Case Studies: How Experimental Data Can Assist With Bridge Management

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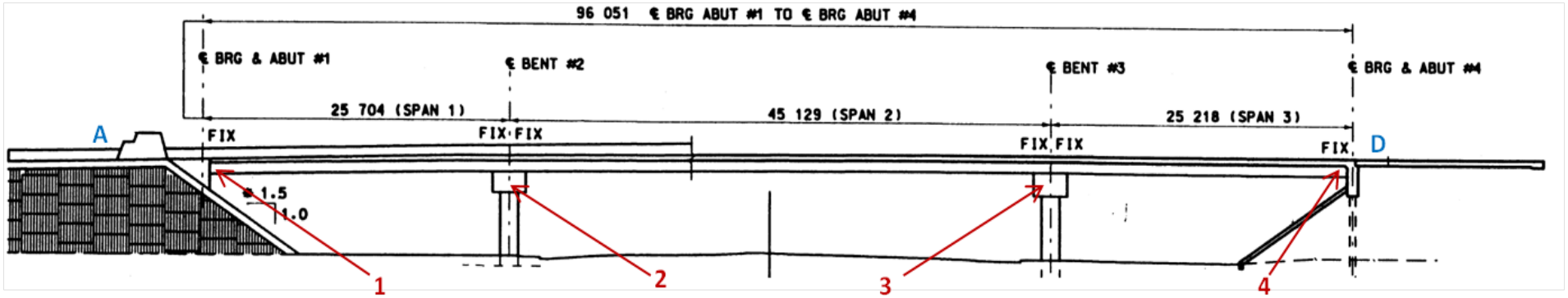
Outline:

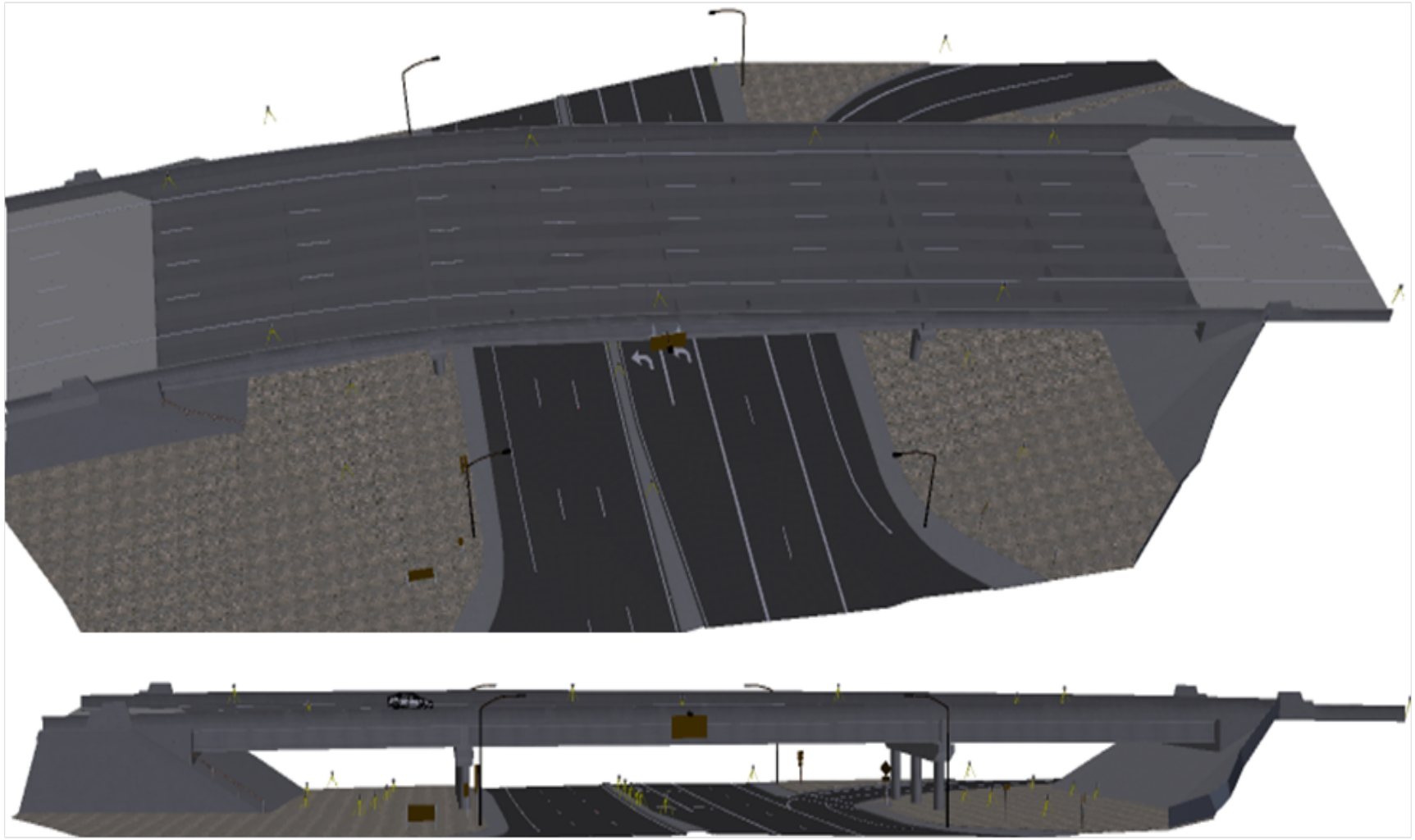
- 400 South I-15 Bridge (Reactive)
- 45 South I-215 Bridge (Proactive)
- Long-Term Bridge Monitoring Program (Research)
- Conclusions

