Current State of Infrastructure Maintenance and Monitoring in USA

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For a Better Quality of Life

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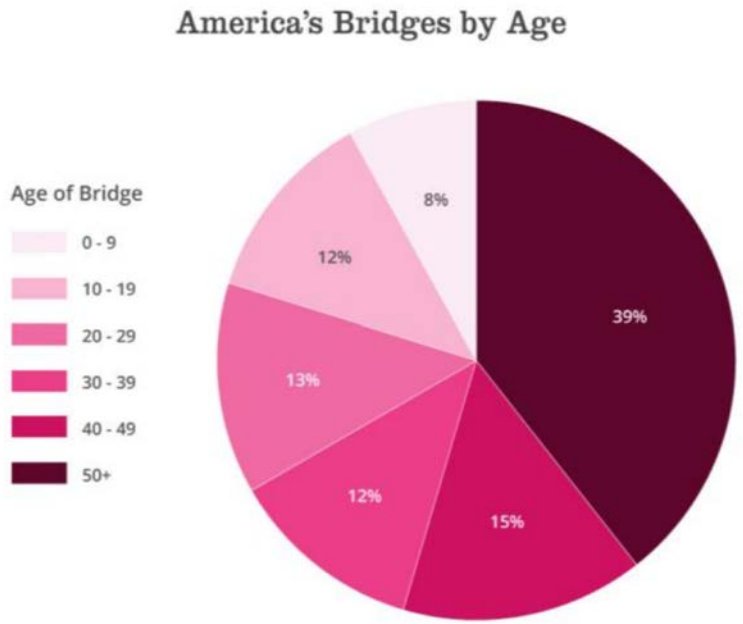
Outline

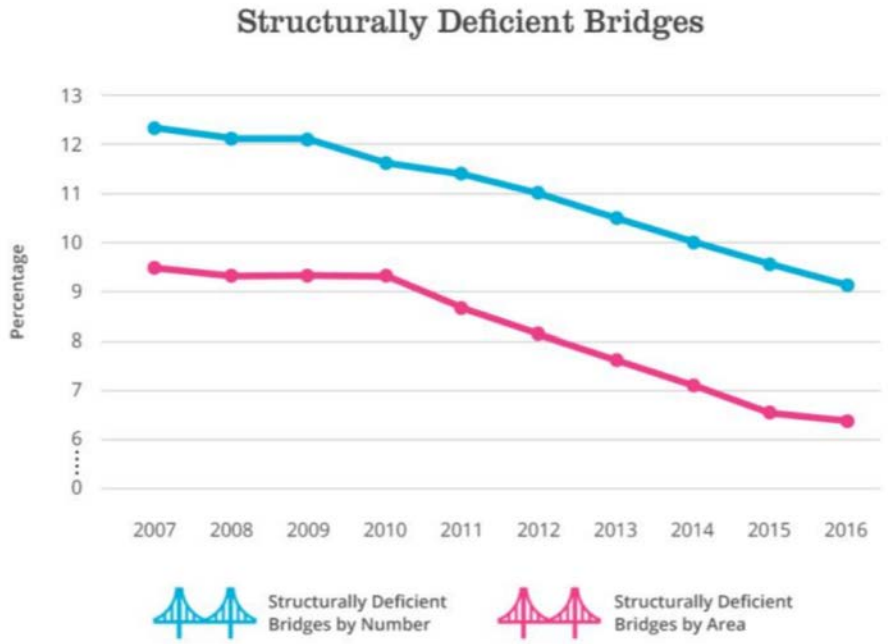
1. **Age of Bridge Infrastructures in US** (1 slide)
2. **Periodic Inspection Requirements in US** (3 slides)
3. **Monitoring Research Efforts in US** (3 slides)
4. **Needs and Challenges in Monitoring Efforts** (1 slide)

1. Deterioration of Bridge Infrastructures in US

Graphical Data based on the ASCE 2017 Infrastructure report card and

- Of the 614,387 bridges in the National Bridge Inventory, 39% are over 50 years or older. (2017)
- Including the 15% with bridges between the ages of 40 and 49, the average age of US bridge is 43 yr old.
- With the past 10-15 years of efforts, the number of structurally deficient bridges is currently at 9% of the inventory.
- Most recent 2021 report card suggests with that there are now **42%** of the **617,000** bridges that are **at least 50 years old**, and **7.5% (46,154 bridges)** are considered as **structurally deficient**.





