


A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor (BRIDGE APPLICATIONS)

STRUCTURAL FATIGUE DAMAGE MONITORING of different components of BRIDGE SYSTEMS (welded, rivets, bolted, and other fatigue specific-sensitive elements) during normal service.



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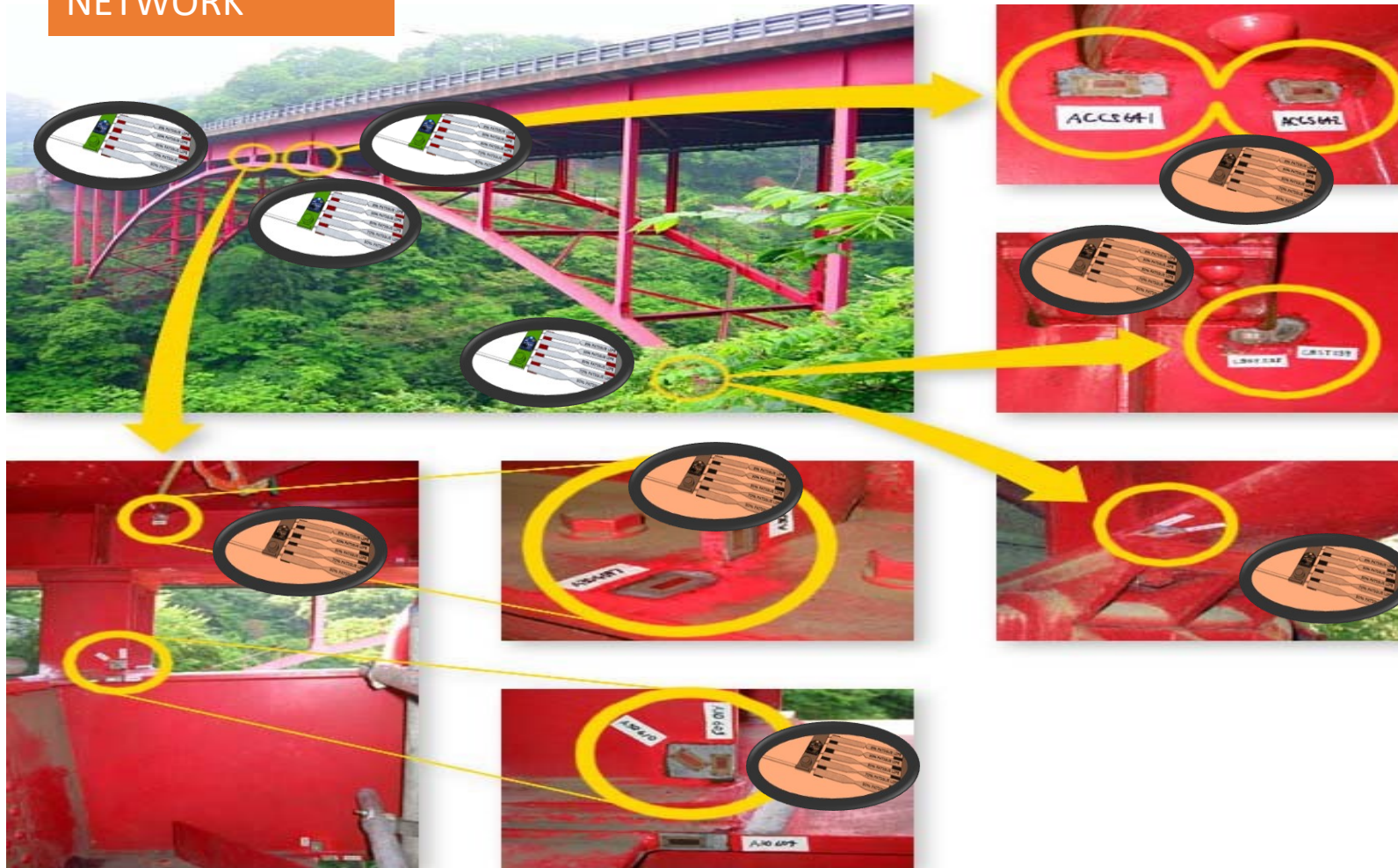
HEALTH MONITORING → STRUCTURAL HEALTH MONITORING

SYSTEM				Key Challenge: Addressing issues of scale. e.g., 600,000 bridges
SENSORS				Key Challenge: Limited private/public sector investment in R+D
SIGNAL				Key Challenge: Affordable yet reliable sensing elements
EXPERT ANALYSIS				Key Challenge: Detecting damage at early stages to enable proactive response

