WORKING WITH DATA

BIG DATA???

1. Research sponsored by American Heart Association
2. Worldwide study identify factors related to heart disease
3. Results from other countries inconsistent with US.
4. Highest per capita incidences in US and UK
5. Only one factor had a high correlation
6. SPEAKING ENGLISH!

BDI and A LOT OF DATA

- University research 1980s
- BDI formed in 1989
- Load test & rate bridges
- Expanded services
- 600+ structures tested

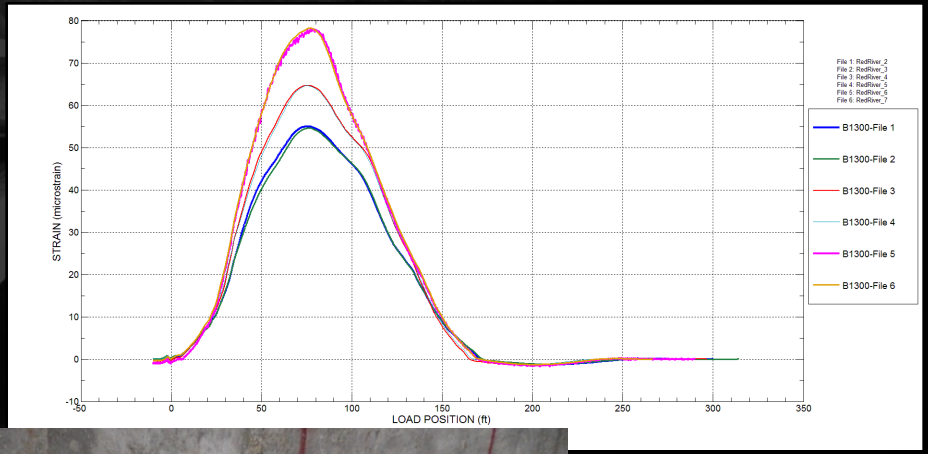
DIAGNOSTIC TESTING

- Get to know structure
- Controlled tests
- Verify / calibrate analysis
- Assess capacity

