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Presentation to the Georgia DOT Board Committee

Advanced Technologies for Enhanced Safety and Lowering Bridge Funding Demand

www.lifespantechnologies.com

January 19, 2011

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Relevant Questions

- Does Georgia really have ~1,100 structurally deficient bridges?
- How can GDOT objectively determine the actual number and manage more effectively?
- If using advanced technology is the answer, will there be a return on investment?
- Have other states used these advanced technologies successfully?
- If the actual number of structurally deficient bridges is significantly less, what impact will that have across the state?

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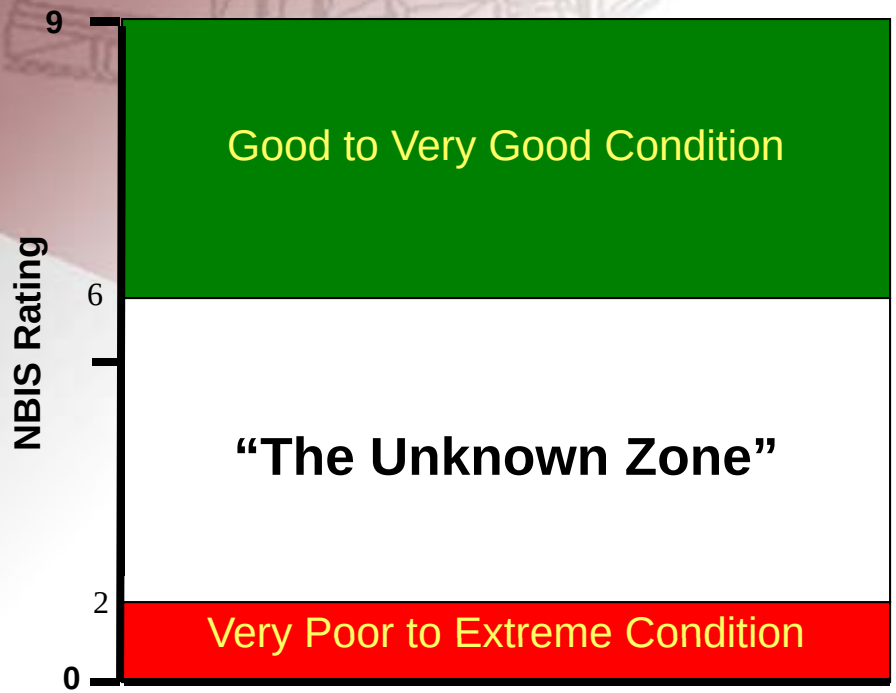
The Issue: Sole Reliance on Visual Inspection

- Visual condition ratings varied by +/- 2 states from the mean in a 2000 FHWA study. (1)
- "This methodology is highly subjective and produces variable results." (2)
- "Visual inspection also does not capture hidden deterioration or damage." (3)