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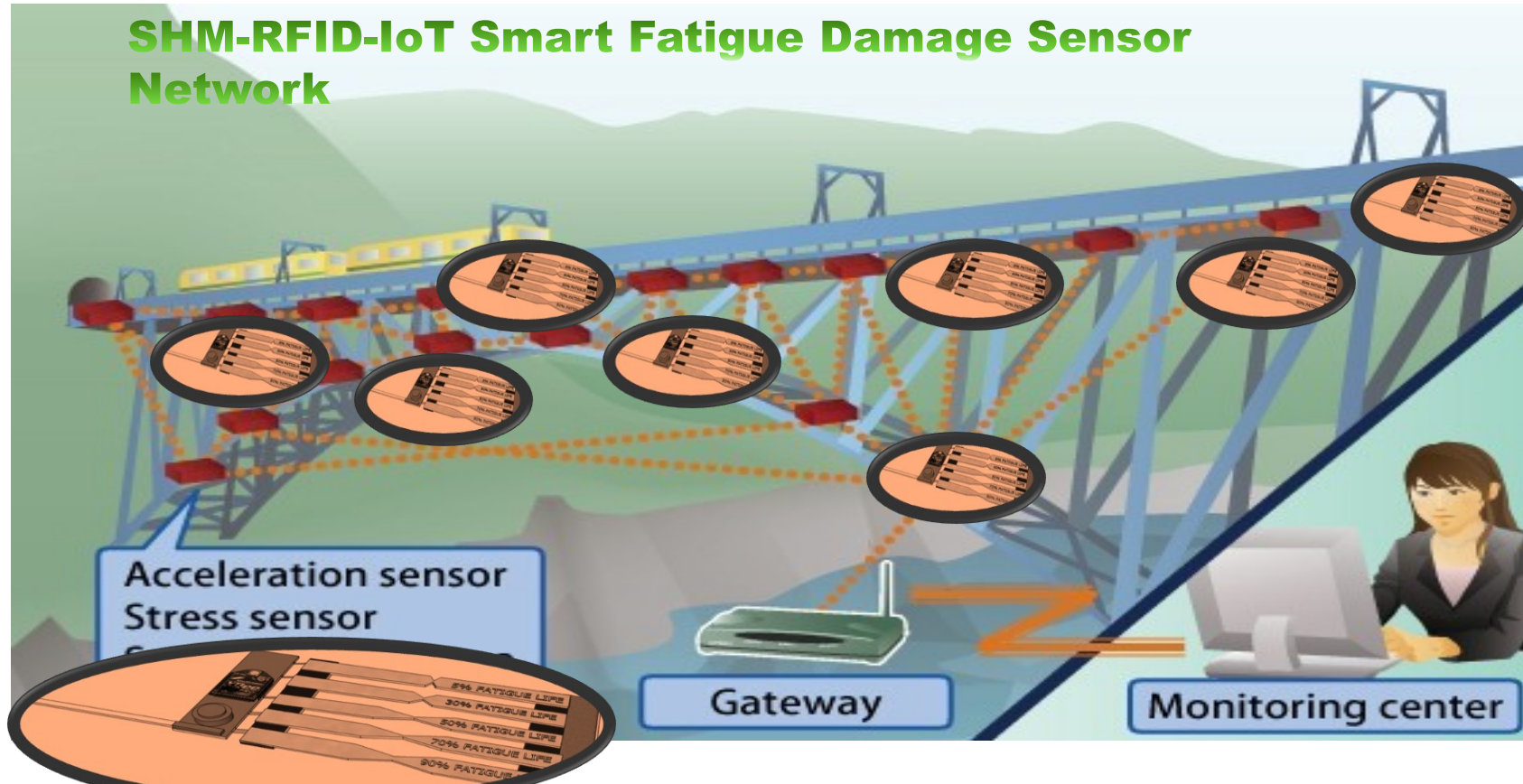
FATIGUE SENSOR NETWORK



STRUCTURAL FATIGUE DAMAGE MONITORING of different components of BRIDGE SYSTEMS (welded, rivets, bolted, and other fatigue specific-sensitive elements) during normal service.

A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor Damage Sensor (BRIDGE APPLICATIONS)

SHM-RFID-IoT Smart Fatigue Damage Sensor Network

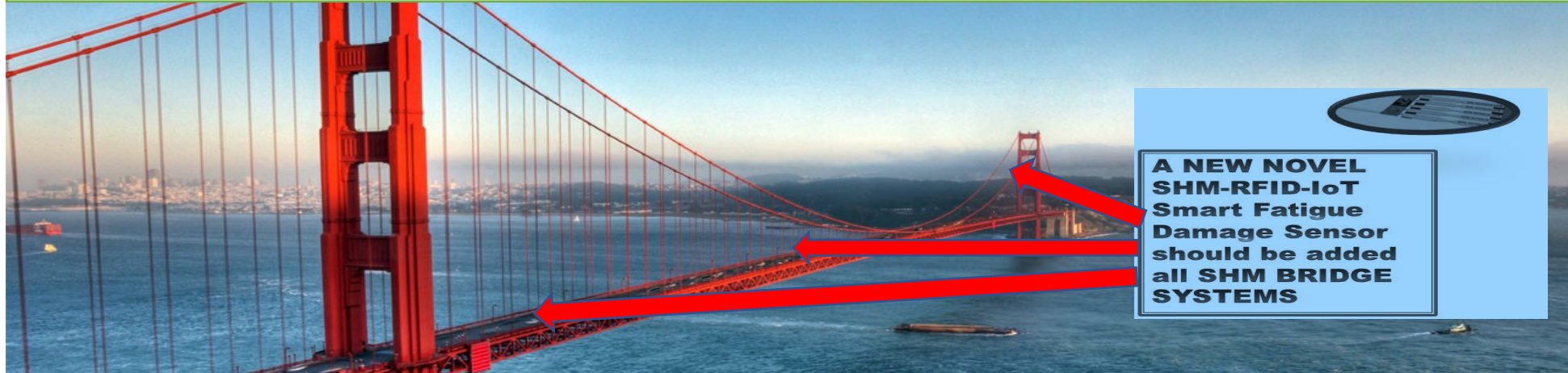


SHM-RFID-IoT Smart Fatigue Damage Sensor

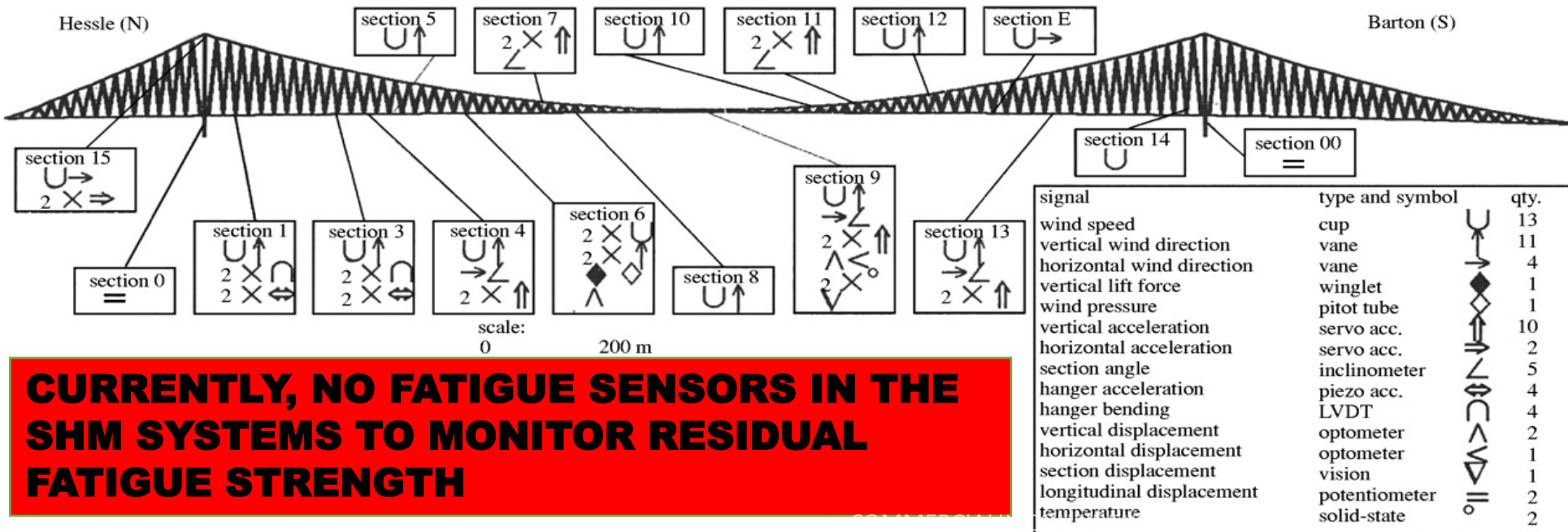
DISTRIBUTED SENSOR NETWORK FOR BRIDGE SHM SYSTEM. FATIGUE SENSOR APPLICATIONS TO BRIDGES: Fatigue sensitive regions, locations under high loads, predetermined and formerly known-experienced spots on the structures and mechanical components such as Riveted, Bolted and Hole Type Connections etc..

