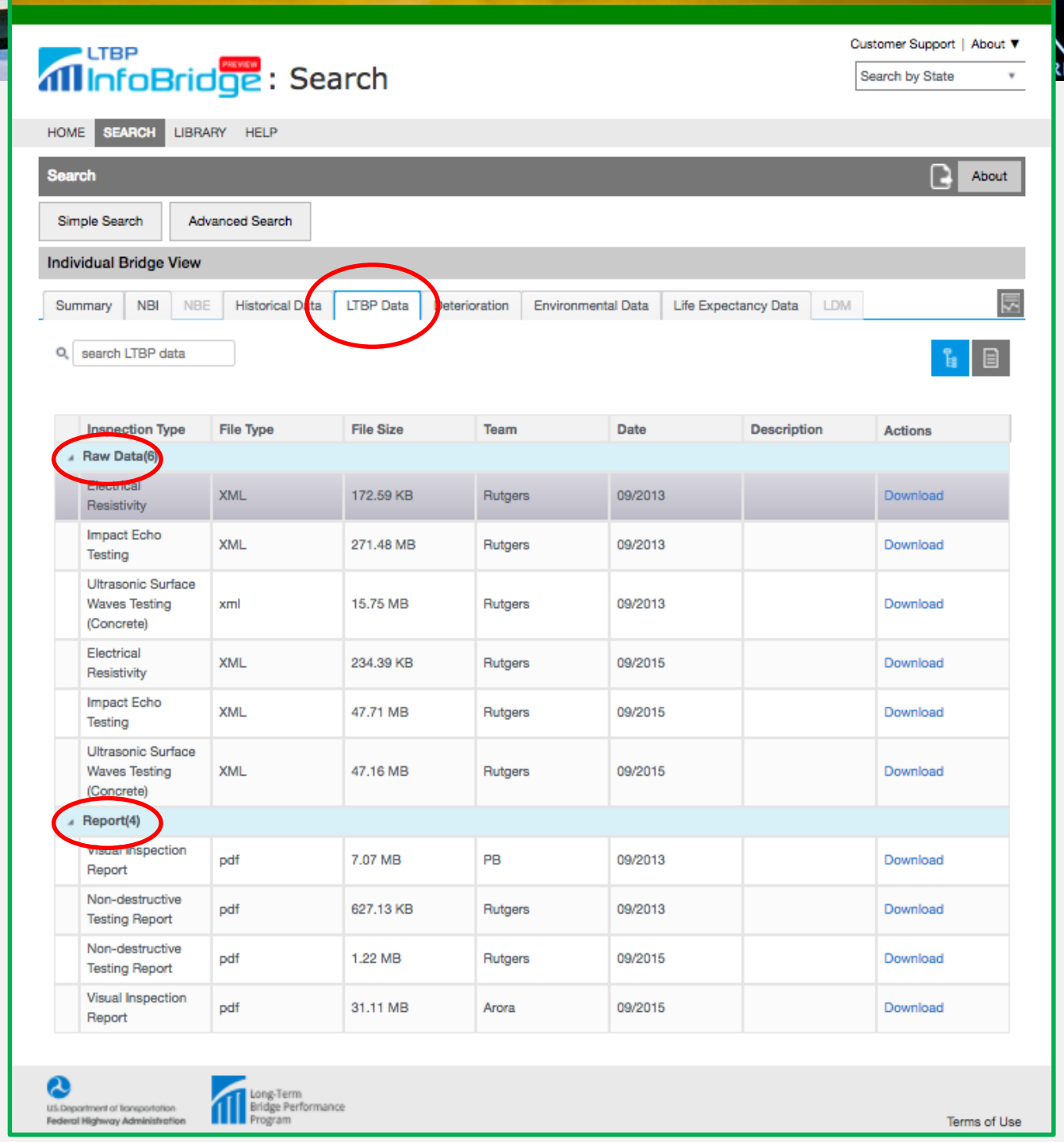

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Visual Inspection Report

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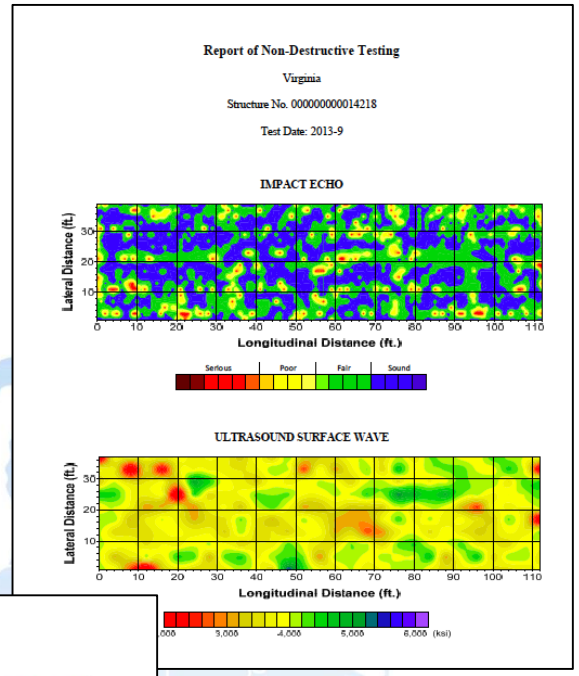
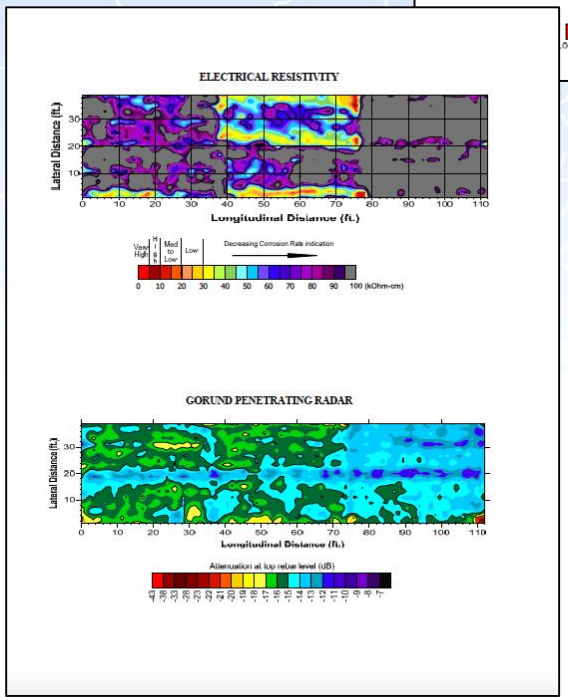
