Structural Health Monitoring

Osama Raad Alazzawi
University of Diyala
College of Engineering
Dep. Of Materials Engineering

Contents:

- Definition…
- What is SHM?
- Importance of SHM
- SHM techniques
- Components
- Conclusion.

Structure:

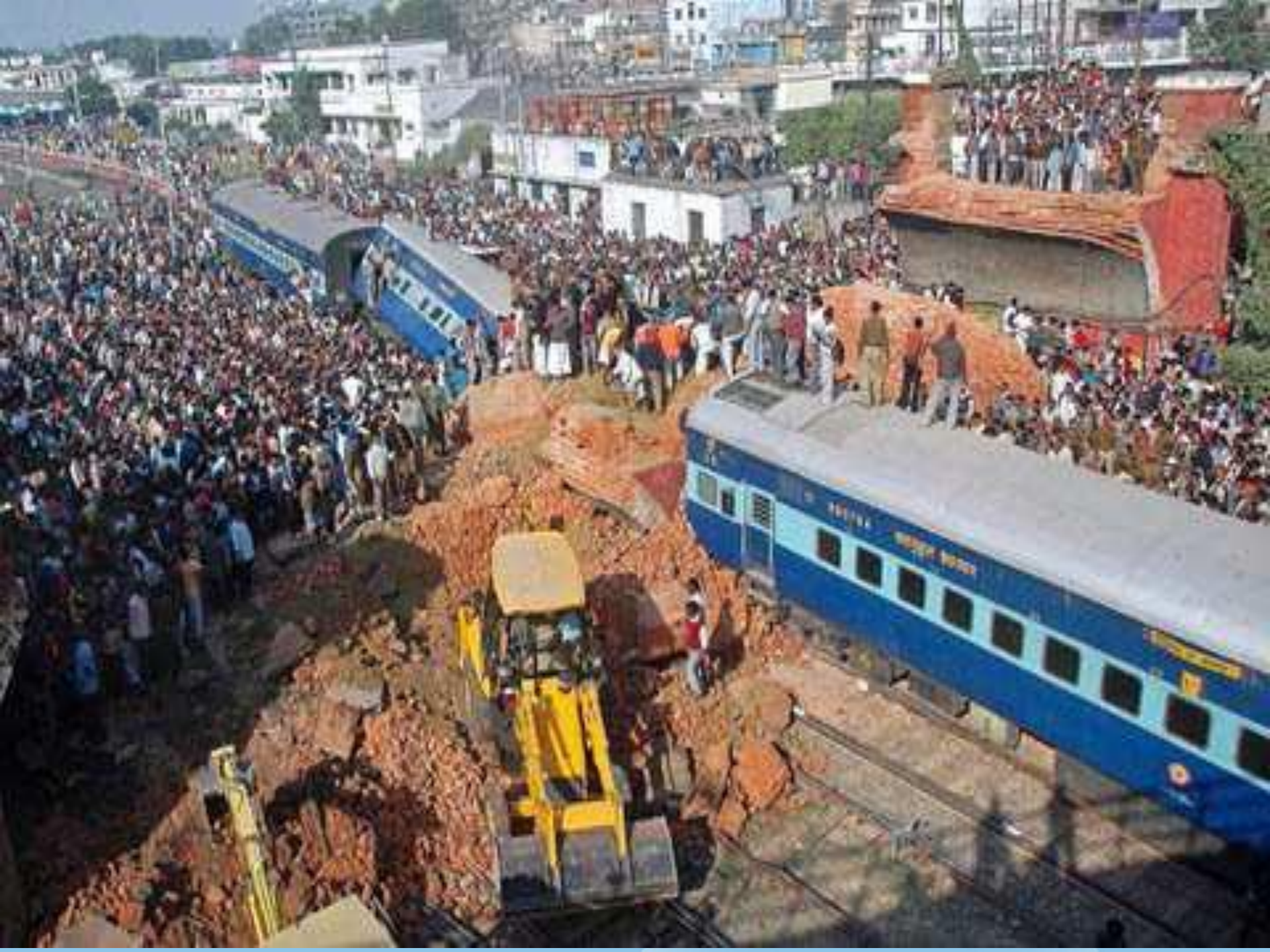
- Combination of :

  - ❖Foundations,
  - ❖Basements,
  - ❖Columns,
  - ❖Beams,
  - ❖Slabs etc…

Types:

Damages Due to:

- mismanagement in construction,
- lack of quality in control,
- temperature conditions……
- Damages such as surface cracks, segregation, settlements etc…



Damage:

- Changes in:
  - geometric properties ,
  - boundary conditions ,
  - system connectivity…

which adversely affect the structure's performance.