2. Periodic Inspection Requirements in US

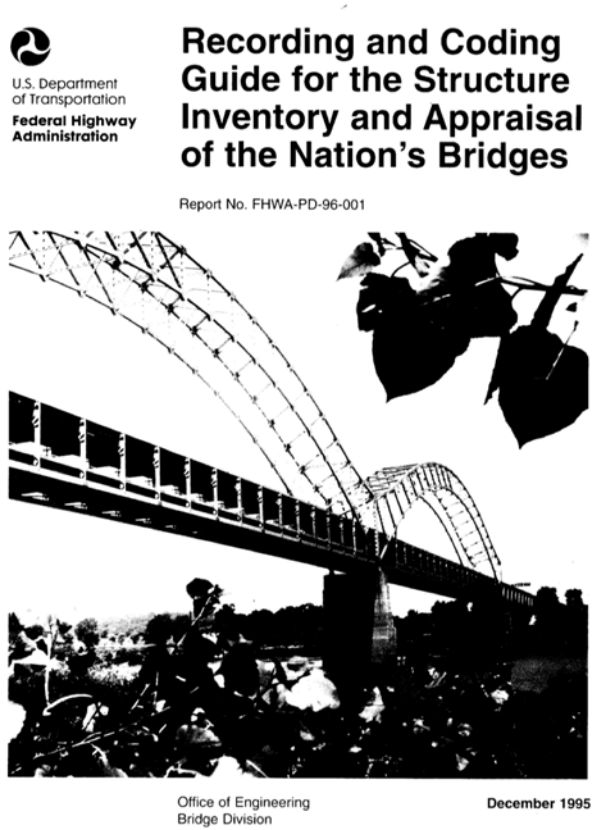
National Bridge Inventory

- FHWA requires bridges that are longer than 20 ft (6 m) on all public roads
- Requires inspection at least once every two years
- Data available for download between 1992 to 2021

```
317     NKA-MF-
00214200000000004500000Mirage
Flats Canal        Lembke Rd
Approx 16 miles
southwest999900051170000000000000
42280379102521880073026909199002
00000050201050050000000050000000
000A151010000020009990004900010 7
0000000050005099 0N0000N000000664
6N232723274NN4873810000000 31224N
N  N
0522000000000522002010    0 0
0N3 0000018001501Y80000082030
NY
1 06251
```

