Intro and Overview
for Structural Health Monitoring and Bridges

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SNAKE OIL
ORIGINAL FORMULA
Structural Health Monitoring
CURES FOR WHAT AILS YA • ACCEPT NO SUBSTITUTES
Monitoring structures for a safe and productive world
Structural Health Monitoring – Los Alamos

The process of implementing a damage identification strategy for aerospace, civil and mechanical engineering infrastructure. Damage is defined as changes to the material and/or geometric properties of these systems, including changes to the boundary conditions and system connectivity, which adversely affect the system’s performance.
Structural Health Monitoring - Origins
Structural Health Monitoring – Birthing Environment

- Heavy use of instrumentation and analysis to determine performance
- Short to medium service life
- Mass-produced products
- Established life-cycle management programs
Structural Health Monitoring – Contributors

- Condition Monitoring
- Non-destructive Evaluation
- Statistical Process Control
- Damage Prognosis
Structural Health Monitoring – 40 years of Evolution
Structural Health Monitoring – Bridge Environment

- Very long service life

- Most damage progresses slowly and indications of damage are usually visual.

- Highly varied population

- Sensor-based damage detection techniques are not fully developed or accepted.
Structural Health Monitoring – Bridge Monitoring

Measure | Meaning | Result
---|---|---

Monitoring structures for a safe and productive world
Structural Health Monitoring – Bridge Monitoring
Structural Health Monitoring – Bridge Monitoring

- Developing applications
- Scaling applications
Bridge Monitoring – scaling SHM programs

- A problem may exist but confirmation is difficult to determine.

- A problem may develop if a specific set of driving circumstances occur
Structural Health Monitoring – Substructure Monitoring

Scour, collision detection, settlement / subsidence, masonry crack propagation, adjacent construction damage, and bearing functionality.
Structural Health Monitoring – Deck and deck support monitoring

Vibration monitoring, crack propagation, strain monitoring, load monitoring and chloride intrusion
Structural Health Monitoring – 3 requirements for success.

1. Risk analysis has to show the need.
Structural Health Monitoring – 3 requirements for success.

2. Parameter that assessments can be based upon.

<table>
<thead>
<tr>
<th>Derived Quantity</th>
<th>Name</th>
<th>Symbol</th>
<th>Equivalent SI units</th>
</tr>
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<tbody>
<tr>
<td>Frequency</td>
<td>hertz</td>
<td>Hz</td>
<td>s⁻¹</td>
</tr>
<tr>
<td>Force</td>
<td>newton</td>
<td>N</td>
<td>m·kg·s⁻²</td>
</tr>
<tr>
<td>Pressure</td>
<td>pascal</td>
<td>Pa</td>
<td>N/m²</td>
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<tr>
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<td>joule</td>
<td>J</td>
<td>N·m</td>
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<tr>
<td>Power</td>
<td>watt</td>
<td>W</td>
<td>J/s</td>
</tr>
<tr>
<td>Electric charge</td>
<td>coulomb</td>
<td>C</td>
<td>s·A</td>
</tr>
<tr>
<td>Electric potential</td>
<td>volt</td>
<td>V</td>
<td>W/A</td>
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<tr>
<td>Electric resistance</td>
<td>ohm</td>
<td>Ω</td>
<td>V/A</td>
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<tr>
<td>Celsius temperature</td>
<td>degree Celsius</td>
<td>°C</td>
<td>K*</td>
</tr>
</tbody>
</table>

*Unit degree Celsius is equal in magnitude to unit kelvin.
Structural Health Monitoring – 3 requirements for success.

3. Know what to do when measurements or trends are realized.
LADOTD – Bayou Corne Sinkhole
LADOTD – Bayou Corne Sinkhole

Courtesy: Assumption Parish Police Jury
LADOTD – Bayou Corne Sinkhole
LADOTD – Bayou Corne Sinkhole

3 – axis accel
2 – axis tilt
1 – temp
LADOTD – Bayou Corne Sinkhole

Your bridge is calling

Pier 2 is starting to shift...
Scaling Bridge Monitoring programs

- Detection and notification of an undesirable event – Collision

- Detection and notification of an undesirable behavior – pier tilt related to scour
Structural Health Monitoring

Thank You