Structure No. 000000000014218

Visual Inspection (Defect level)





NDE Assessment

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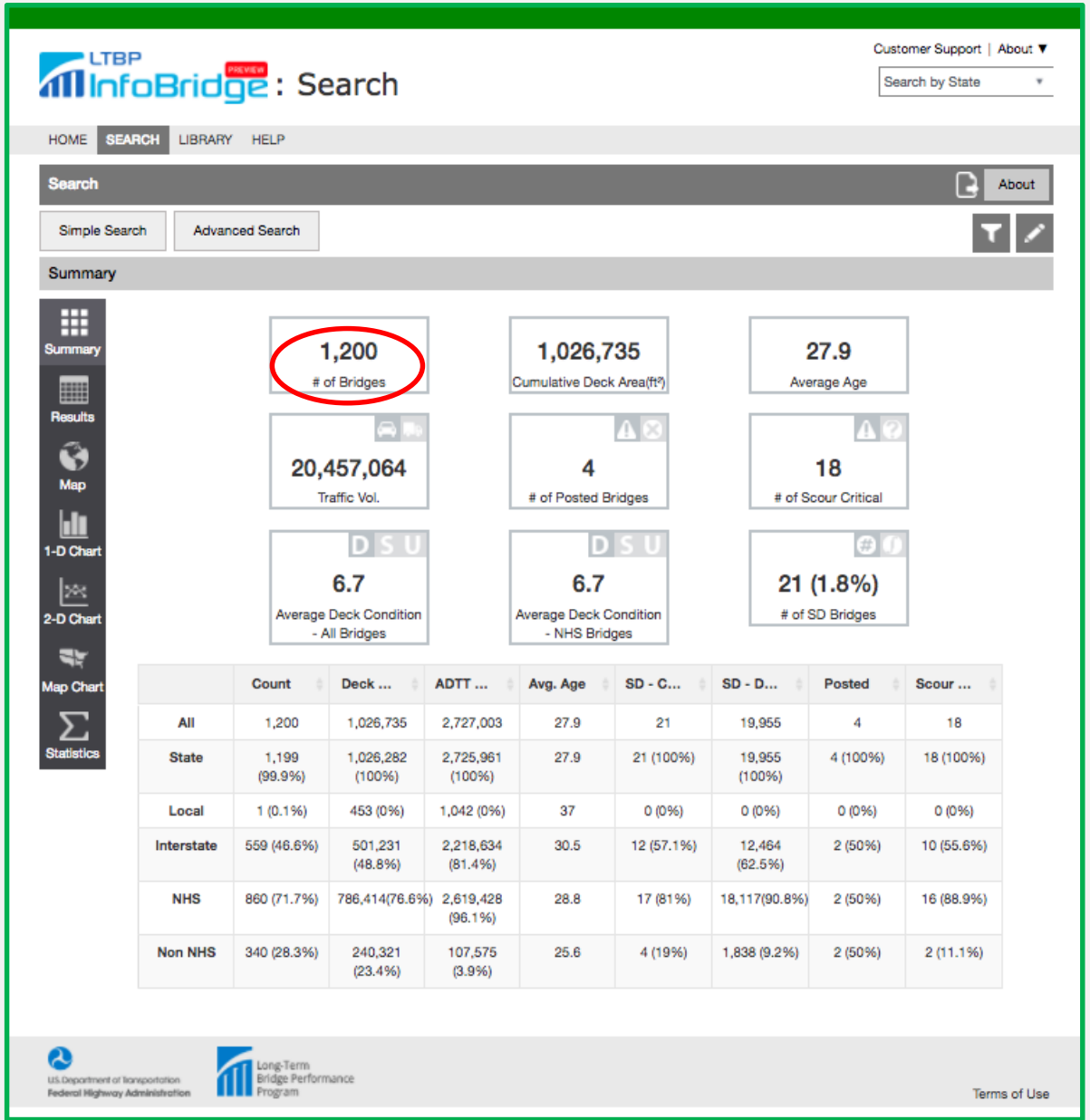
Legacy Data Mining – Untreated Bridge Decks