Information for Many Bridges

Required by FHWA for NBI



U.S. Department of Transportation
Federal Highway Administration

Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges

Report No. FHWA-PD-96-001

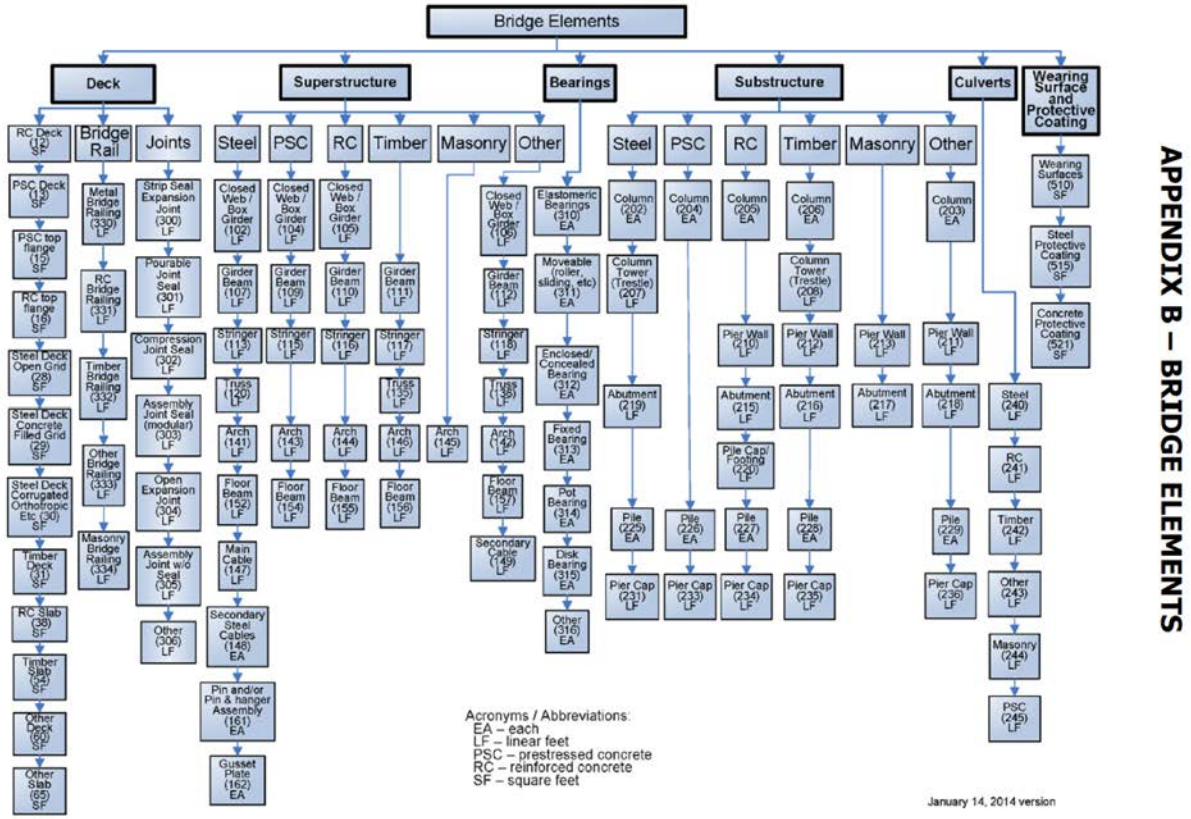
Office of Engineering
Bridge Division

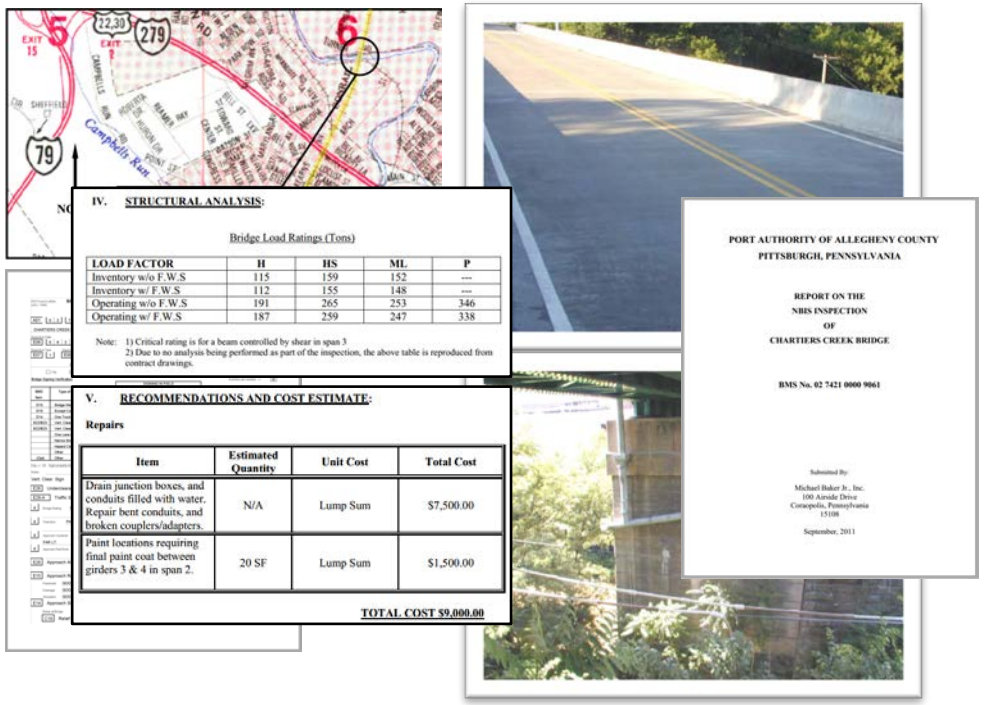
December 1995

2. Periodic Inspection Requirements in US

National Bridge Element Data and State DoT Inspection Data

- Element level data available from 2015 to 2021
- State DoT manages photos, load ratings, drawings, inspection reports in their own repositories separate from NBI, NBE data