400 South I-15 Bridge

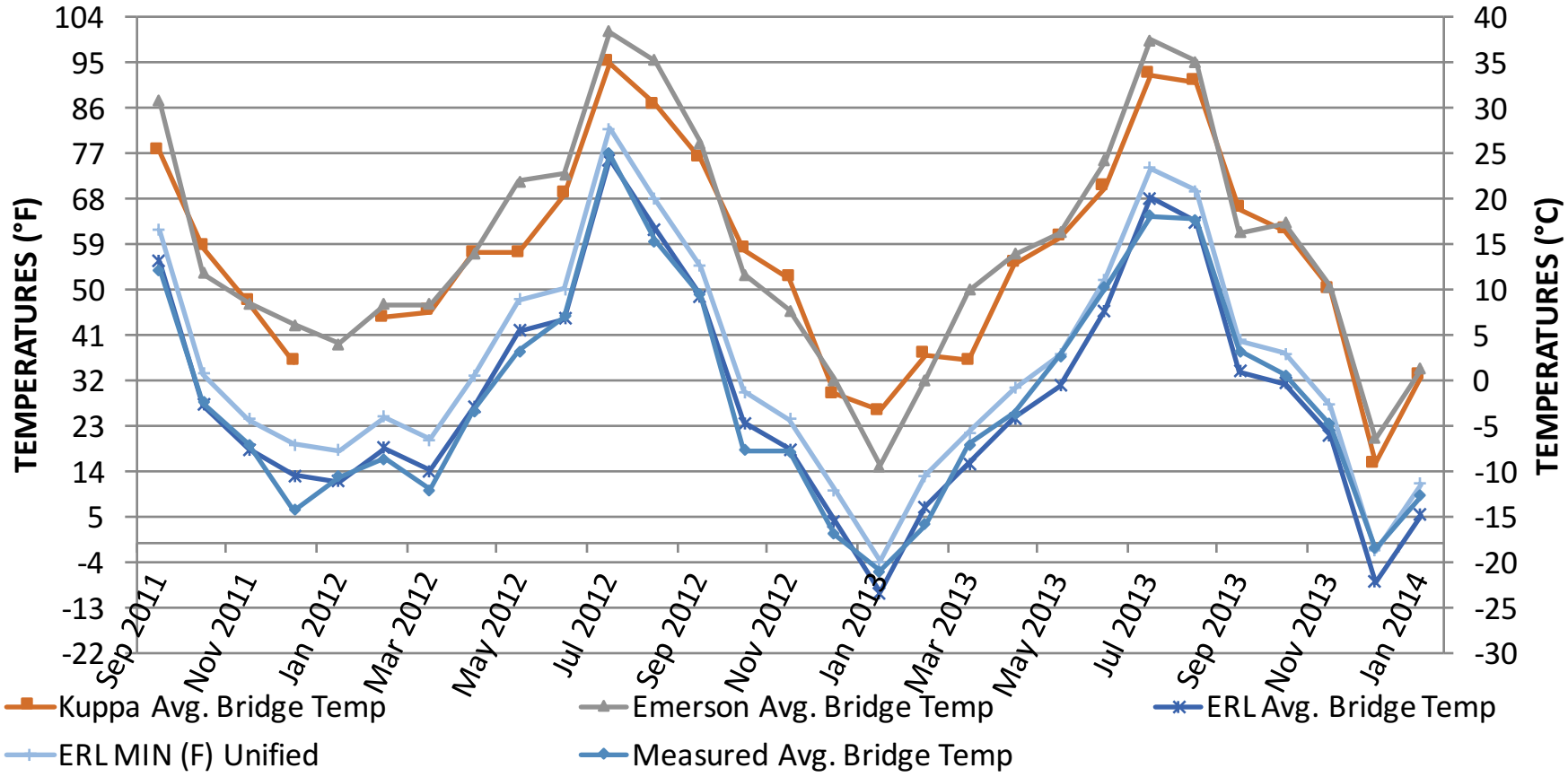
BRIDGE-ING: BIG DATA WORKSHOP



NV5 Survey

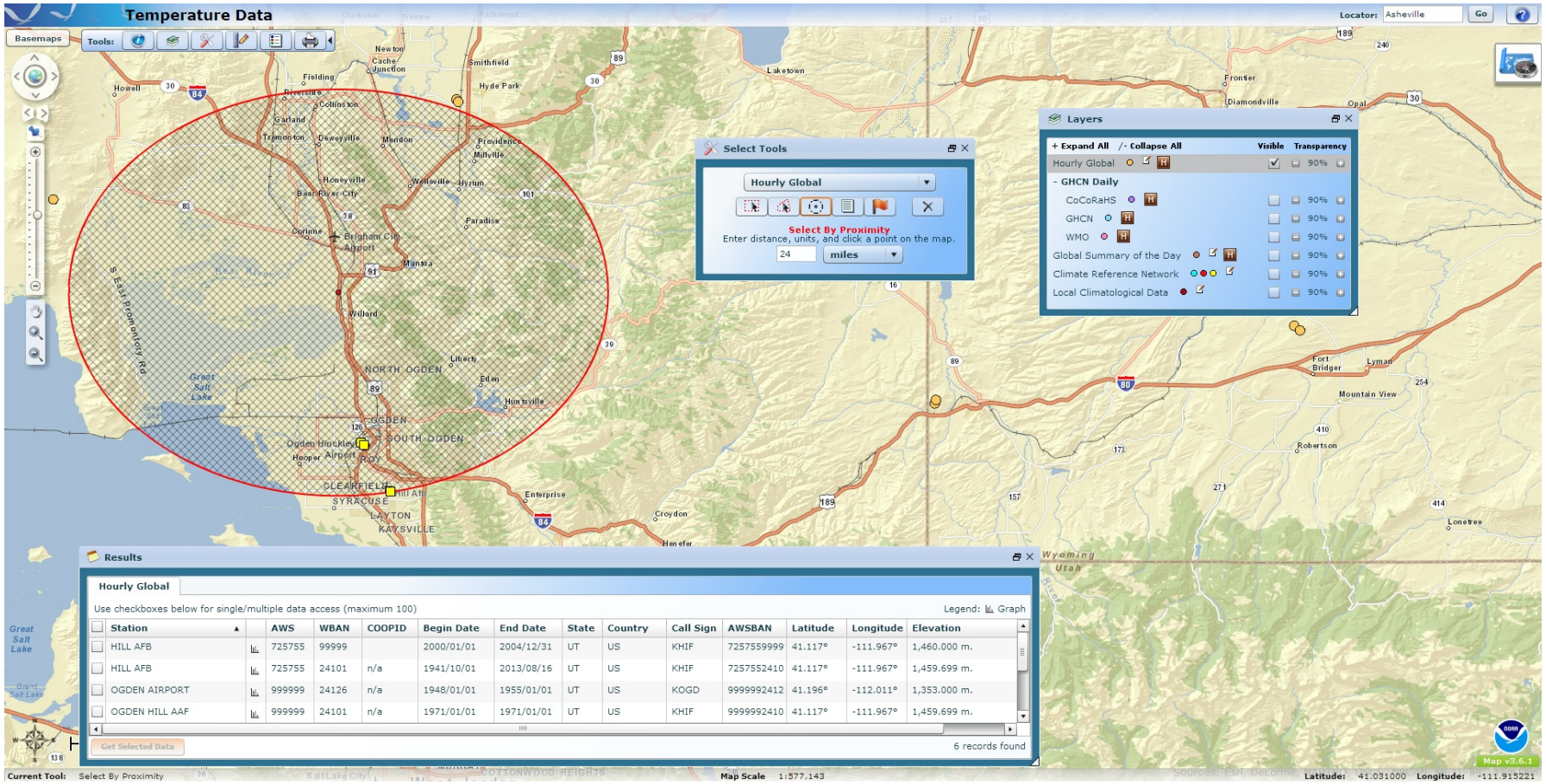


Prediction of Average Uniform Bridge Temperature – Utah Bridge



Comparison of Minimum Measured and Predicted Average Bridge Temperatures (Utah Bridge)

Long-Term Prediction of Average Temperature Ranges – Utah Bridge



NOAA Weather Station (Yellow Square) and Utah Bridge (Red Dot)

Long-Tern Prediction of Average Temperature Ranges – Utah Bridge

Summary of the Utah Max Avg. Bridge Temp			
Method	MONTH	Max Avg. Bridge Temp. (°F)	AASHTO (°F)