	Count	Deck ...	ADTT ...	Avg. Age	SD - C...	SD - D...	Posted	Scour ...
All	1,200	1,026,735	2,727,003	27.9	21	19,955	4	18
State	1,199 (99.9%)	1,026,282 (100%)	2,725,961 (100%)	27.9	21 (100%)	19,955 (100%)	4 (100%)	18 (100%)
Local	1 (0.1%)	453 (0%)	1,042 (0%)	37	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Interstate	559 (46.6%)	501,231 (48.8%)	2,218,634 (81.4%)	30.5	12 (57.1%)	12,464 (62.5%)	2 (50%)	10 (55.6%)
NHS	860 (71.7%)	786,414(76.6%)	2,619,428 (96.1%)	28.8	17 (81%)	18,117(90.8%)	2 (50%)	16 (88.9%)
Non NHS	340 (28.3%)	240,321 (23.4%)	107,575 (3.9%)	25.6	4 (19%)	1,838 (9.2%)	2 (50%)	2 (11.1%)

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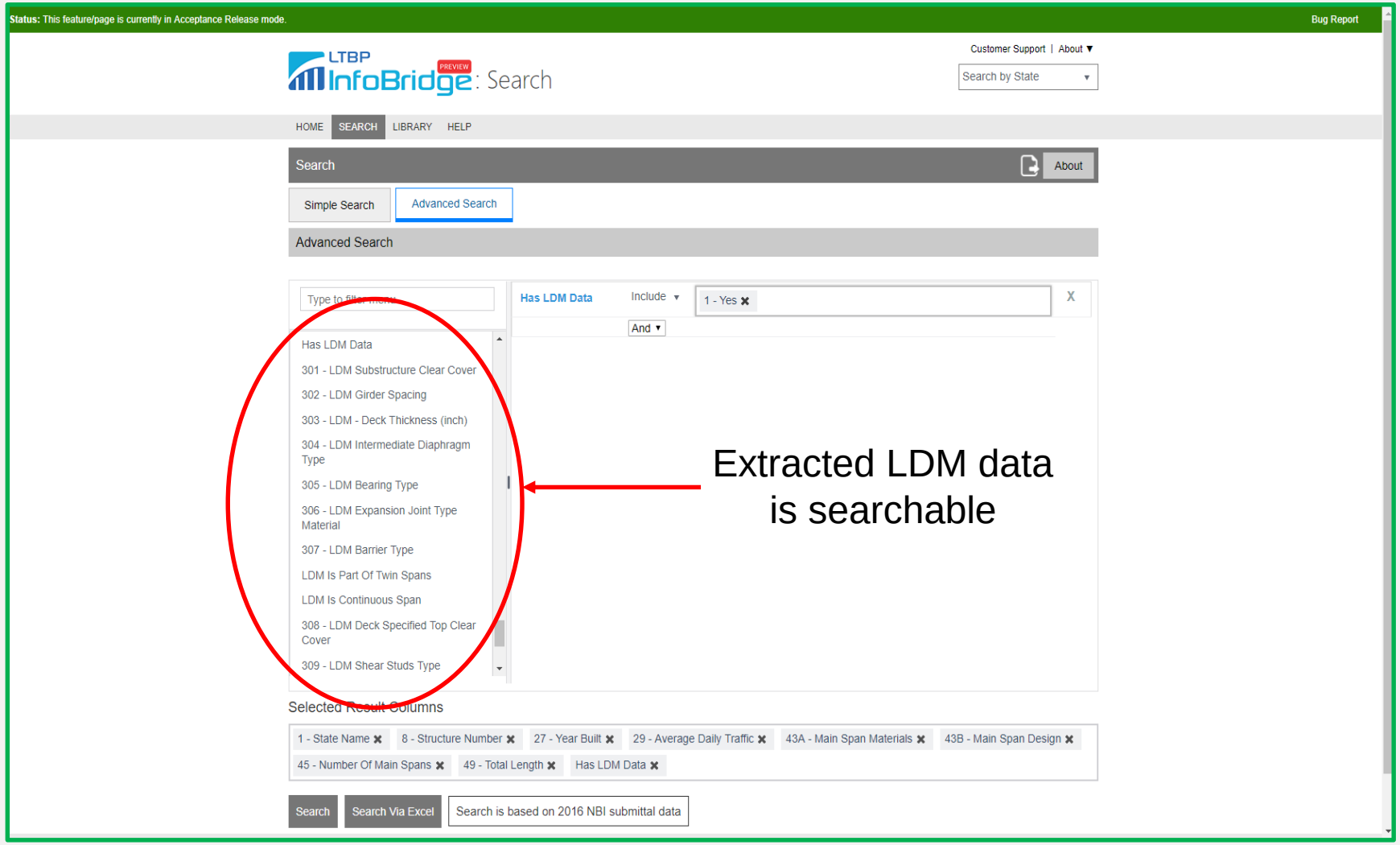