A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor

(SHM BRIDGE APPLICATIONS-SENSORS)



Identify all the Fatigue Critical HOT SPOTS in STRUCTURES for the applications of Smart fatigue damage sensors in order to monitor the RESIDUAL FATIGUE STRENGTH

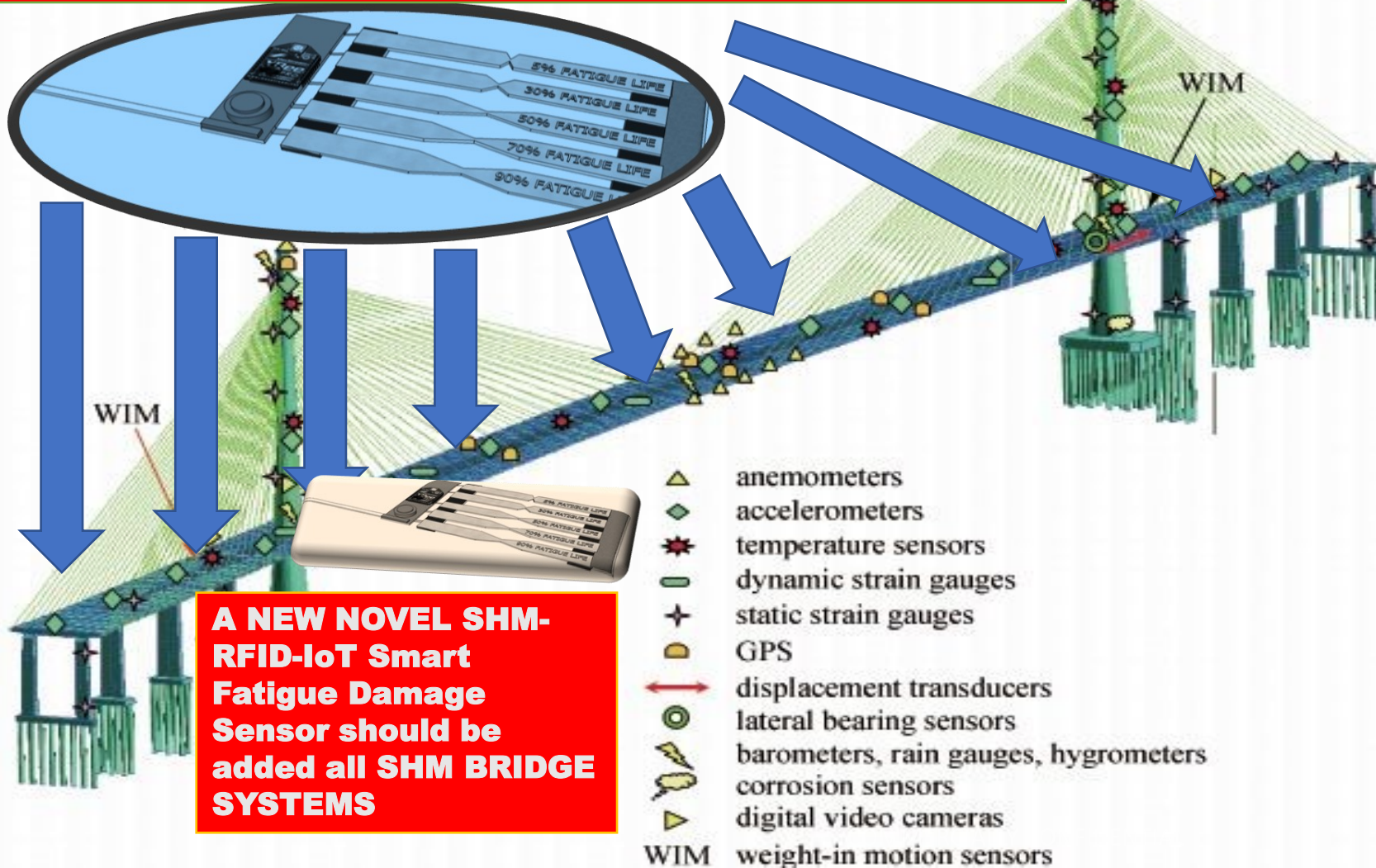


CURRENTLY, NO FATIGUE SENSORS IN THE SHM SYSTEMS TO MONITOR RESIDUAL FATIGUE STRENGTH

A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor

(SHM BRIDGE APPLICATIONS-SENSORS)