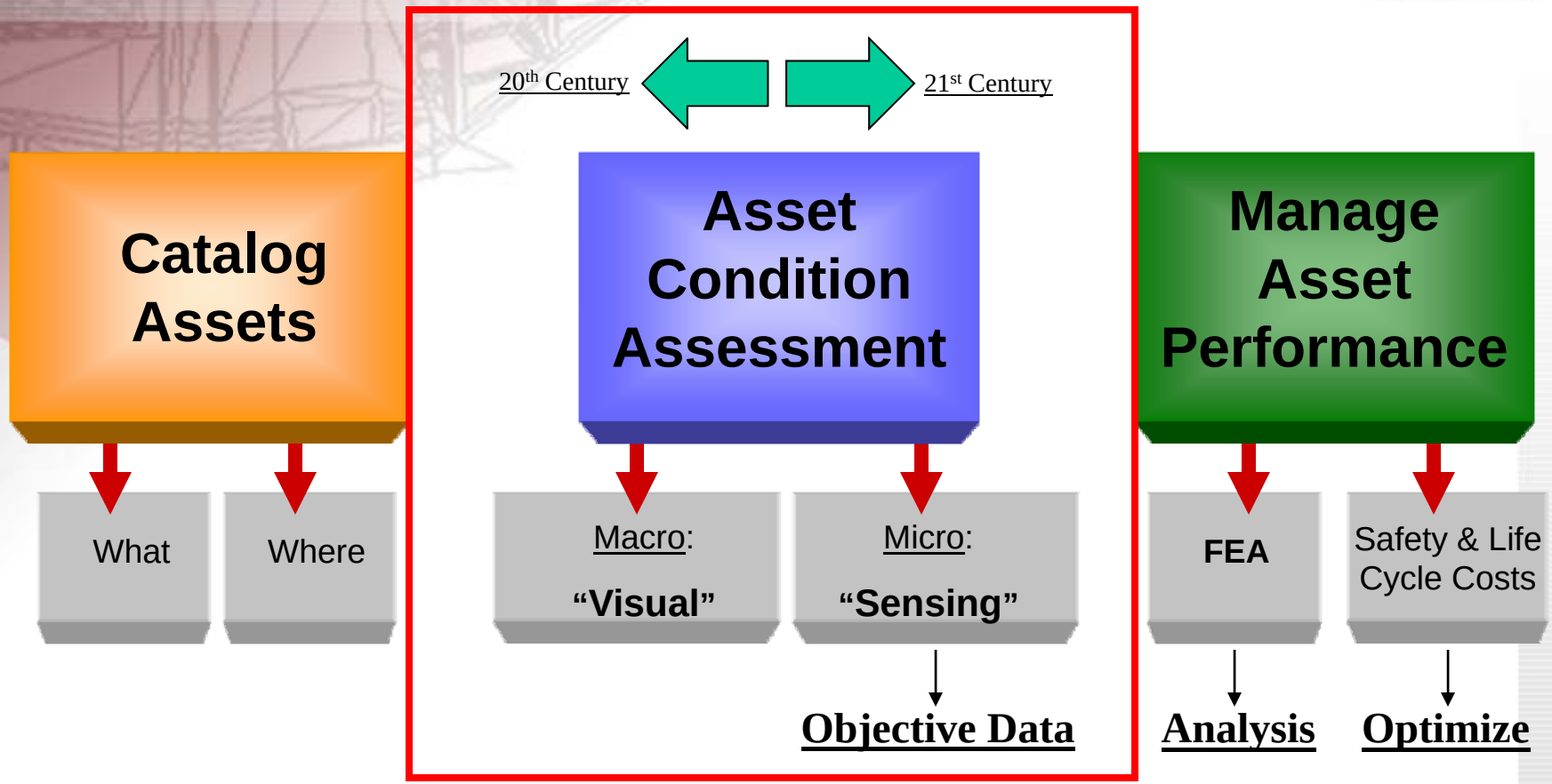
1. ***Reliability of Visual Inspection***; Public Roads Magazine, March/April 2001
2. ***Condition Assessment of Highway Structures, Past, Present and Future***; TR Circular E-C104
3. **IBID**

The Unknown Zone



- **A Large Unknown Zone:**
  - inflates need for funding bridge rehabilitation and replacement projects.
  - results in unnecessary load postings, creating detours and school bus/fire issues.
  - makes prioritizing bridge capital programs nearly impossible.
  - makes risk management extremely difficult.
  - makes asset management much less effective.
  - makes optimization of life cycle costs impossible.

Augmenting Visual Inspection



When to Use Advanced Assessment Technologies

- Before a major bridge rehabilitation project.
- Before a major bridge replacement project.
- To assess known defects, e.g. cracks, to reduce risk.
- When load postings cause significant detours.
- To develop options for lowering life cycle costs.

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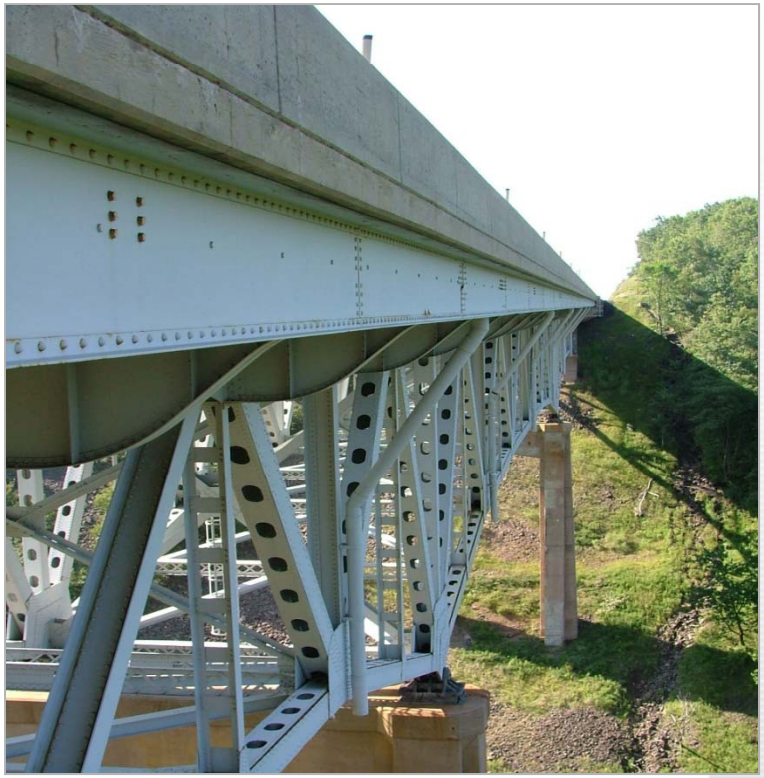
Safely Deferring Repair