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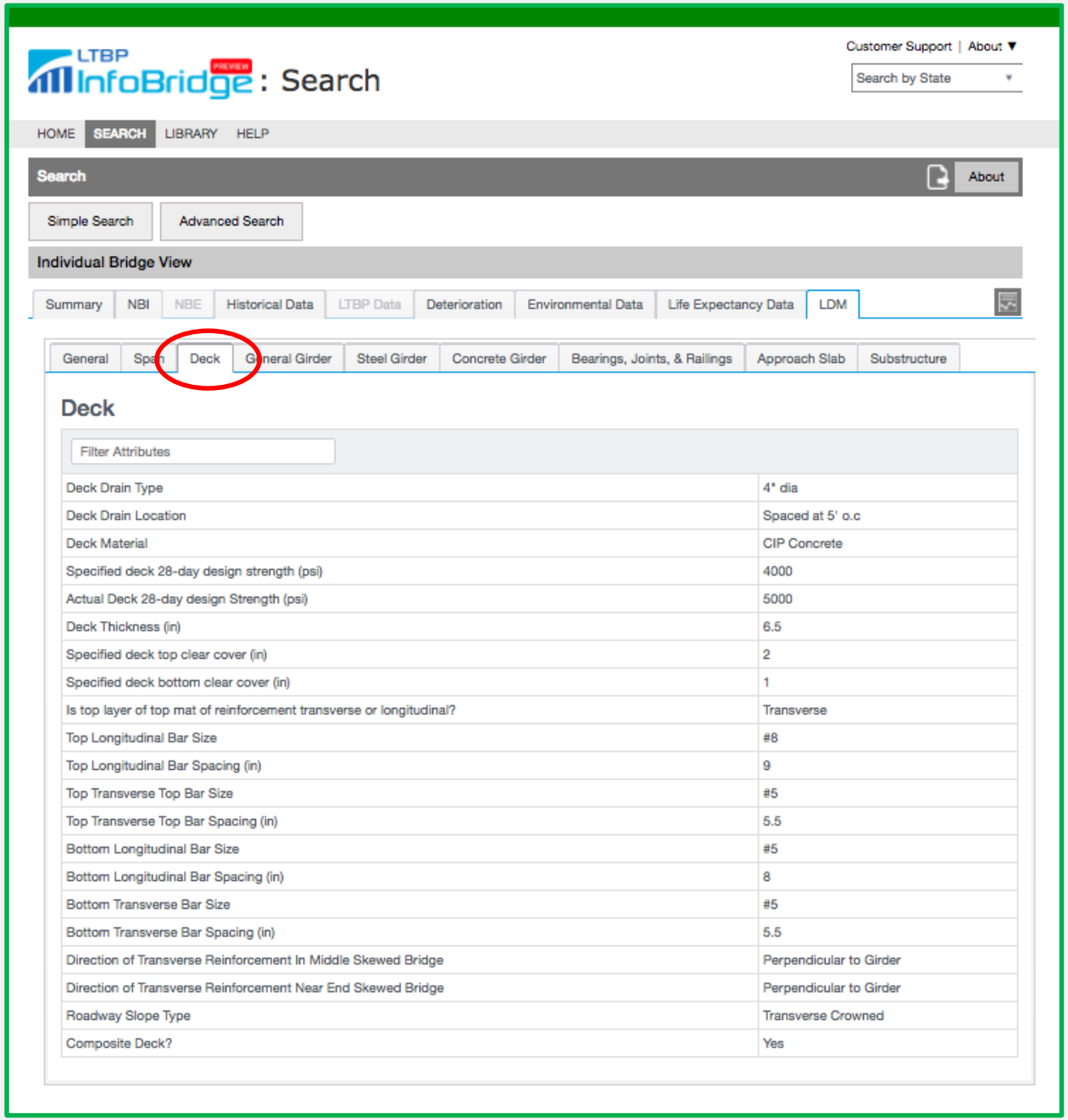