Kuppa ABT (°F)	Jul 1969	98.22	105.00
Emerson ABT (°F)	Jul 2007	109.95	105.00
ERL ABT (°F)	Jul 1969	107.87	105.00

Summary of the maximum predicted average bridge temperature for the Utah Bridge

Summary of the Utah Min Avg. Bridge Temp			
Method	MONTH	Min Avg. Bridge Temp. (°F)	AASHTO (°F)
Kuppa ABT (°F)	Dec 1990	10.63	-10.00
Emerson ABT (°F)	Dec 1990	4.91	-10.00
ERL ABT (°F)	Dec 1990	-21.75	-10.00
ERL Unified ABT (°F)	Dec 1990	-15.67	-10.00

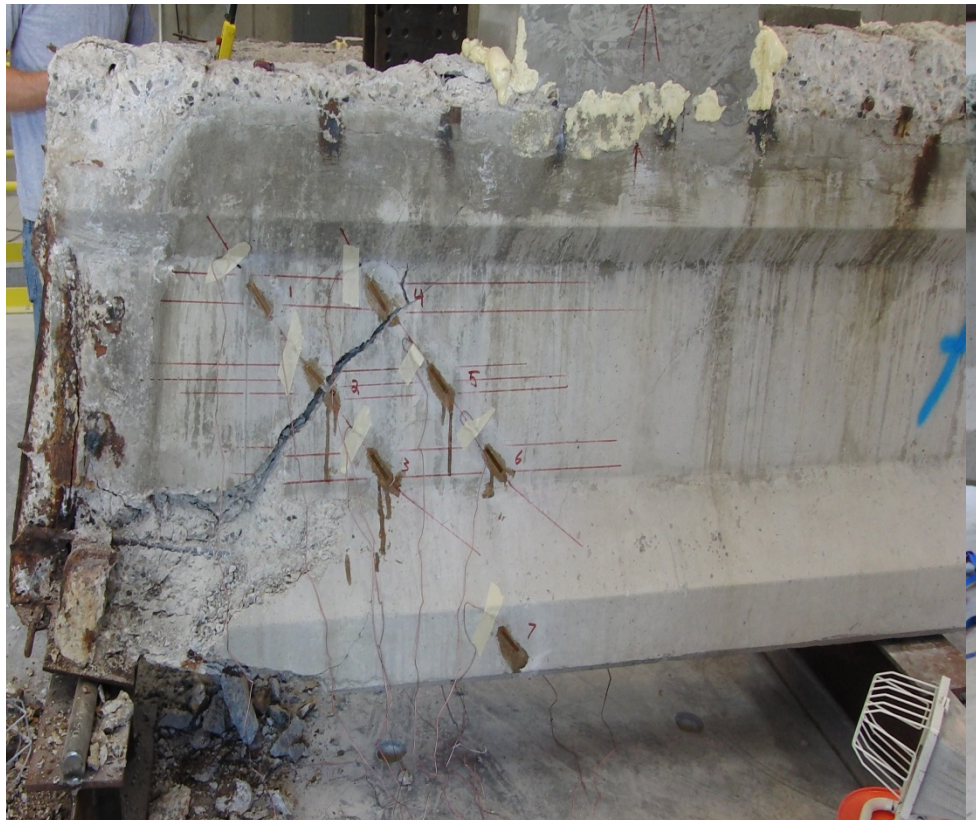
Summary of the minimum predicted average bridge temperature for the Utah Bridge