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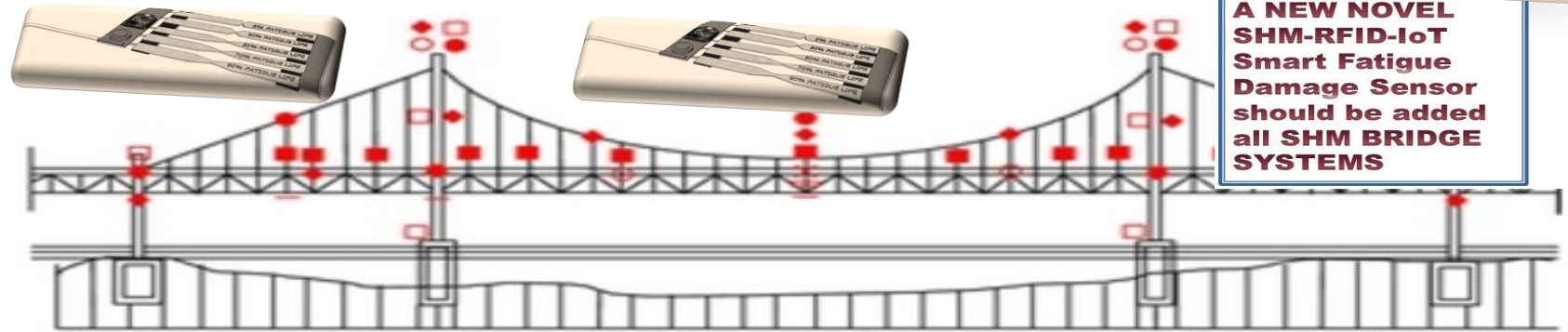
A NEW NOVEL SHM-RFID-IoT Smart Fatigue Damage Sensor should be added all SHM BRIDGE SYSTEMS

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A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor

(SHM BRIDGE APPLICATIONS-SENSORS)



A NEW NOVEL SHM-RFID-IoT Smart Fatigue Damage Sensor should be added all SHM BRIDGE SYSTEMS

Symbol	Sensor	Number	Behavior	Symbol	Sensor	Number	Behavior
●	Thermometer	21	Cable and member	■	1D accelerometer	12	Cable
:::	Static strain gage	12	Tower	□	2D accelerometer	4	Tower top and deck
		8@4	Anchor bolt	□	3D accelerometer	10	Deck
		42	Deck. cross section	○	Anemometer	3	Tower foundation
		10@4	Anchor plate	×	Laser disp. sensor	4	Wind
—	Dynamic strain gage	8	Link shoe	⬛	Potentiometer	3	Expansion joint
◆	2D tiltmeter	76	Deck. cross section	SL	Static data logger	4	
		99	Etc.	DL	Dynamic data logger	2	
		10	Tower inclination			2	

DISTRIBUTED SENSORS (Dynamic Strain gage, Accelerometer, Potentiometer, Etc.) NETWORK FOR BRIDGE SHM SYSTEM.

FATIGUE SENSOR APPLICATIONS TO BRIDGES: Fatigue sensitive regions, locations under high loads, predetermined and formerly known-experienced spots on the structures and mechanical components such as Riveted, Bolted and Hole Type Connections etc..

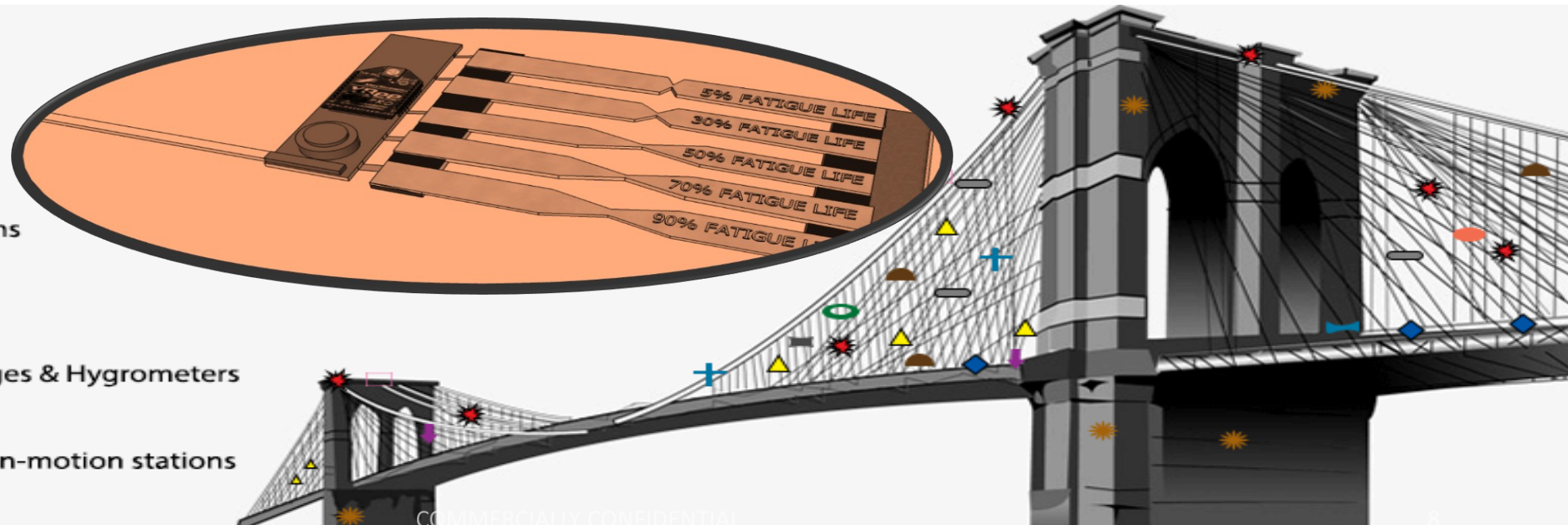
A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor

(SHM BRIDGE APPLICATIONS-SENSORS)

DISTRIBUTED SENSORS (Dynamic Strain gage, Accelerometer, Potentiometer, Etc.) NETWORK FOR BRIDGE SHM SYSTEM.

FATIGUE SENSOR APPLICATIONS TO BRIDGES: Fatigue sensitive regions, locations under high loads, predetermined and formerly known-experienced spots on the structures and mechanical components such as Riveted, Bolted and Hole Type Connections etc..