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Individual Bridge View

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, & 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

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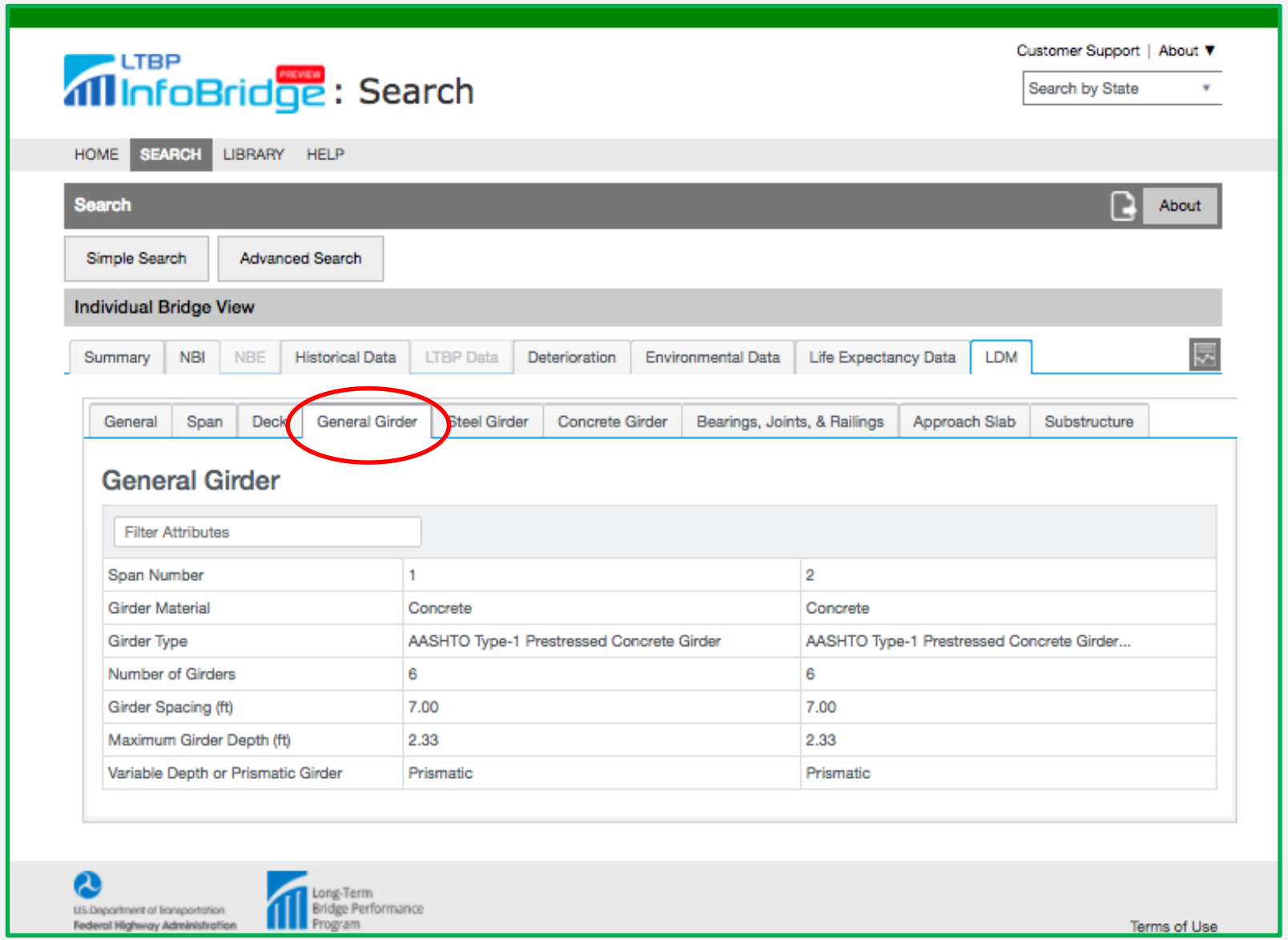