Files for Each Bridge

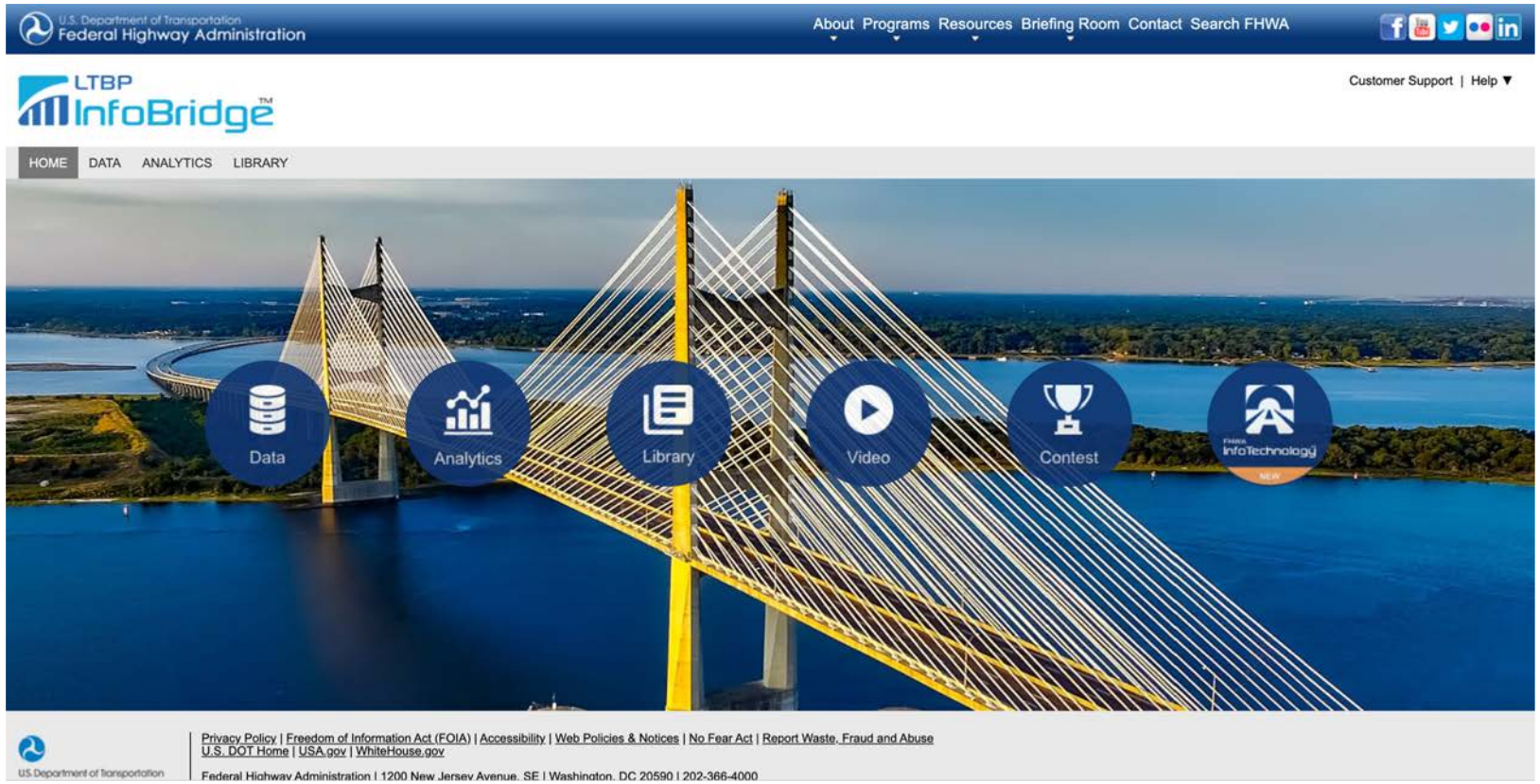
Managed by bridge owners.

Different from state-to-state.

2. Periodic Inspection Requirements in US

Long-term Bridge Performance (LTBP) *InfoBridge*

- InfoBridge web portal started as one of the efforts of the LTBP program in 2019.
- Tries to archive, share, and allow analytics on web portal including NBI, NBE data of bridge inventory and some NDT data for limited number of bridges