- Problem: Is the third party (NBIS report) recommended repair program necessary?
- Customer: **Pennsylvania Turnpike**
- Objectives:
  - Monitor key tensile and compressive strains.
  - Calibrate a finite element model to analyze current condition and repair efficacy.
- Results:
  - Recommended safe deferral of $875,000 repair program.
  - Recommended bearing replacement.
- **Conclusion: Owner has a 700% return on investment (ROI).**



Safely Deferring Replacement

- Problem: City can't afford to replace 15 deficient short-span bridges.
- Customer: **City of Phoenix, AZ**
- Objectives:
  - Conduct initial load test.
  - Stiffen bridge with CFRP wrap.
  - Monitor for 24 months to be sure.
- Results:
  - Bridge is stiffer.
  - Ongoing monitoring .
- **Conclusion: Owner saves ~$3 million dollars on one bridge by implementing a unique repair program; a 300% ROI.**

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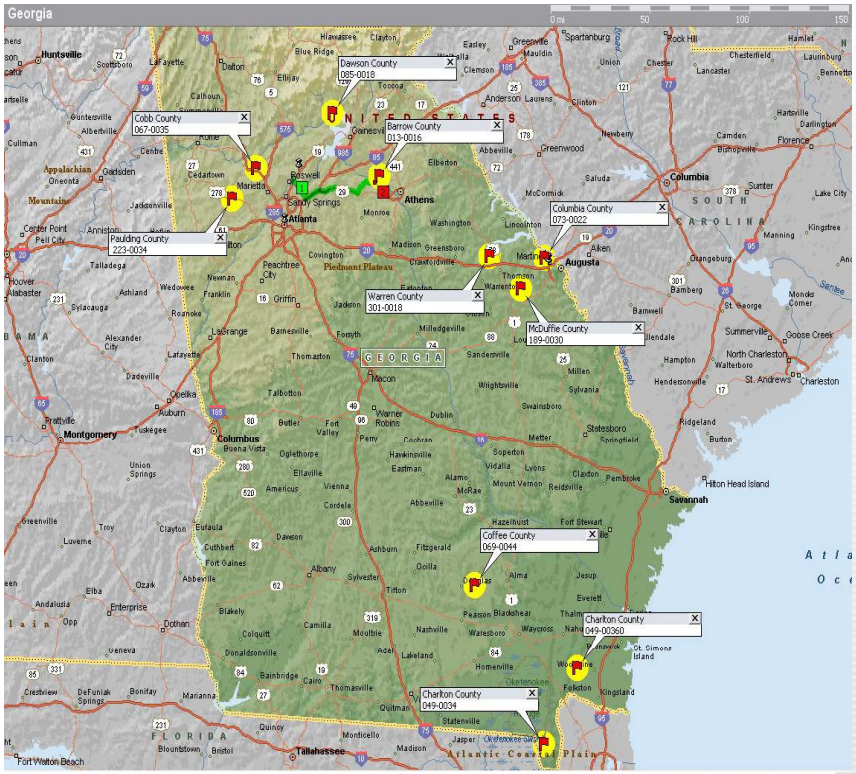
Evaluation of Load Postings

- Problem: Are load postings correct?
- Customer: **Georgia DOT**
- Objectives:
  - Ten county-owned bridges for load test.
  - GDOT-selected sample across Georgia.
- Results:
  - Two postings increased >100%.
  - Three need minor repairs to remove postings.
  - Critical components changed on four bridges.
- **Conclusion:** Visual inspection and analytics are overly conservative and causing too many short span bridges to be posted, have low sufficiency ratings, and premature replacement.