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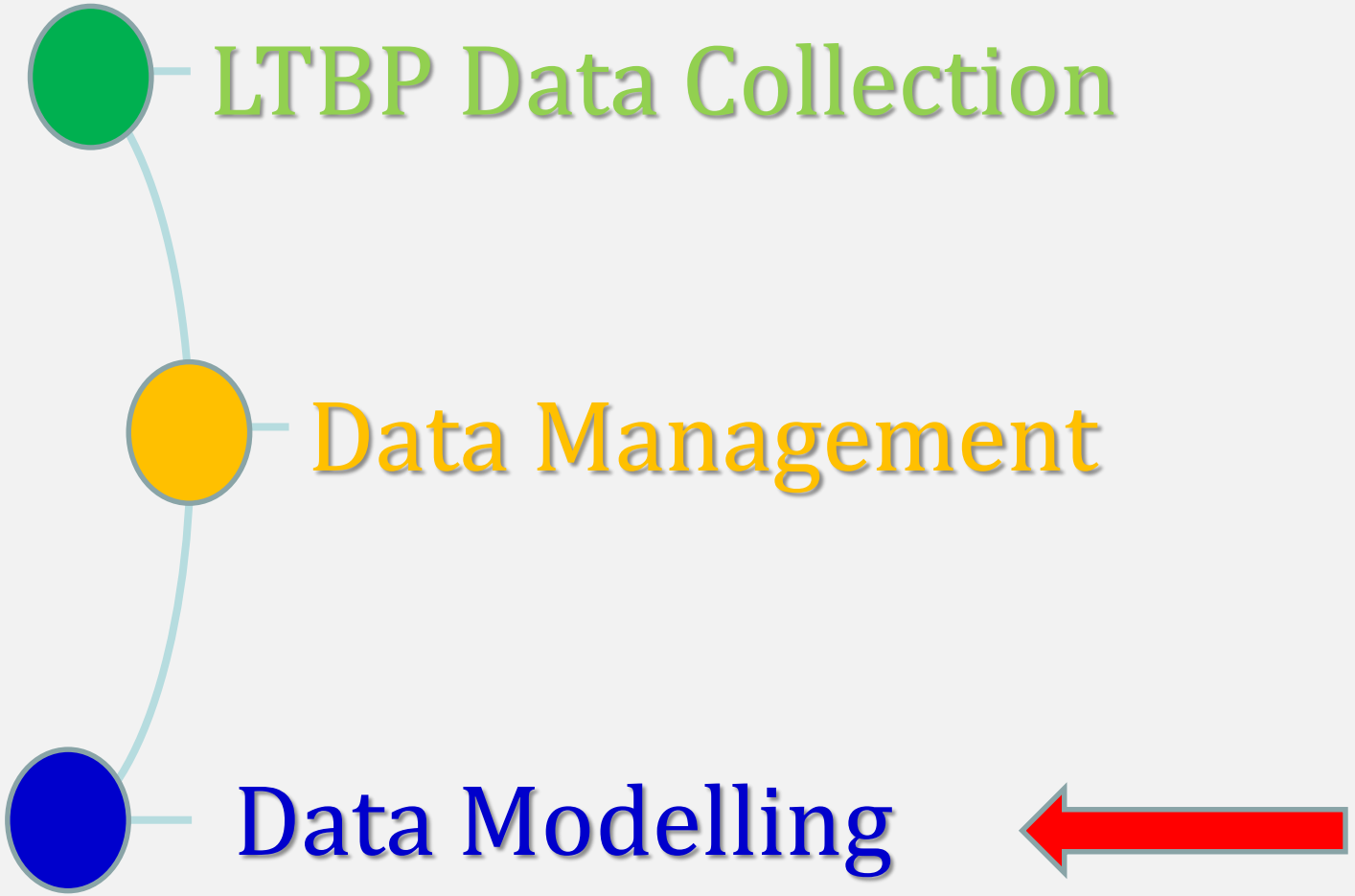