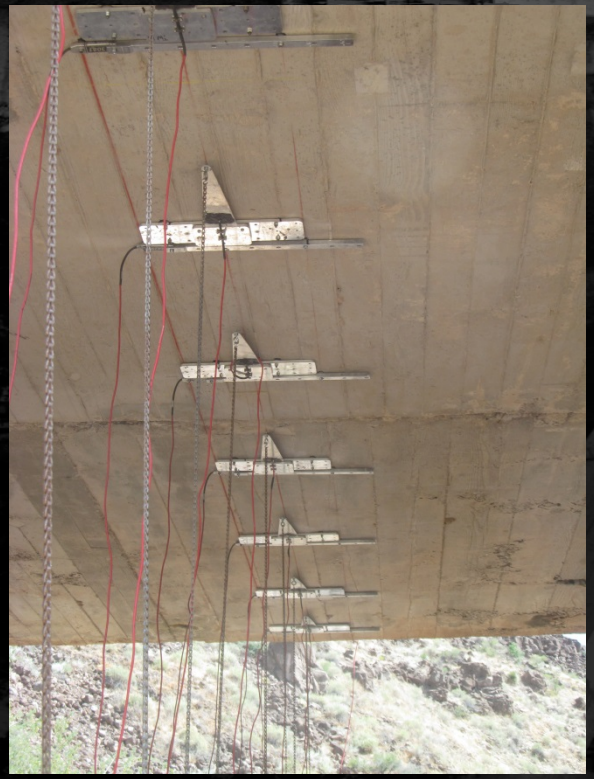
HOW TO TEST A BRIDGE

- Apply load
- Measure responses

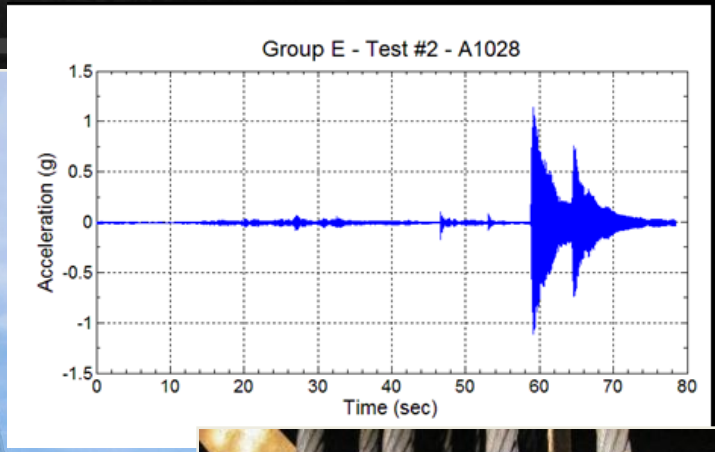
MEASURE STRAINS



MEASURE DISPLACEMENT & ROTATION

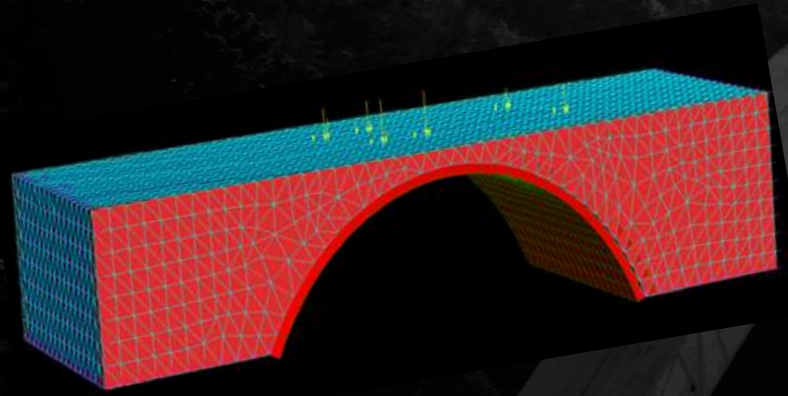


MEASURE ACCELERATIONS

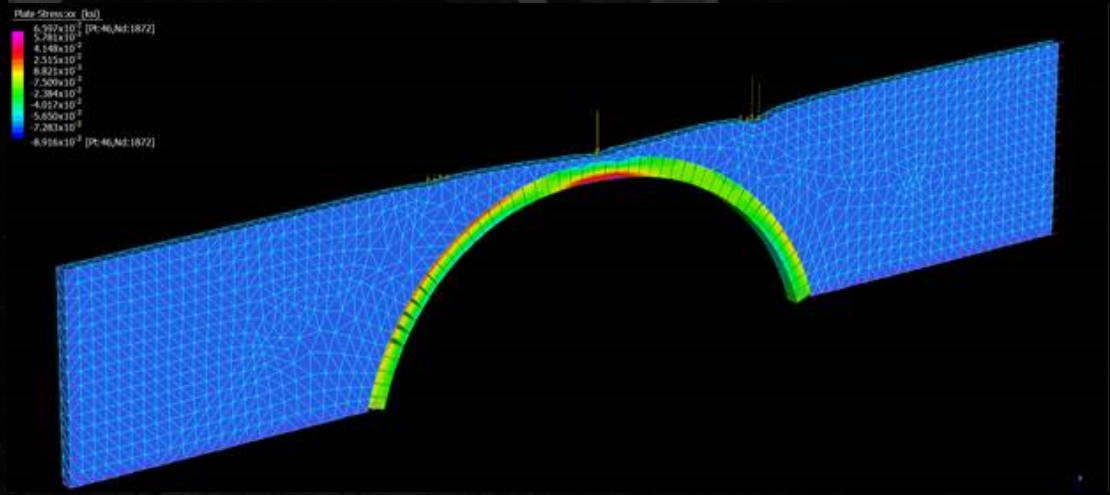


COMPUTED DATA

- Simulate load test with analytical model
- Compare results (thousands of comparison points)