3. Monitoring Research Efforts in US

Active Structural Health Monitoring Research Groups in US

Institution	Project Investigator	URL
University of Illinois at Urbana Champaign	Dr. Billie F. Spencer	https://sstl.cee.illinois.edu
University of Illinois at Urbana Champaign	Dr. John S. Popovics	https://cee.illinois.edu/directory/profile/johnpop
Purdue University	Dr. Shirley Dyke	https://engineering.purdue.edu/IISL/
Purdue University	Dr. Mohammad R. Jahanshahi	https://web.ics.purdue.edu/~jahansha/
University of Michigan	Dr. Jerome P. Lynch	http://www-personal.umich.edu/~jerlynch/
Los Alamos National Lab	Dr. Charles R. Farrar	https://www.lanl.gov/projects/national-security-education-center/engineering/about-us/index.php
Rugters University	Dr. Nenad Gucunski	https://cee.rutgers.edu/fac/nenad-gucunski
University of California, San Diego	Dr. Michael Todd	https://shm.ucsd.edu/
University of California, Los Angles	Dr. Sriram Narasimhan	https://sri-lab.seas.ucla.edu
University of Nebraska-Lincoln	Dr. Jinying Zhu	https://nuengr.unl.edu/faculty/jzhu/

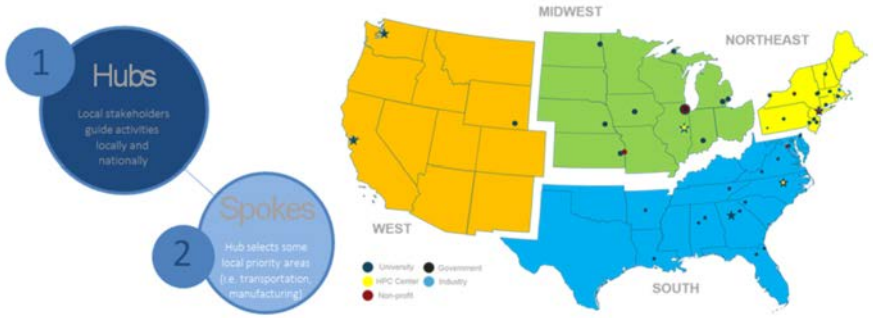
3. Monitoring Research Efforts in US

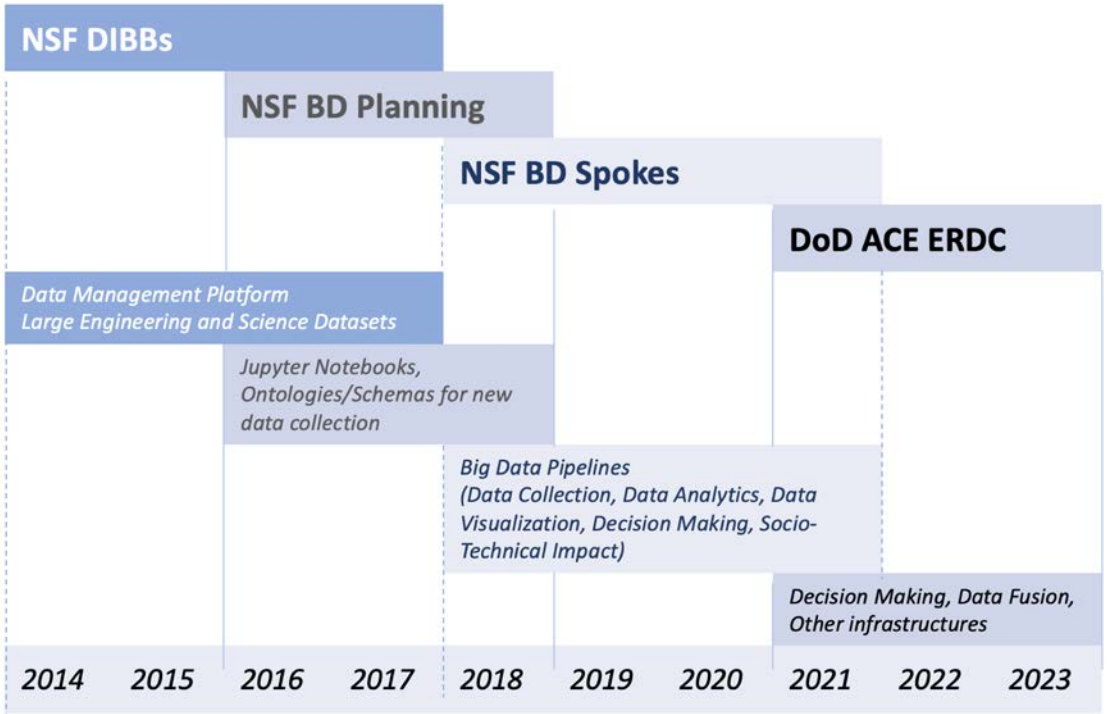
Active Structural Health Monitoring Research Groups in US and Canada (Asian Researchers)