Assuring Safe Operation

- Problem: How can we safely operate a bridge with severe corrosion and limited funding?
- Owner: **South Carolina DOT**
- Objectives:
  - Monitor key locations for strain and temperature.
  - Notify SCDOT if strains exceed certain maximum values.
- Results:
  - Bridge is safely handling truck traffic.
  - Overweight vehicles were captured and enforcement actions taken.
- **Conclusion: Safe deferral of planned $600,000+ repair project; 500% ROI.**

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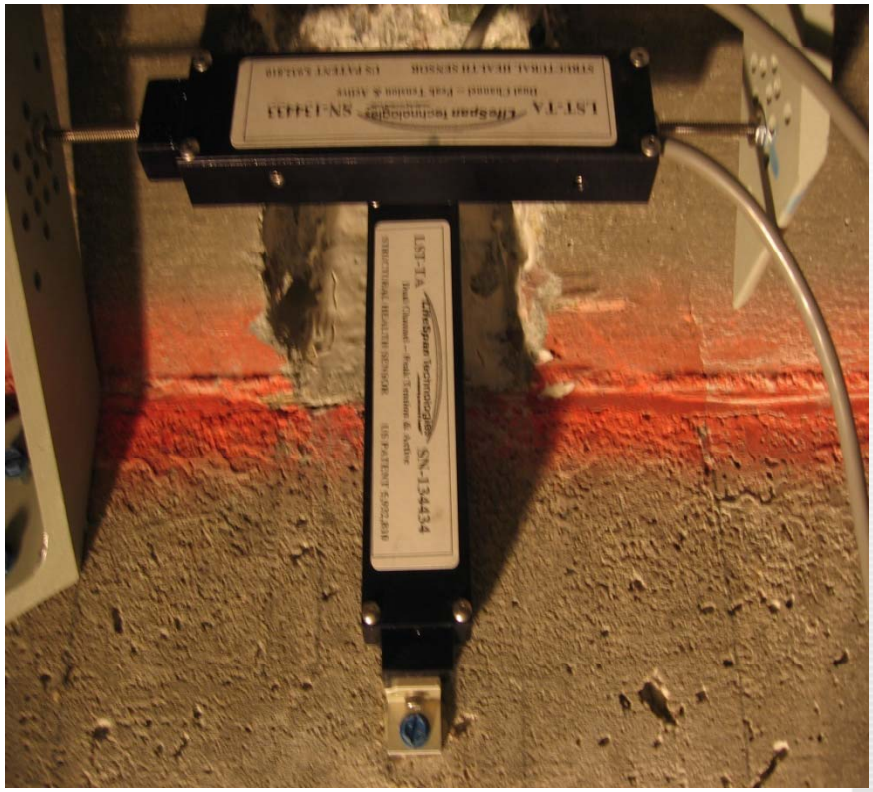
Repair Assessment

- Problem: Was the deck repair method effective?
- Owner: **Caltrans**
- Objectives:
  - Monitor before repair for gaps.
  - Monitor after for several months to confirm repairs worked.
- Results:
  - Initial monitoring confirmed problem.
  - Subsequent monitoring confirmed repair worked.
- **Conclusion: Caltrans will use the repair method in the future to save millions vs. replacement.**



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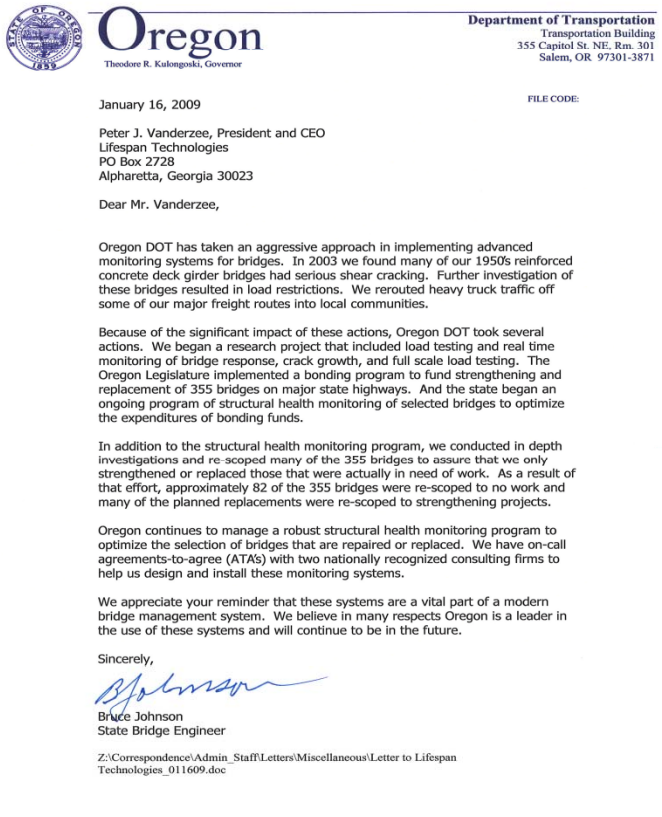
Reduce Bridge Funding Demand