What should we do?

In 19th Century:

- A new field emerged namely **Structural Health Monitoring.**

What is *S*tructural *H*ealth *M*onitoring?

- The process of implementing a damage detection and characterization strategy for engineering structures is referred as *S*tructural *H*ealth *M*onitoring.

(in short…)

Importance of SHM:

- SHM improves - safety & functionality of structures.
- Monitoring - develop innovative design methodologies - timely warning of impending failures.
- Structural condition monitoring and assessment are required for timely and cost-effective maintenance.

SHM Techniques:

- Until very recently, visible inspection by trained personnel had been the most common tool to identify the external signs of damage structures.
- Then new techniques is used for damage assessment, such as X-ray, ultrasonic,, etc…
- One of the promising techniques is:

“ELECTROMECHNICAL IMPEDANCE (EMI) TECHNIQUE”

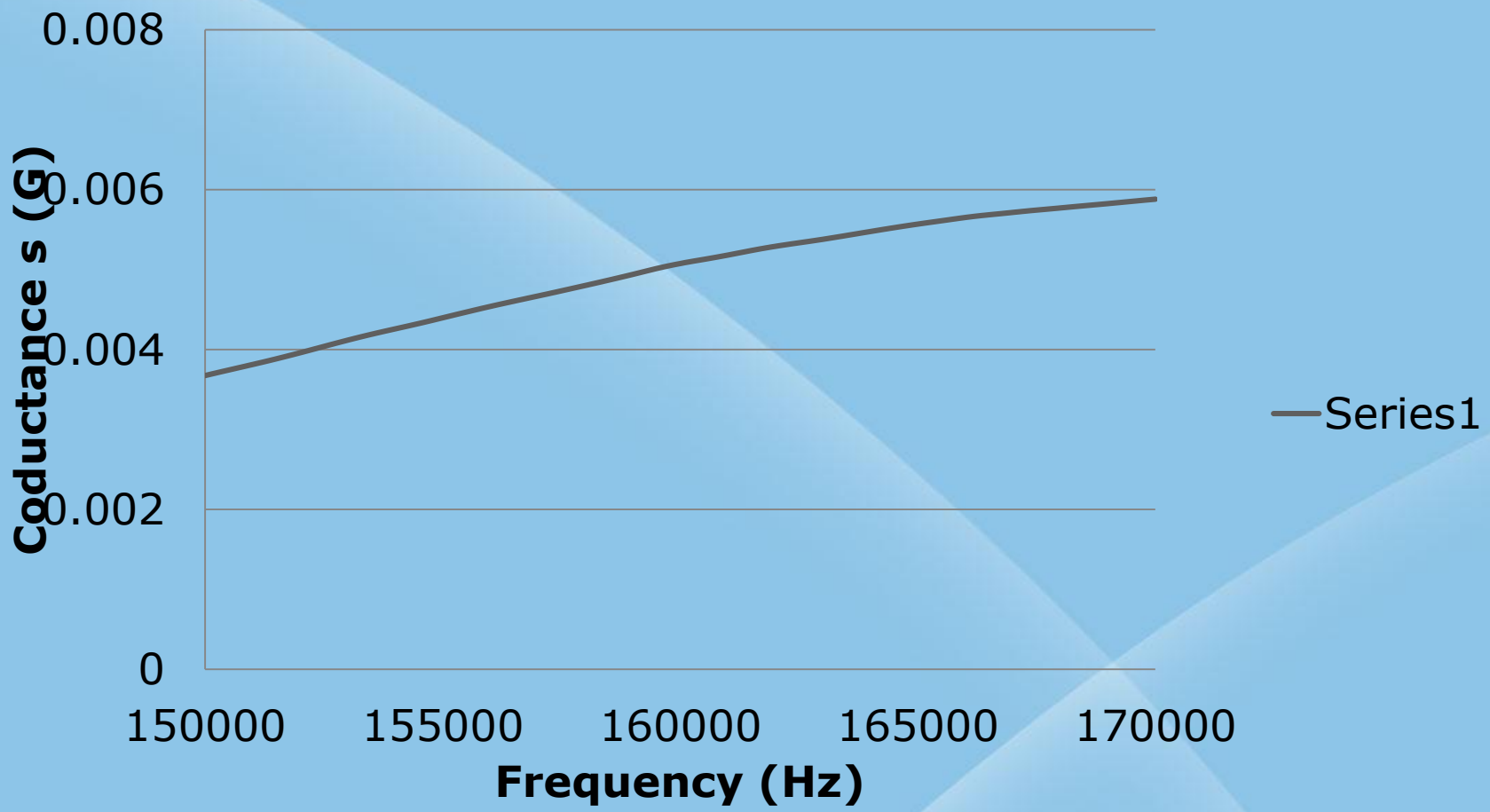
ELECTRO MECHNICAL IMPEDANCE (EMI) TECHNIQUE :

- In the EMI, a piezo-electric ceramic (PZT) sensor patch is bonded /embedded in the structure (smart material)
- The conductance signature of the patch is acquired over a high frequency range (30-400 kHz).
- This signature forms the benchmark for assessing the structural health. when it is desired to assess the health of the structure, the signature is acquired again and compared with the benchmark signature.