Institution	Project Investigator	URL
University of Central Florida	Dr. Hae-Bum Yun	https://www.cece.ucf.edu/hae-bum-yun/
Stanford University	Dr. Hae Young Noh	https://cee.stanford.edu/person/haeyoung-noh
University of Kansas	Dr. Jian Li	http://www.people.ku.edu/~j407l652/
University of Arizona	Dr. Hongki Jo	https://smartstructure.weebly.com
University of Connecticut	Dr. Shinae Jang	https://smart.engr.uconn.edu
Missouri University of Science and Technology	Dr. Genda Chen	http://web.mst.edu/~gchen/
University of Nebraska-Lincoln	Dr. Chungwook Sim	https://engineering.unl.edu/cee/faculty/chungwook-sim/
University of Manitoba	Dr. Young-jin Cha	https://www.youngjincha.com
University of Alabama	Dr. Wei Song	https://eng.ua.edu/eng-directory/dr-wei-song/
University of Waterloo	Dr. Chul Min Yeum	https://cviss.net

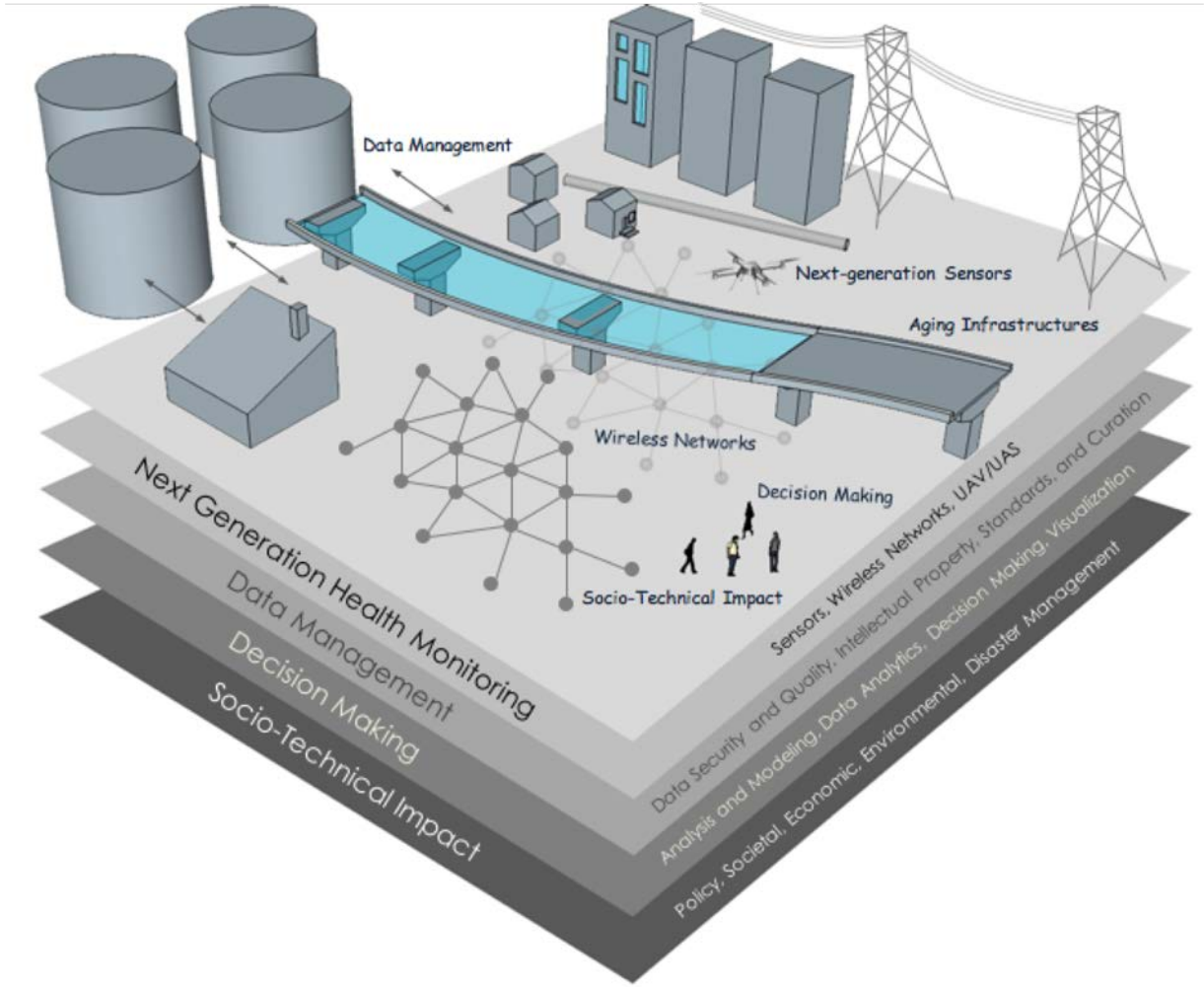
3. Monitoring Research Efforts in US

C.Sim Lab at UNL





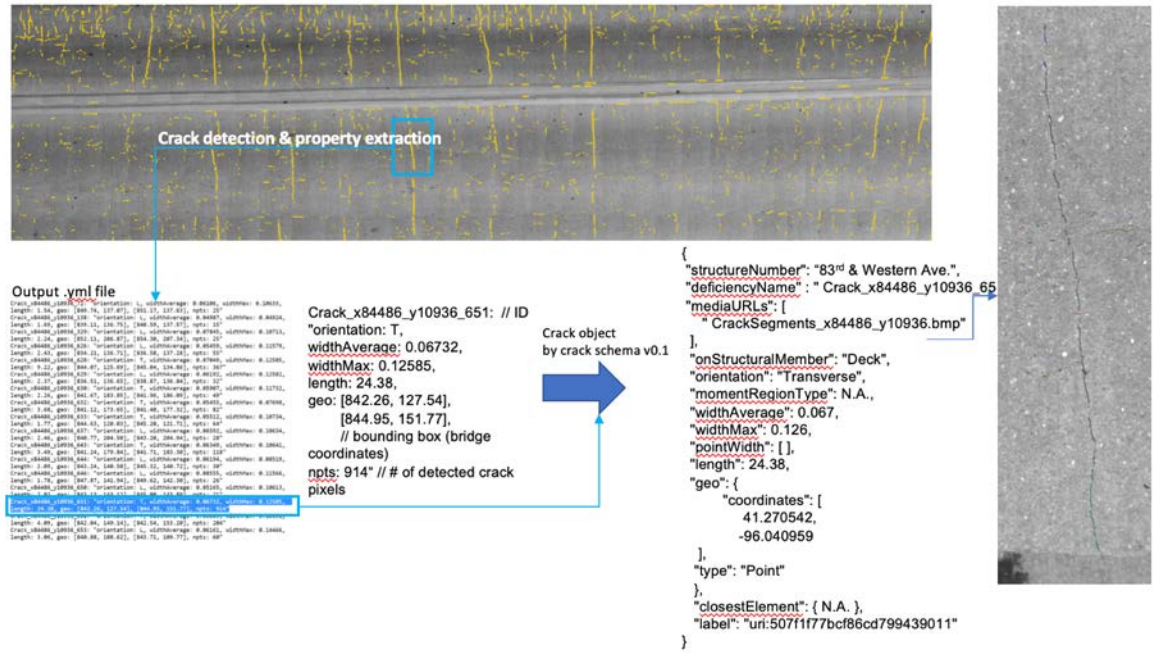
SMARTI Framework

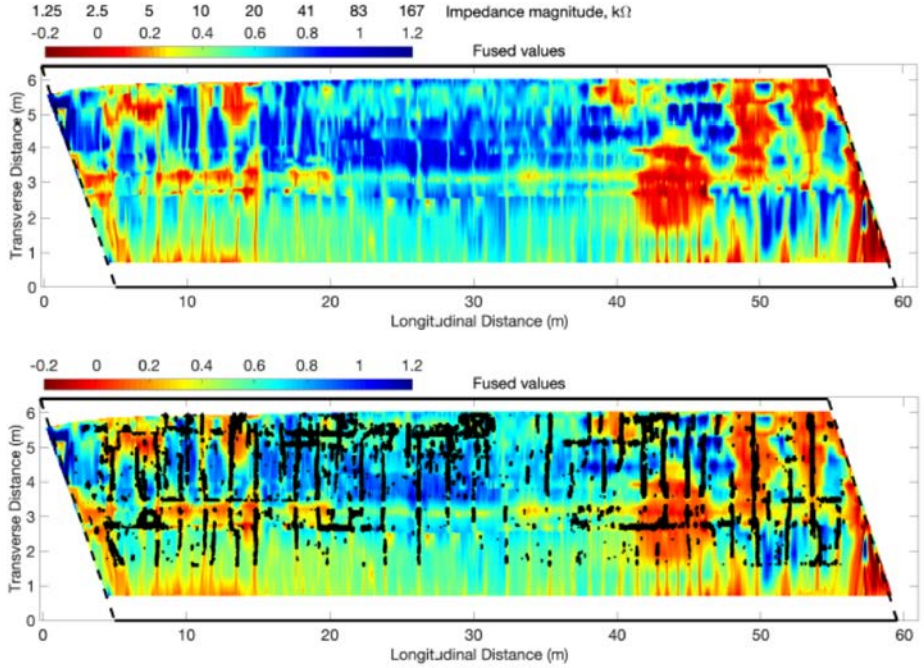


3. Monitoring Research Efforts in US

C.Sim Lab at UNL

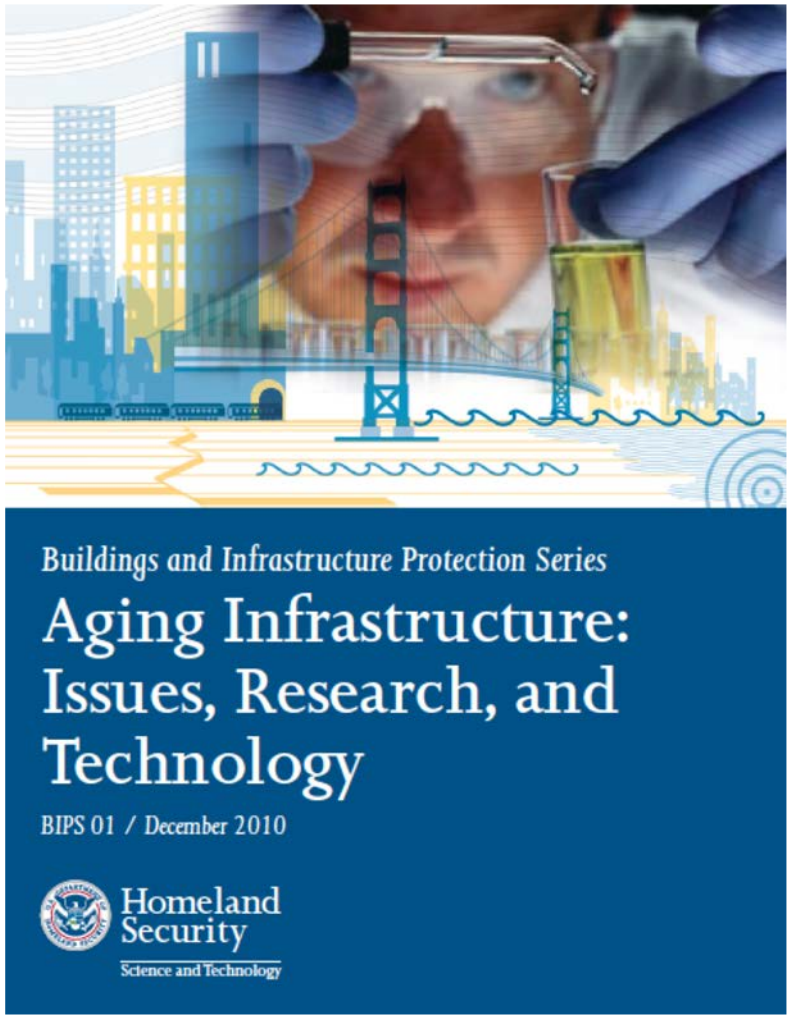
- *Nebraska bridge dataset available at **datacenterhub.org***
- *Bridge schemas for Big Data pipeline available at **http://bridgingbigdata.github.io/bridgehealthschema/schema/crack.schema.json***
- *Created transverse crack mapping image pipeline, GPR pipeline, and load test data pipeline, examples available at **datacenterhub.org (SMARTI datasets)***
- *Autonomous UAV control, on-board processing, corrosion on steel connection members pipeline*
- *Data fusion, and other infrastructures*





4. Needs and Challenges in Monitoring Efforts

DHS Report (2010)



Two issues are paramount

*What is the **present condition**?*

***How urgent is it** to expend significant public funds to effect its **repair, replacement,** and management **improvement**?*