- ▲ Anemometers
- ◆ 3D Accelerometers
- ☀ Temperature Sensors
- ▬ Dynamic Strain Gauges
- ⊕ Static Strain Gauges
- Global Positioning Systems
- ▼ Tiltmeters
- ⊖ Buffer Sensors
- Bearing Sensors
- Electro-Magnetic Sensors
- ⚡ Barometers, Rainfall Gauges & Hygrometers
- ☀ Corrosion Cells
- Digital Video Cameras
- ▬ DWIMS: Dynamic Weigh-in-motion stations

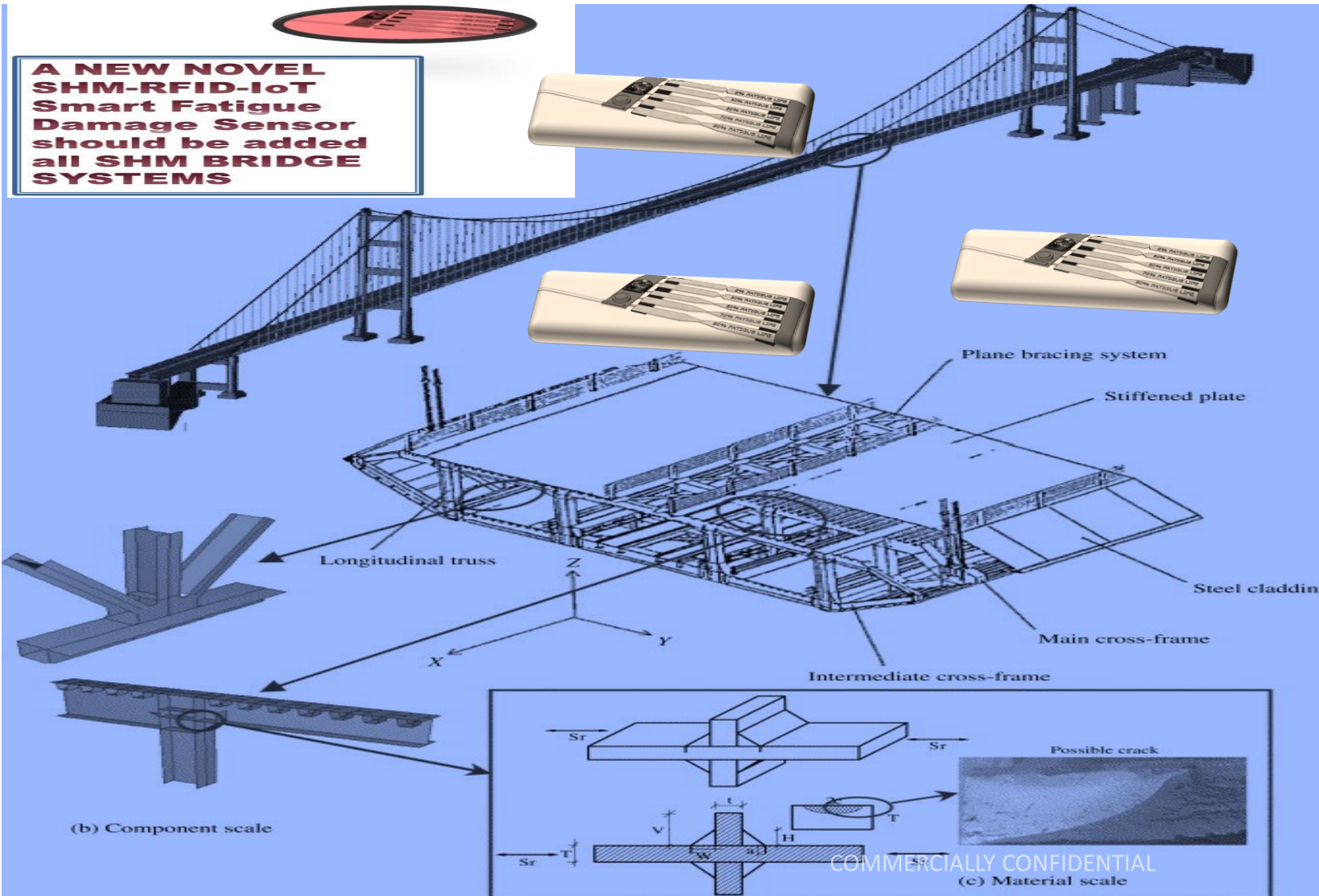


A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor

(SHM BRIDGE APPLICATIONS-SENSORS)

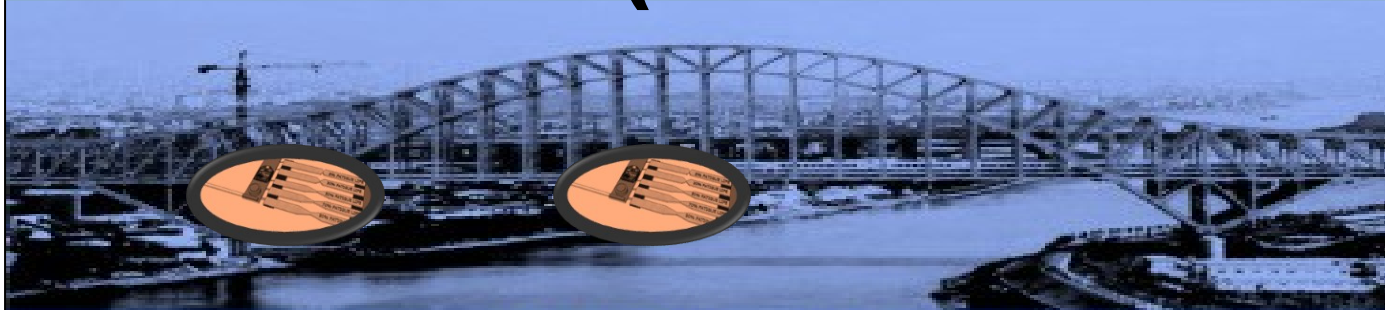
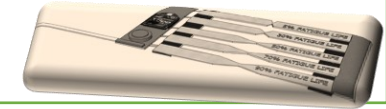


A NEW NOVEL SHM-RFID-IoT Smart Fatigue Damage Sensor should be added all SHM BRIDGE SYSTEMS



DISTRIBUTED SENSOR NETWORK FOR BRIDGE SHM SYSTEM. FATIGUE SENSOR APPLICATIONS TO BRIDGES: Fatigue sensitive regions, locations under high loads, predetermined and formerly known-experienced spots on the structures and mechanical components such as Riveted, Bolted and Hole Type Connections etc..