I-215 over 45th South Bridge

	Girders 1-6	Girders 7-8
Span length	23 ft	34.5 ft
Remaining Deck Height	5 in.	4 in.
Stirrup Spacing	23 in.	17 in.
# of Prestressing Strands	12	14
Eccentricity of Prestressing Strands	11 in.	9.46 in.
Concrete Compressive Strength	7100 psi	9300 psi

Girders

Shear Tests

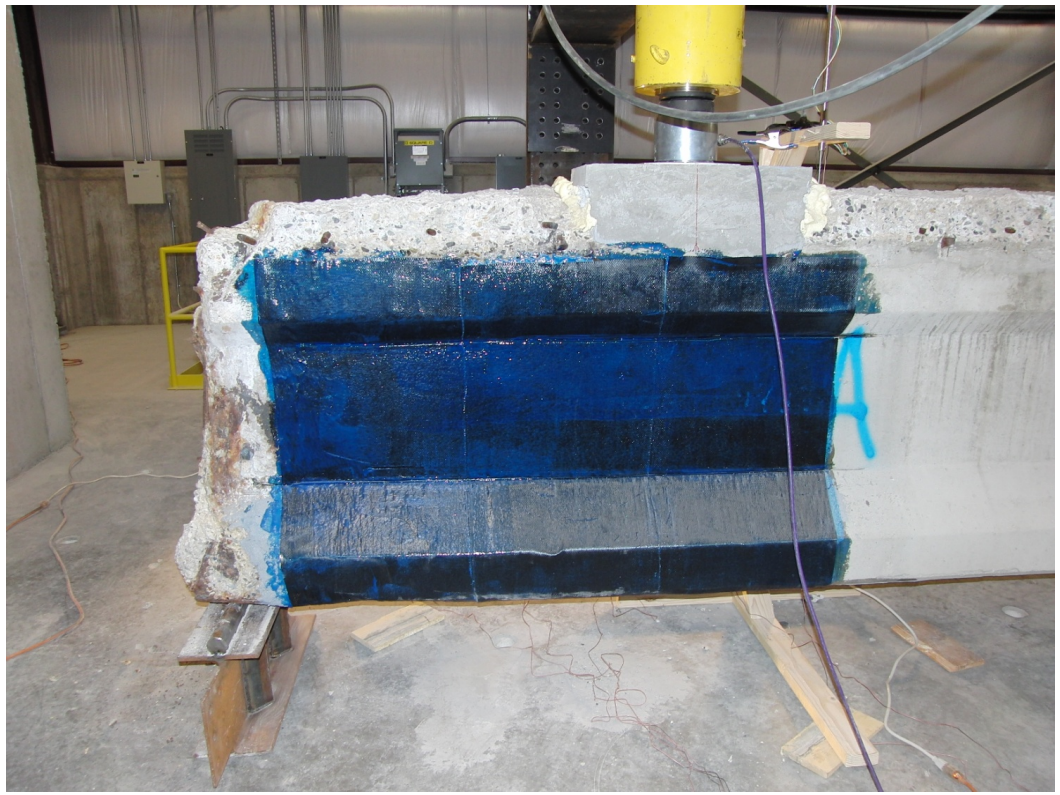


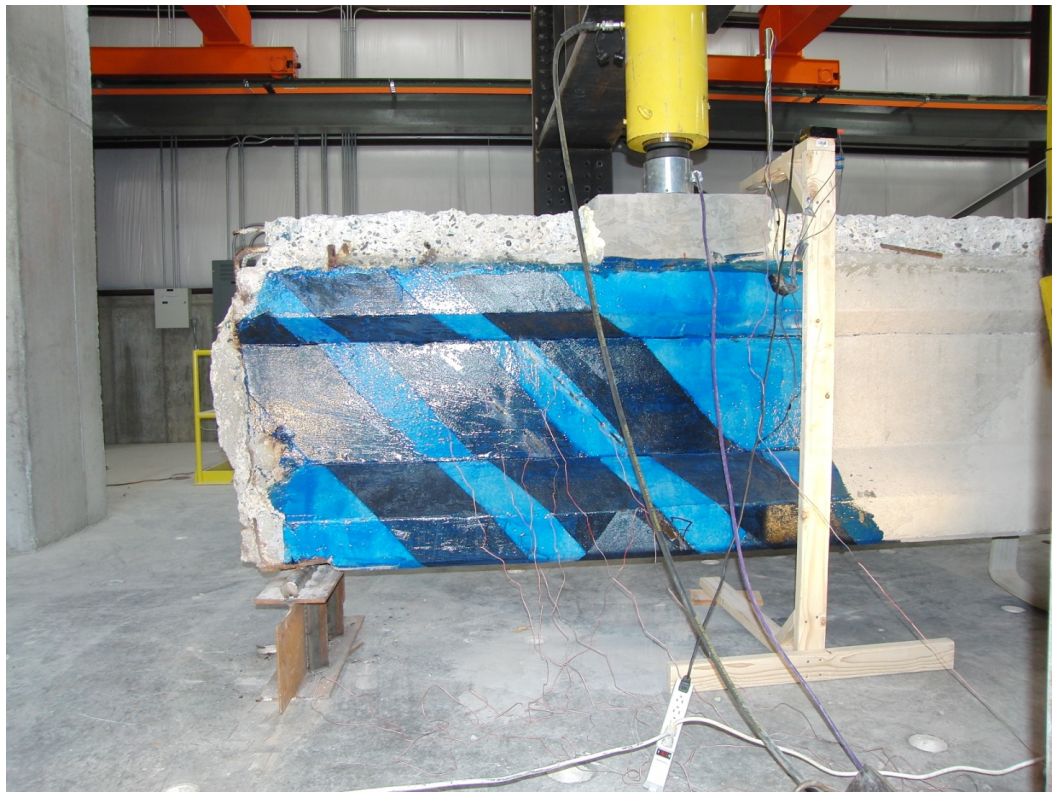
Web Shear Failure

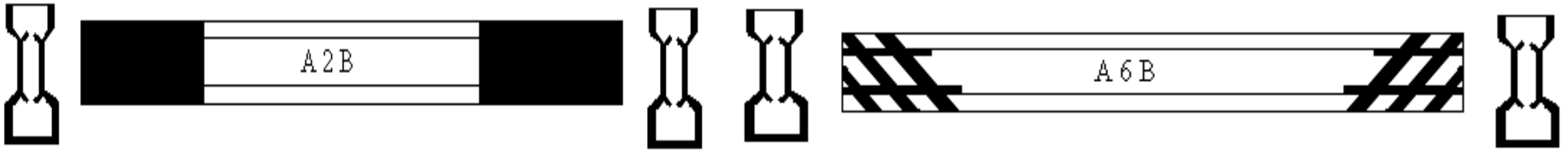
Flexural Shear Failure

Predictive Methods

Method	Girder 1-6 Shear (kips)	Percent of Measured	Girder 7-8 Shear (kips)	Percent of Measured
AASHTO General	47.8	30.02%	37.7	13.43%
AASHTO Simplified	82.3	51.67%	100.3	35.76%
ACI Simplified	101.7	63.90%	131.1	46.74%
ACI Detailed	91.0	57.14%	136.8	48.76%
Strut and Tie	157.7	99.05%	258.7	92.25%
Measured	159.22		280.44	