- Problem: 355 “bad” bridges on Interstate highways.
- Owner: **Oregon DOT**
- Objectives:
  - Used advanced technology to determine actual condition.
  - Safely defer replacements.
  - Repair vs. replace where possible.
- Results:
  - 82 bridges (23%) require NO ACTION.
  - Many more repaired vs. replaced.
- **Conclusion: Oregon DOT and Feds save MULTI-MILLIONS by avoiding unnecessary projects.**



Oregon
Theodore R. Kulongoski, Governor

Department of Transportation
Transportation Building
355 Capitol St. NE, Rm. 301
Salem, OR 97301-3871

FILE CODE:

January 16, 2009

Peter J. Vanderzee, President and CEO
Lifespan Technologies
PO Box 2728
Alpharetta, Georgia 30023

Dear Mr. Vanderzee,

Oregon DOT has taken an aggressive approach in implementing advanced monitoring systems for bridges. In 2003 we found many of our 1950's reinforced concrete deck girder bridges had serious shear cracking. Further investigation of these bridges resulted in load restrictions. We rerouted heavy truck traffic off some of our major freight routes into local communities.

Because of the significant impact of these actions, Oregon DOT took several actions. We began a research project that included load testing and real time monitoring of bridge response, crack growth, and full scale load testing. The Oregon Legislature implemented a bonding program to fund strengthening and replacement of 355 bridges on major state highways. And the state began an ongoing program of structural health monitoring of selected bridges to optimize the expenditures of bonding funds.

In addition to the structural health monitoring program, we conducted in depth investigations and re-scoped many of the 355 bridges to assure that we only strengthened or replaced those that were actually in need of work. As a result of that effort, approximately 82 of the 355 bridges were re-scoped to no work and many of the planned replacements were re-scoped to strengthening projects.

Oregon continues to manage a robust structural health monitoring program to optimize the selection of bridges that are repaired or replaced. We have on-call agreements-to-agree (ATA's) with two nationally recognized consulting firms to help us design and install these monitoring systems.

We appreciate your reminder that these systems are a vital part of a modern bridge management system. We believe in many respects Oregon is a leader in the use of these systems and will continue to be in the future.

Sincerely,

Bruce Johnson
State Bridge Engineer

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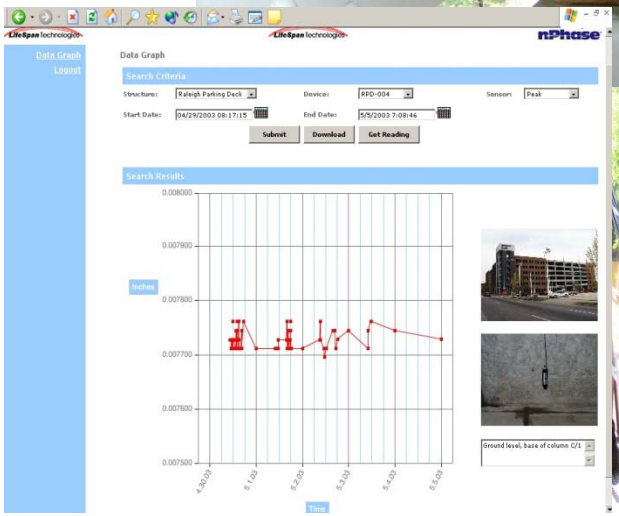
Recommendations

- Advance the knowledge base in GDOT by demonstrating technology on two long span bridges with low sufficiency ratings (proposed in 2009).
- Plan and execute a state-wide program to evaluate 50 posted and/or low sufficiency bridges.
- Use the results to develop and execute a state-wide program for the remaining structurally deficient and posted bridges.
- Strengthen GDOT's asset and bridge management programs to safely defer bridge rehab and replacement projects and lower system risk.