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(a) Dongping Bridge



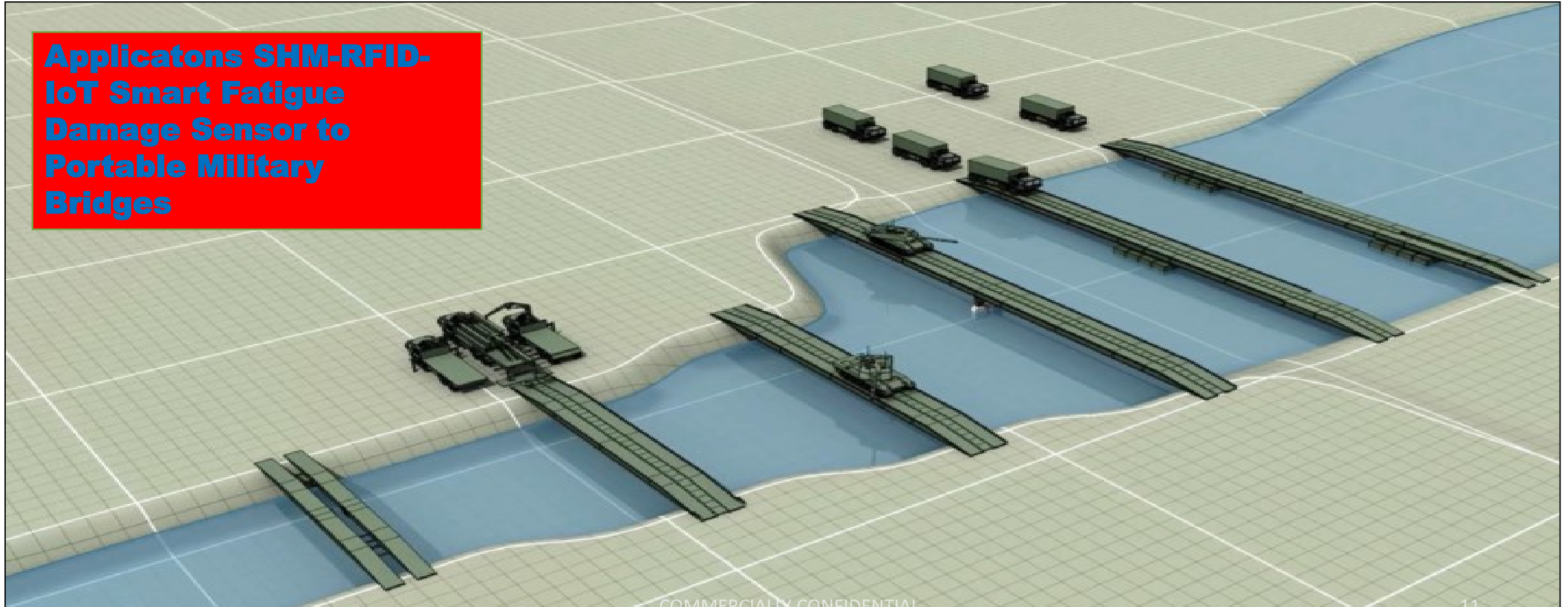
(b) Dashengguan Bridge



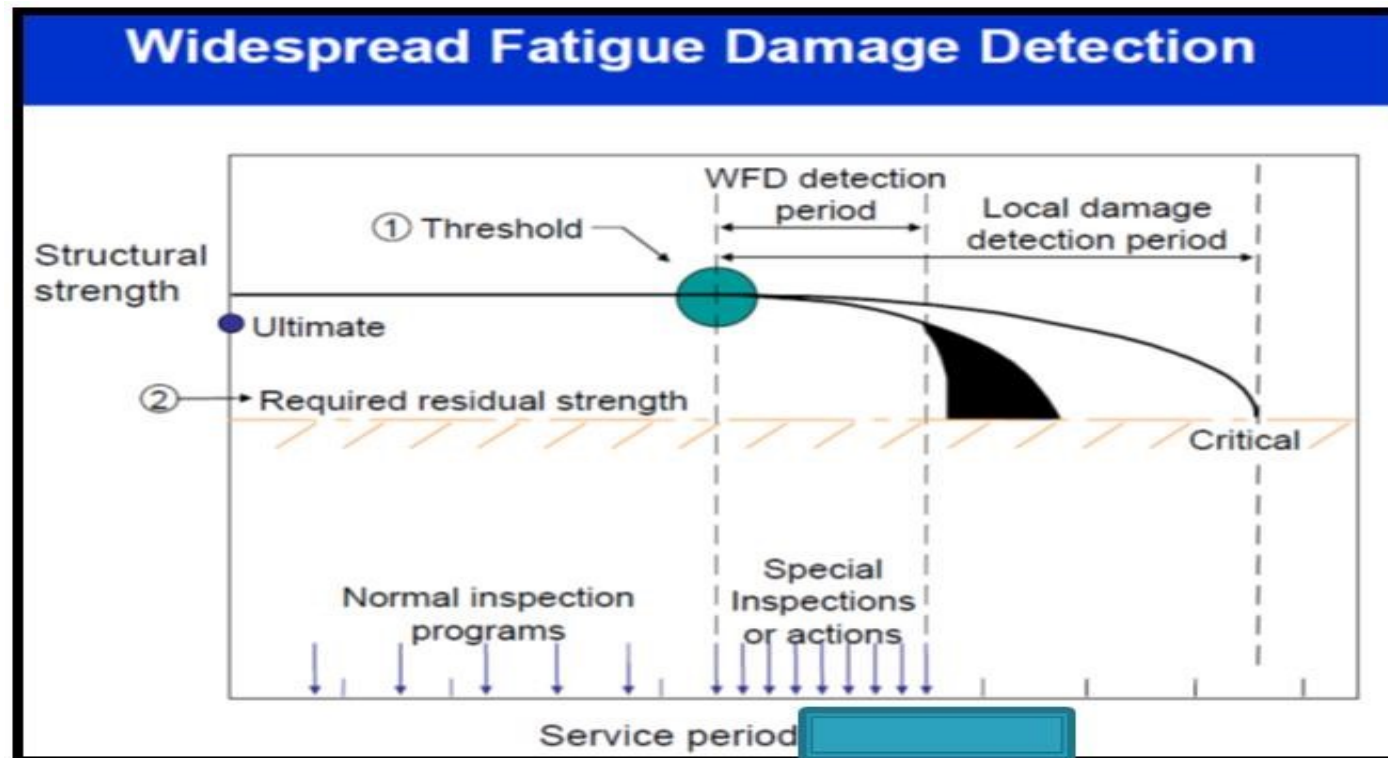
Identify all the Fatigue Critical HOT SPOTS in STRUCTURES for the applications of Smart fatigue damage sensors in order to monitor the RESIDUAL FATIGUE STRENGTH or Fatigue Lifetime. Specific and Fatigue sensitive regions, locations under high loads, predetermined and formerly known-experienced spots on the structures and mechanical components such as Riveted, Bolted and Hole Type Connections etc..