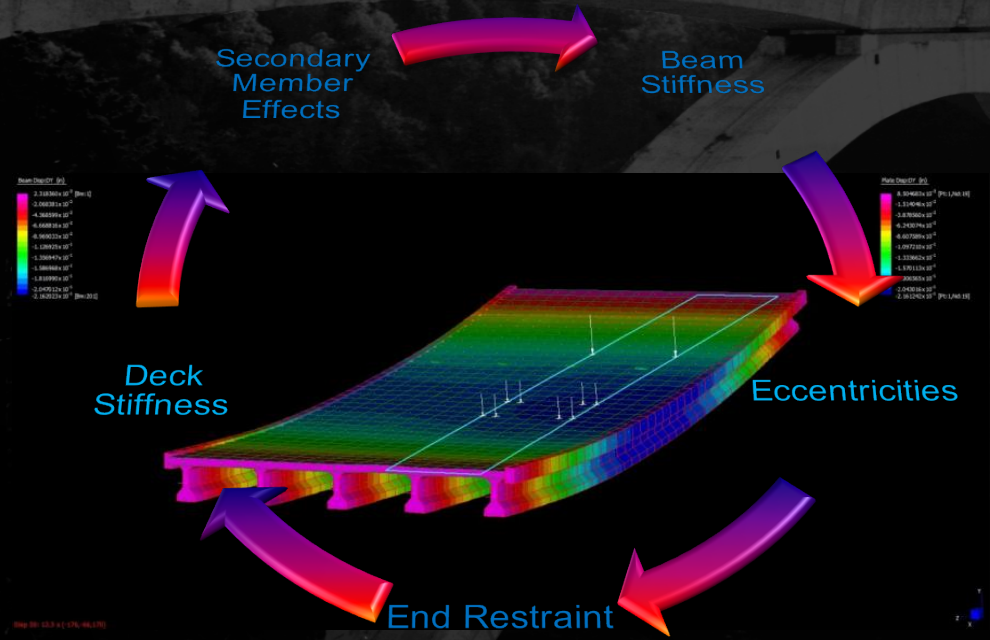


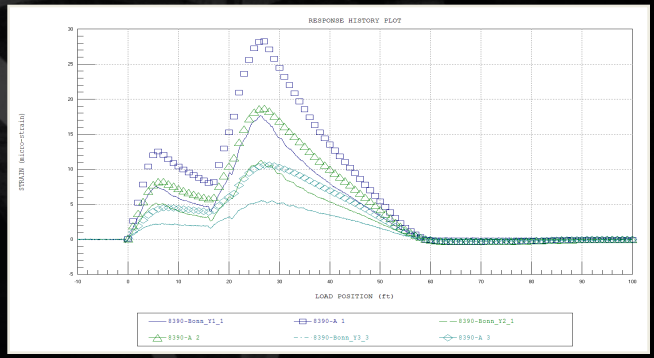
- 40 – 80 sensor
- 100 truck positions

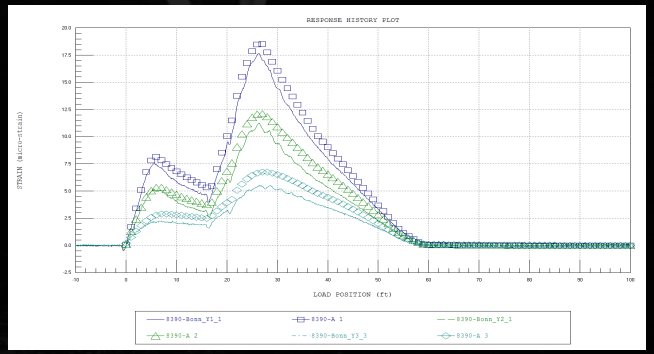


INTEGRATED APPROACH

- Reconcile differences in data sets







ADDRESS SPECIFIC QUESTIONS

Does this bridge need to be posted?

Is the load limit accurate?

Can necessary vehicles cross?

WHAT CAN IT TAKE

Can a bridge designed for 15 tons carry a 1M lb. transport?

How about 2 million?

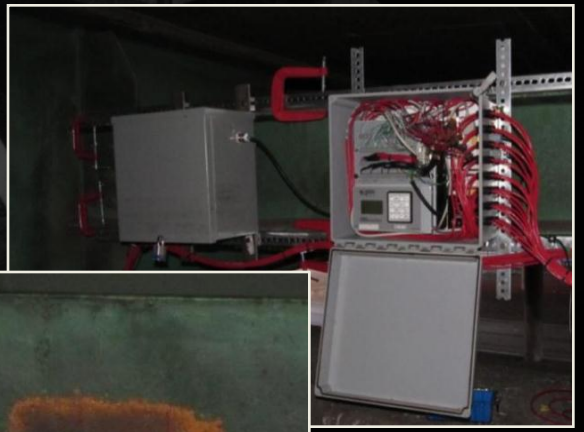
ASSESS DAMAGE & EVALUATE REPAIR

How bad is it doc?

Is it as good as new?

MAINTAIN OR REPLACE?

What is the remaining fatigue life of this bridge?



Deck replacement or new bridge?