Carbon Fiber Retrofit

Federal Highway Administration
Long-Term Bridge Performance Program

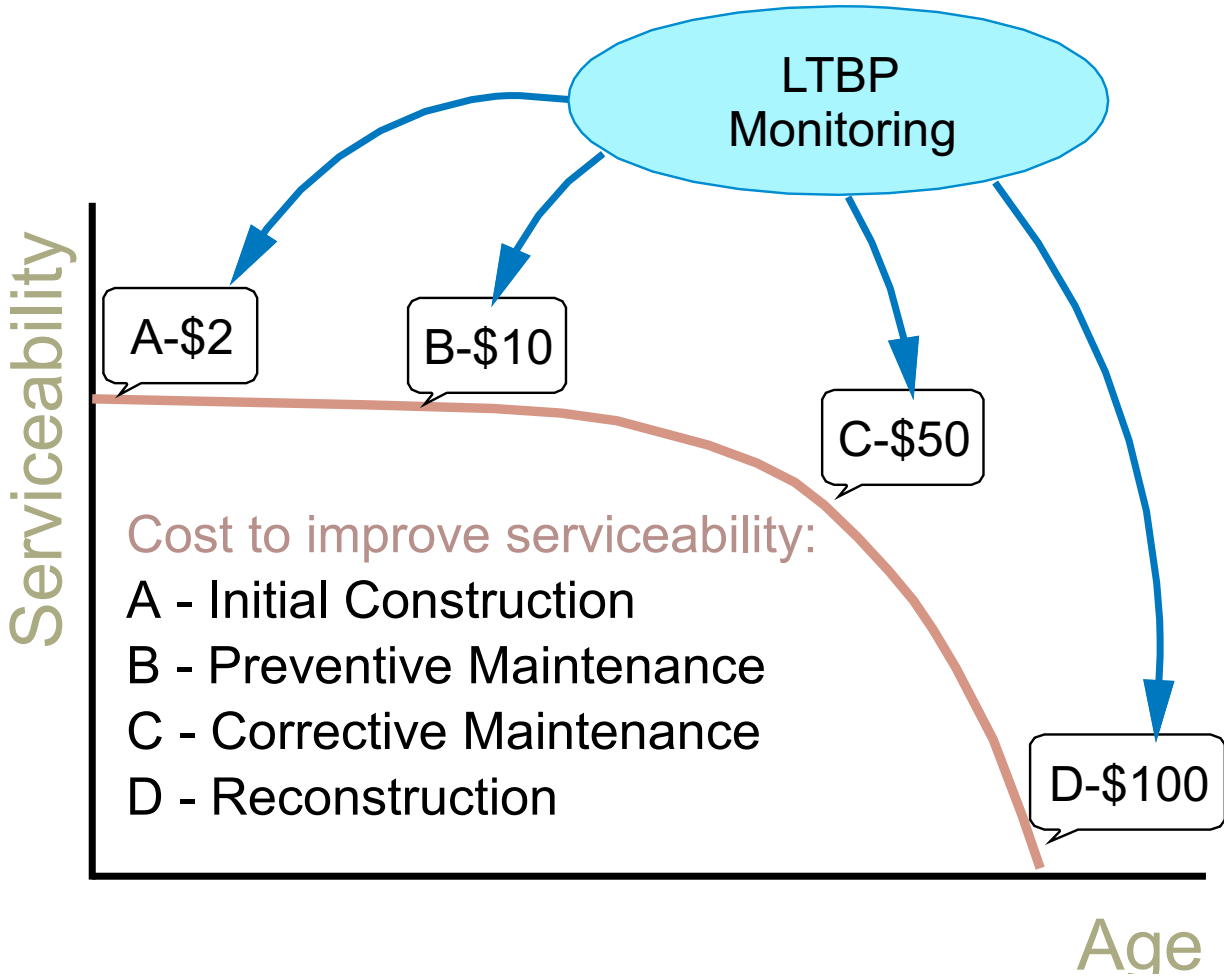
Pilot Phase –

Long Term Monitoring

Objectives