A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor (MILITARY PORTABLE BRIDGE SHM APPLICATIONS)

Applications SHM-RFID-IoT Smart Fatigue Damage Sensor to Portable Military Bridges

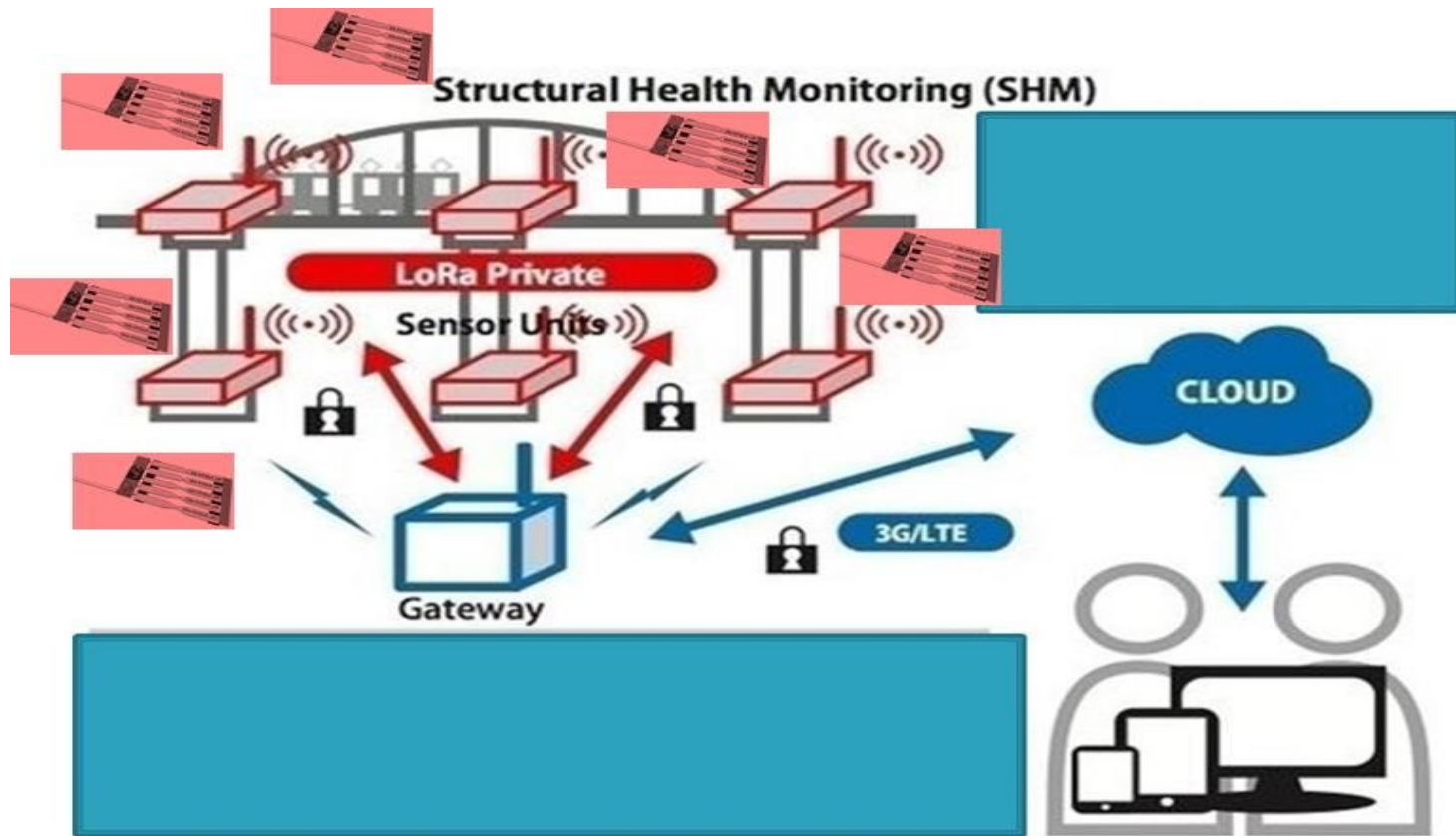


A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor (BRIDGE APPLICATIONS) LIFETIME -FATIGUE STRUCTURAL STRENGTH



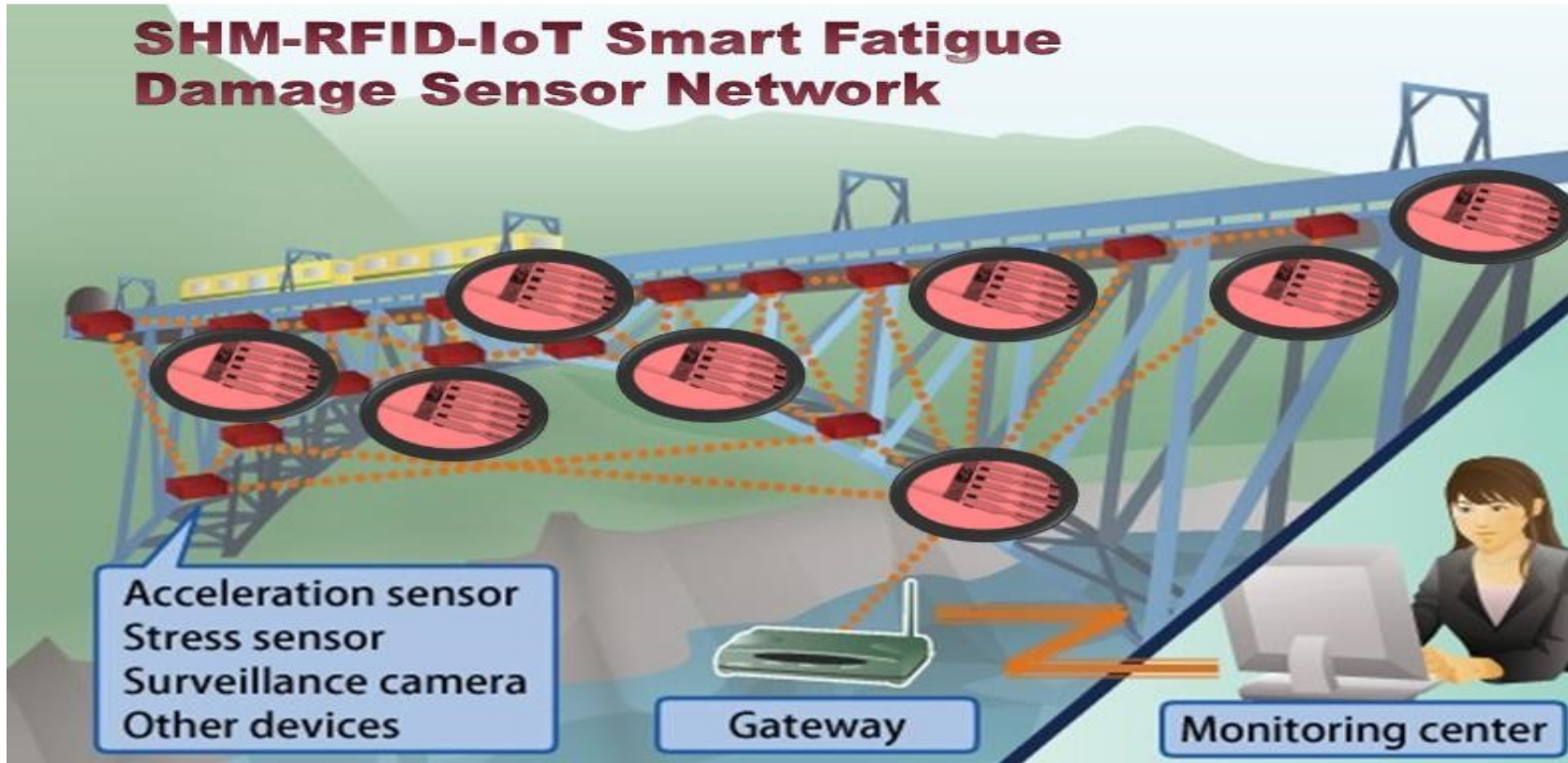
DETECTION OF FATIGUE DAMAGE LOCAL CRACKS: STRUCTURAL FATIGUE DAMAGE MONITORING AND FATIGUE DAMAGE DETECTION of different components of BRIDGE SYSTEMS (fatigue specific-sensitive elements) during normal service based on the visible-detectable FATIGUE CRACKS

A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor (BRIDGE APPLICATIONS)



**WIRELESS
STRUCTURAL
FATIGUE DAMAGE
MONITORING AND
FATIGUE DAMAGE
DETECTION of
different
components of
BRIDGE SYSTEMS
(fatigue specific-
sensitive elements)