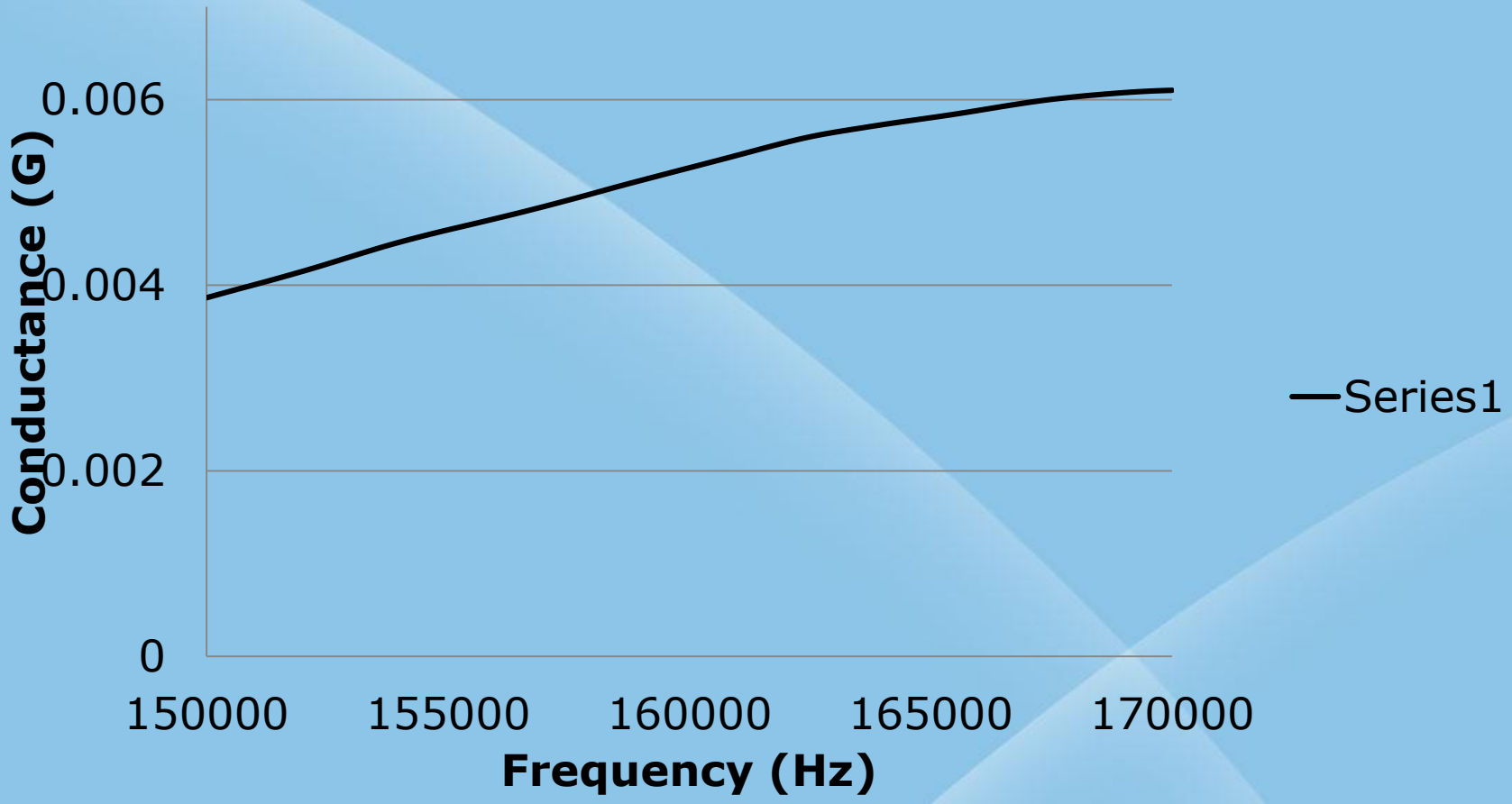
EXPERIMENTAL STUDY

- An R.C. Model Bridge of dimension (2×0.5×0.15)m
- And instrumentation (embedded PZT patch at 0.9m distance from the left support), However, the bridge was loaded with two point load system
- The concrete bridge was subjected to five loading cases. In the first case of loading was free of load and In the fifth stage (failure stage) was subjected to 70 KN at each point load.