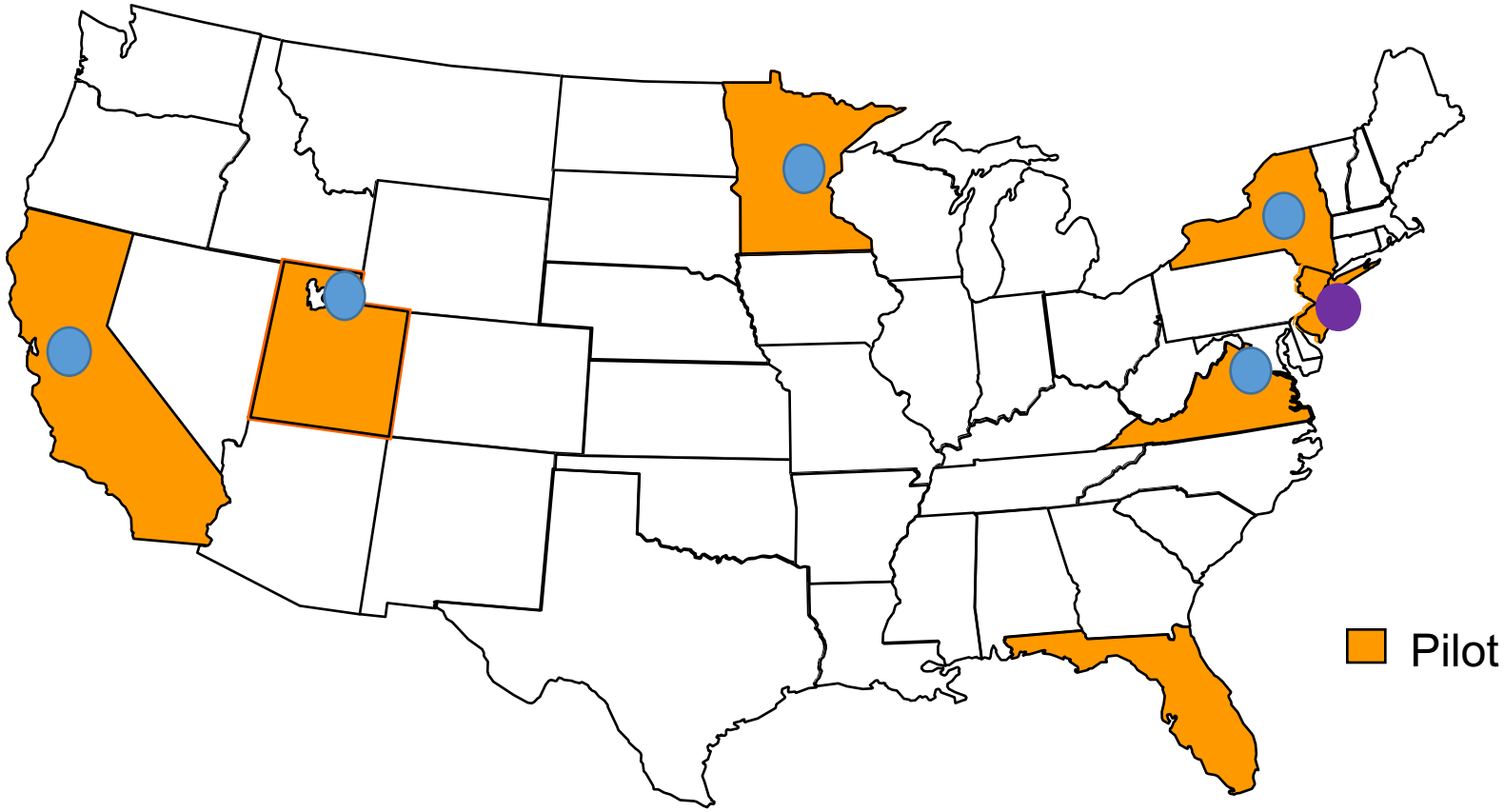
- Monitoring for long term data of selected bridges over time.
- Document weather and loading environment.
- Compare long term bridge data among bridges within groups.