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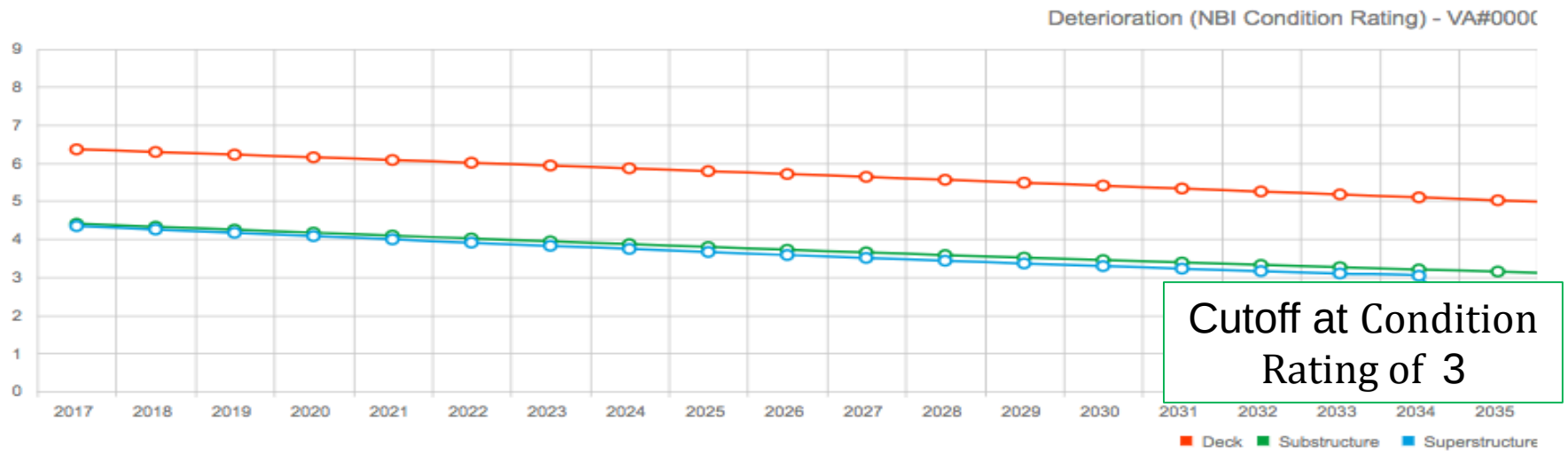
Modelling Approach	Data Driven
Input Data	NBI
Data Type	Best Quantity
Model	Markovian Distribution
Model Attributes	Age

User-Defined Model Parameters



Cutoff at Condition Rating of 3

Data Modelling

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Data Modelling

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Forecast adjusted based on NDE field data

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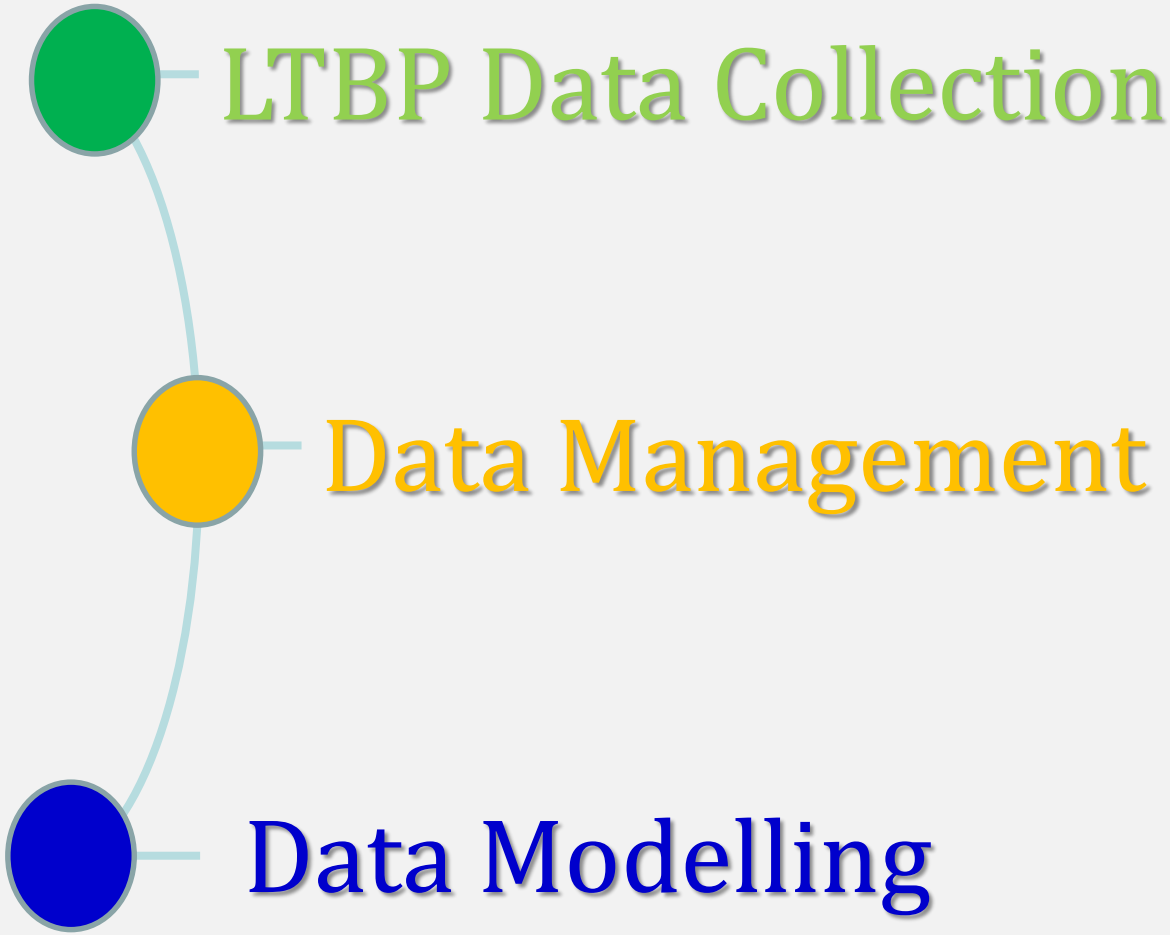