CONDUCTANCE (G) AT FIRST LOADING CASE

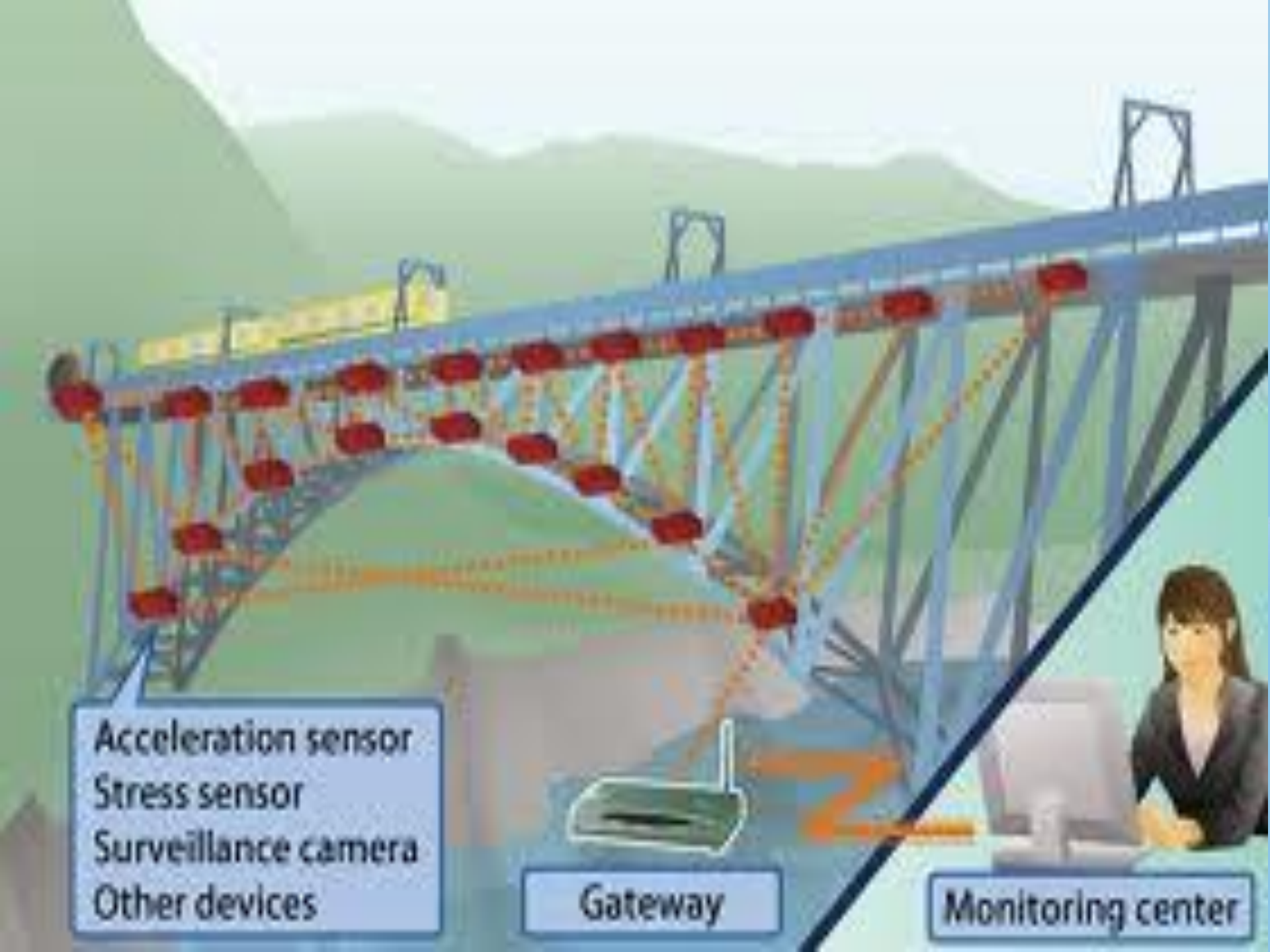


CONDUCTANCE AT DAMAGE CASE



Components:

- Structure
- Sensors
- Data acquisition systems
- Data management
- Data transfer
- Data interpretation and diagnosis


Acceleration sensor
Stress sensor
Surveillance camera
Other devices
Gateway
Monitoring center

Conclusion:

- This concept ends with conclusion with that even structures have life and we (Engineers) are here to protect it from various diseases.

THANK YOU...