Long-Term
Bridge Performance
Program



Long-Term
Bridge Performance
Program

Pilot Bridge Sites



Long-Term Bridge Performance Program

- Live Load, dynamic and deck tests completed
- Deck tests partially completed

BRIDGE-ING: BIG DATA WORKSHOP

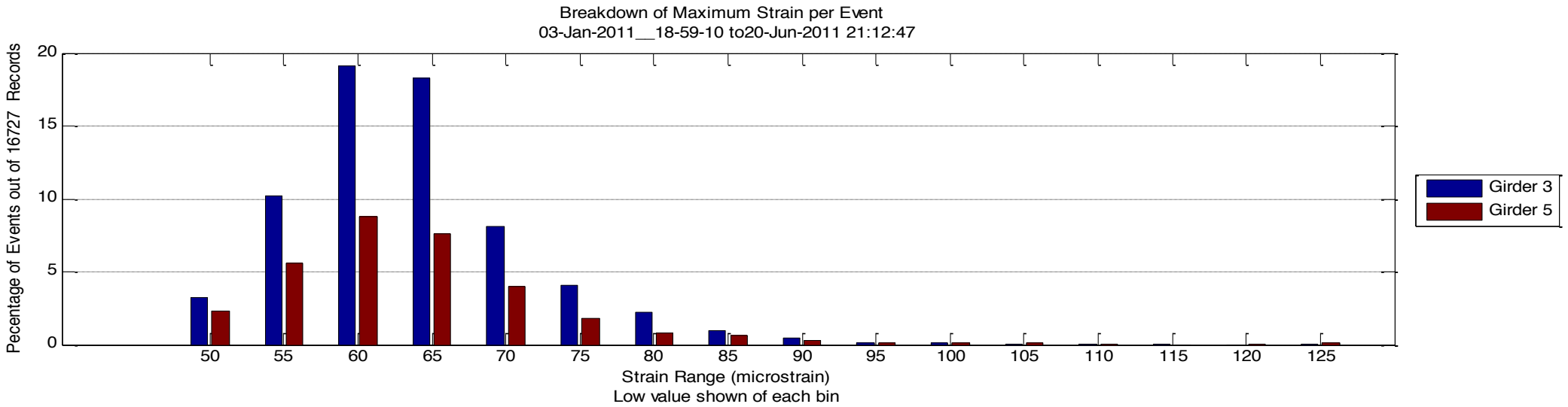
California Bridge

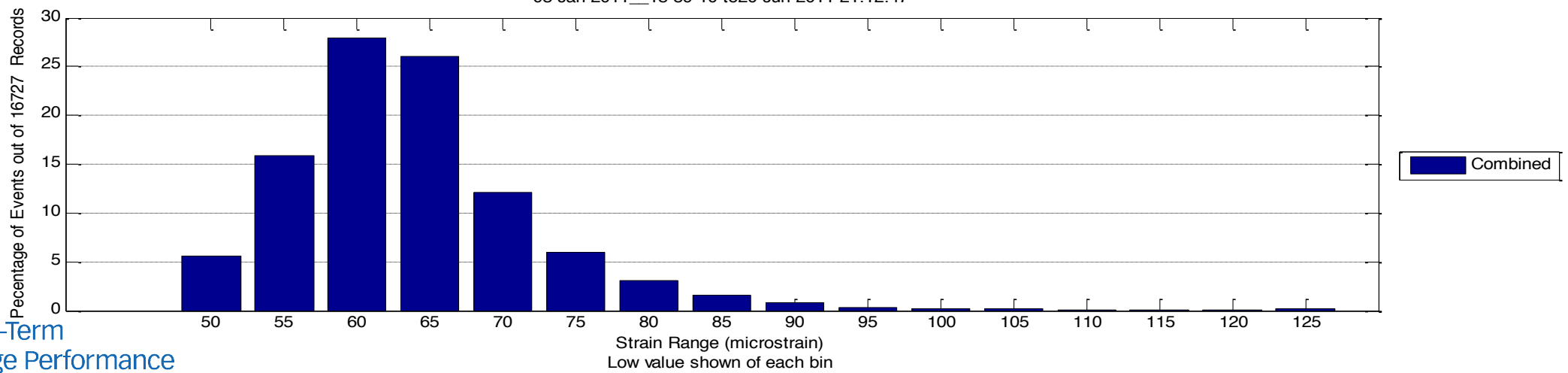
Utah Bridge

Virginia Bridge

Strain Histogram

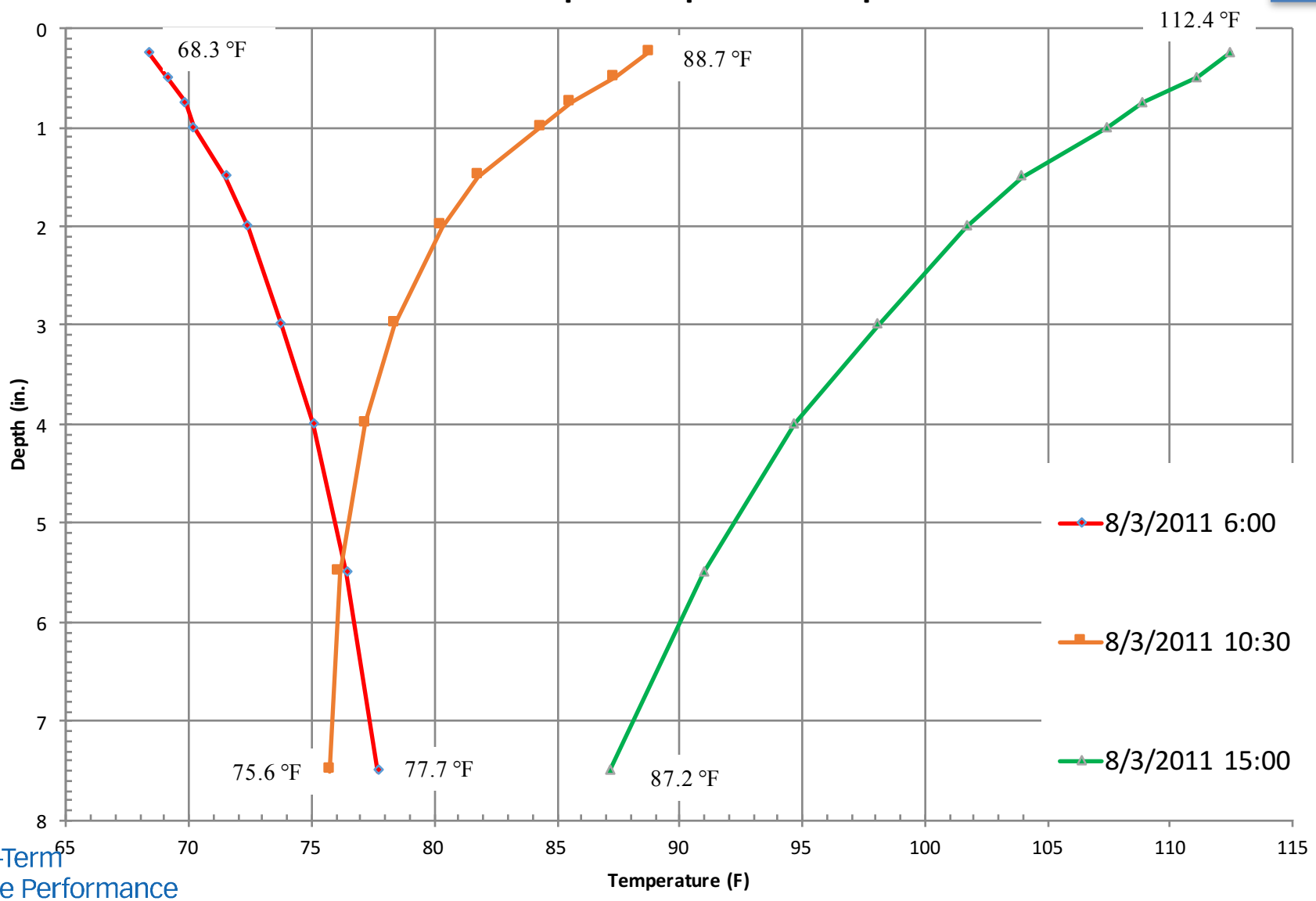
Virginia Bridge





Long-Term Bridge Performance Program

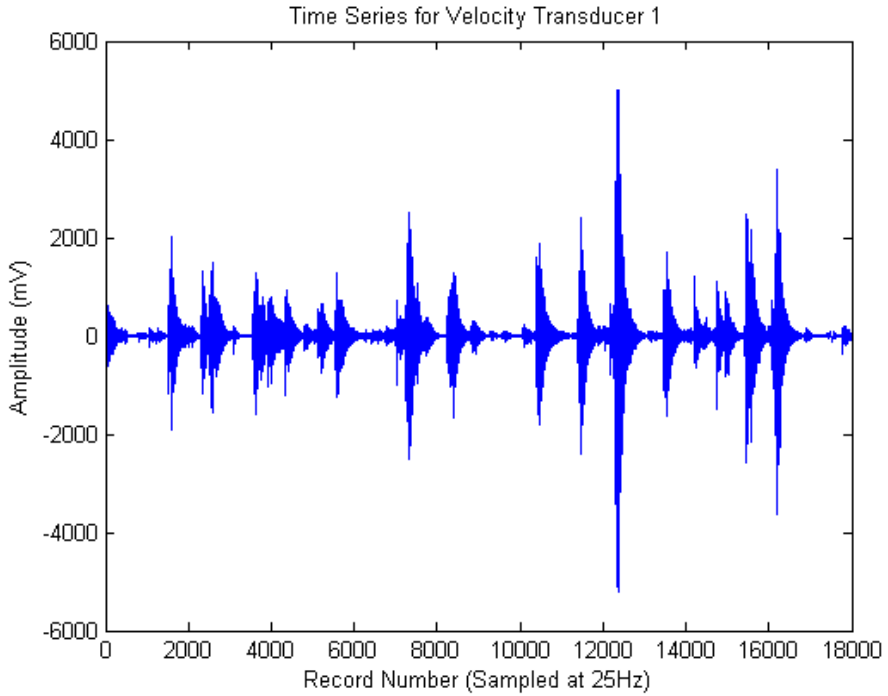