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Next Steps .....

Long-Term
Bridge Performance
Program

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
- LTBP InfoBridge PREVIEW Cloud Deployment

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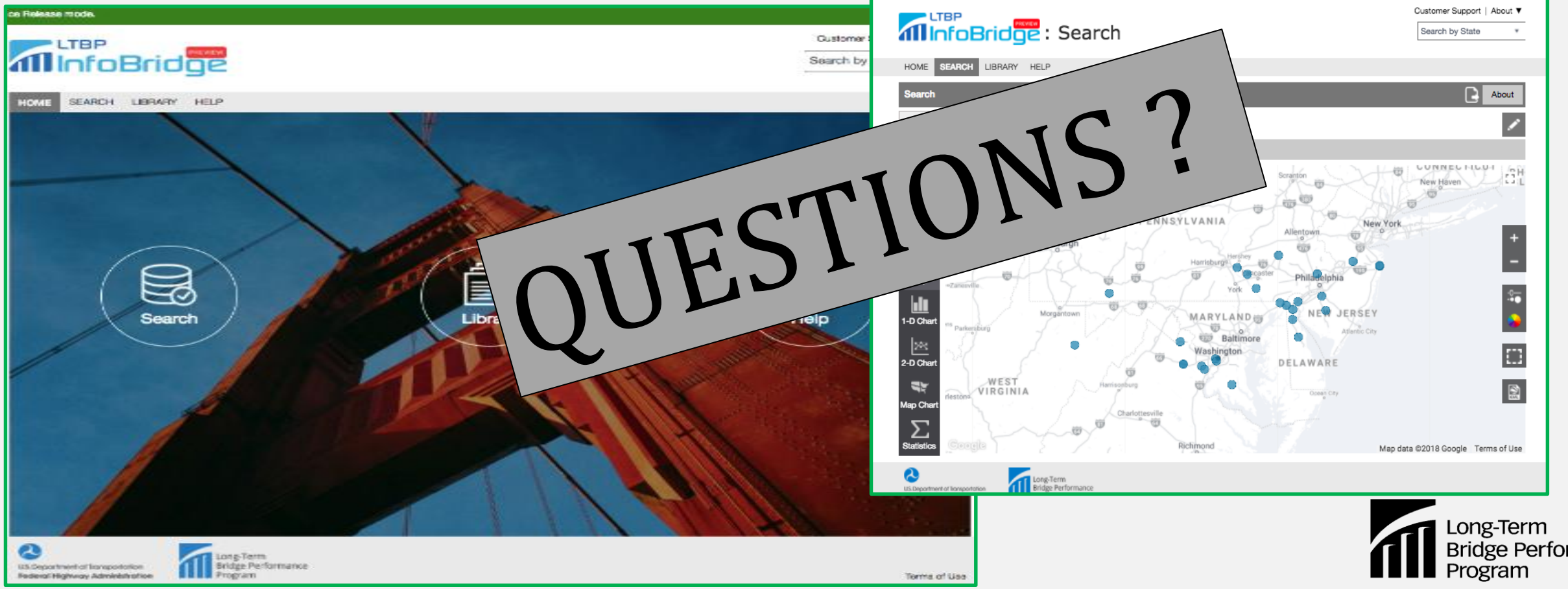

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