TEST RESULT SUMMARY

Bridge Type	Influencing Factors	Percent Improvement
RC Slabs	Greatest benefit, end conditions, edge stiffening, no longitudinal joints	30 to 60%
Beam Slab Bridges 5 or more beams	Ratings controlled by moment, Beam lines > wheel lines, End conditions and edge stiffening	20 to 40%
Culverts and arches	Function of fill depth, end-conditions, span length	20 to 30%
Truss Bridges	Members inline with floor system	0 to 30%
RC T-Beam Bridges	Ratings controlled by shear, # of beam lines, edge stiffening.	0 to 20%
2 Girder bridges	No improvement in distribution. End conditions may influence ratings.	0 to 20%

THE BIG DATA PICTURE

- US, state & county inventories
- Target testing for best odds of success
- Maximize ROI
- Proactive vs reactive
  - asset management

LEVERAGE RESULTS

- Test representative sample

KDOT – Illinois Bulletin Slabs

- 6 Bridges tested
- 120 bridges load rated

MONITORING

Like testing … but different

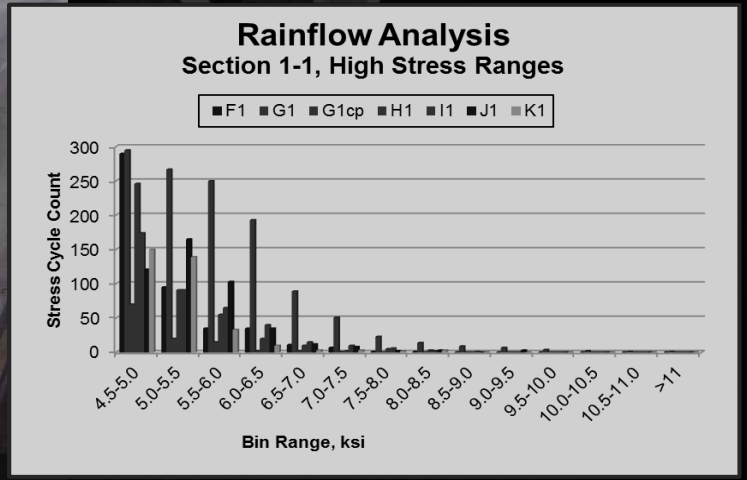
- Longer duration
- Equipment stays
- Bigger investment
- Different questions

MONITORING – CHECKING LIMITS

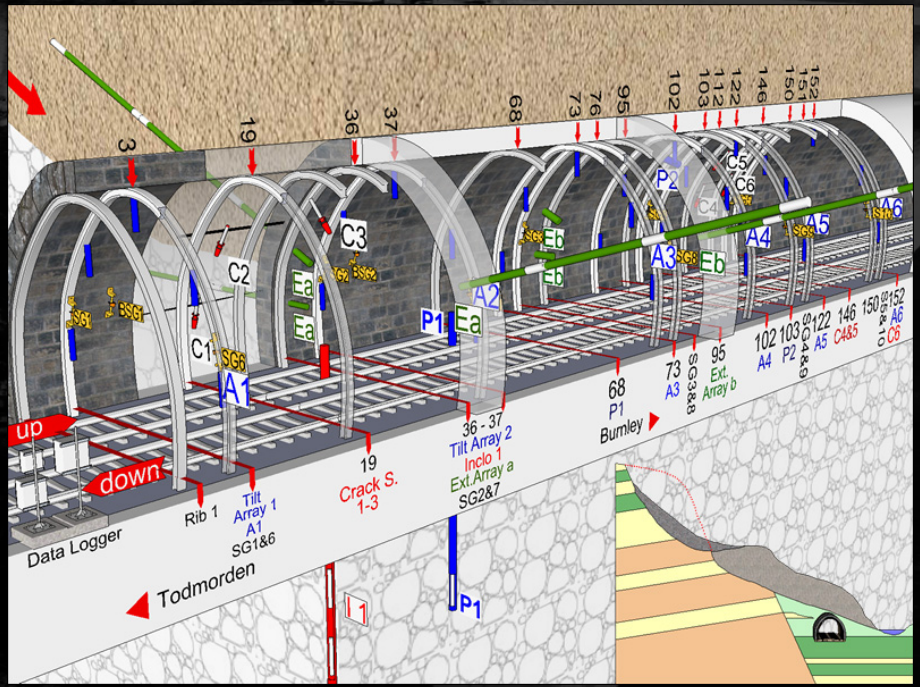
- Crack growth
- Settlement
- Slope stability
- Early warning

MONITORING – DYNAMIC

- Capturing overload events
- Bridge Weigh-in-Motion
- Fatigue life



NEXT GENERATION



- DATUM Monitoring
- Consistent data platform
- Potential for Big Data
  - Continuous damage detection
  - Remote load tests
  - Multiple structure correlation

THANK YOU!

BDI

"We Stand Below Our Work"