California Bridge

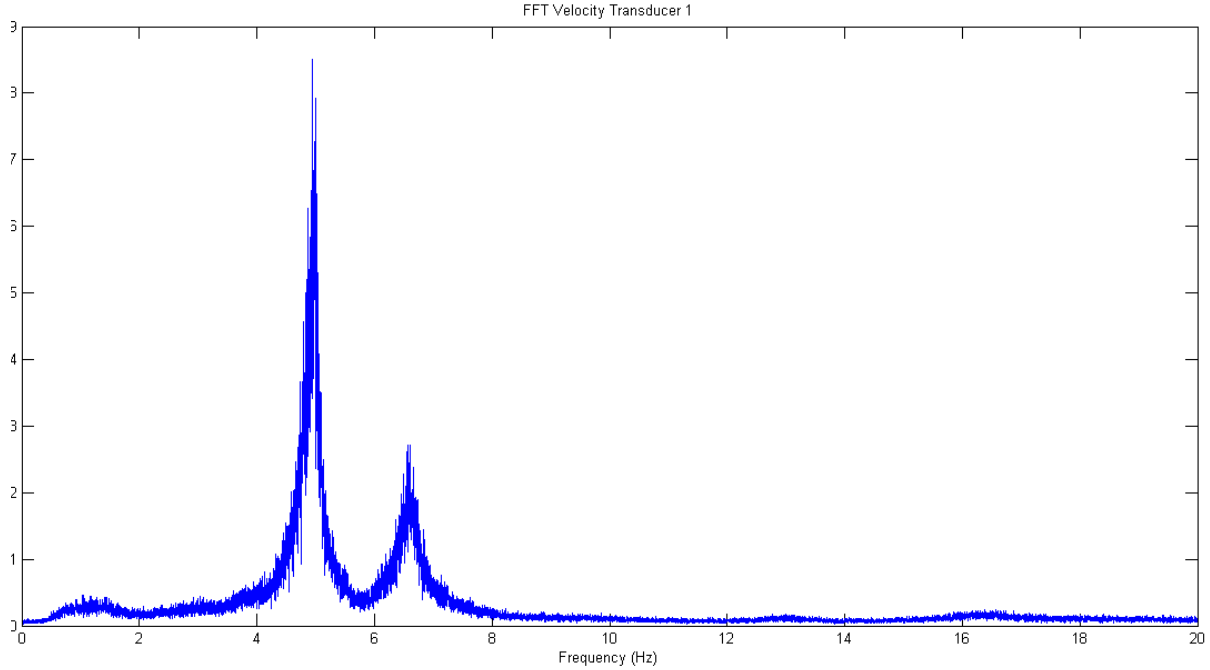


Long-Term Bridge Performance Program

Vibration Data

Utah Bridge





Long-Term Bridge Performance Program

Conclusions

- A properly developed testing plan can be used to provide data for a wide variety of bridge issues.
- Communication between stakeholders is key to establish clear goals and objectives.
- Data management should be addressed at the start of the project.
- An implementation plan should be discussed at the start of every project.