during normal
service.**

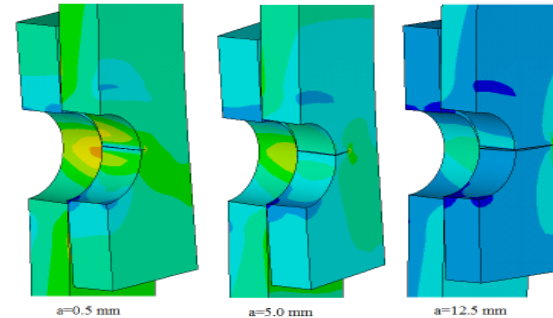
A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor (BRIDGE APPLICATIONS)



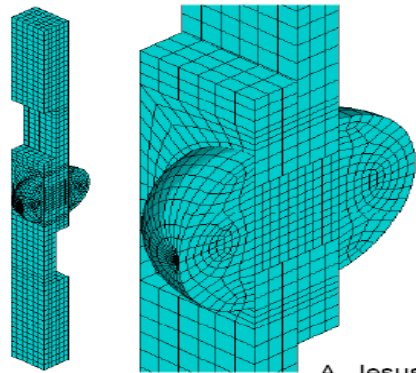
Fatigue sensitive regions, locations under high loads, predetermined and formerly known-experienced spots on the structures and mechanical components such as Riveted, Bolted and Hole Type Connections etc..

A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor (BRIDGE APPLICATIONS-RIVETED JOINTS)

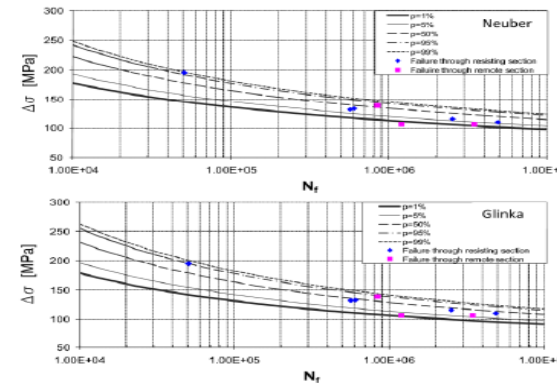
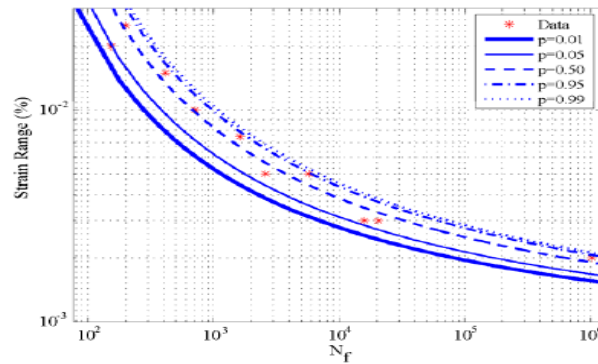
- Local Approaches base on Fracture Mechanics or based of S-N of ϵ -N curves of plain material may be used as a true alternative.
- Local Approaches requires detailed stress analysis of riveted joints.



J. Correia & A. Jesus, 7ICSB - SteelBridges, 2008.



A. Jesus *et al.*, Int. J.of Fatigue, 2010.

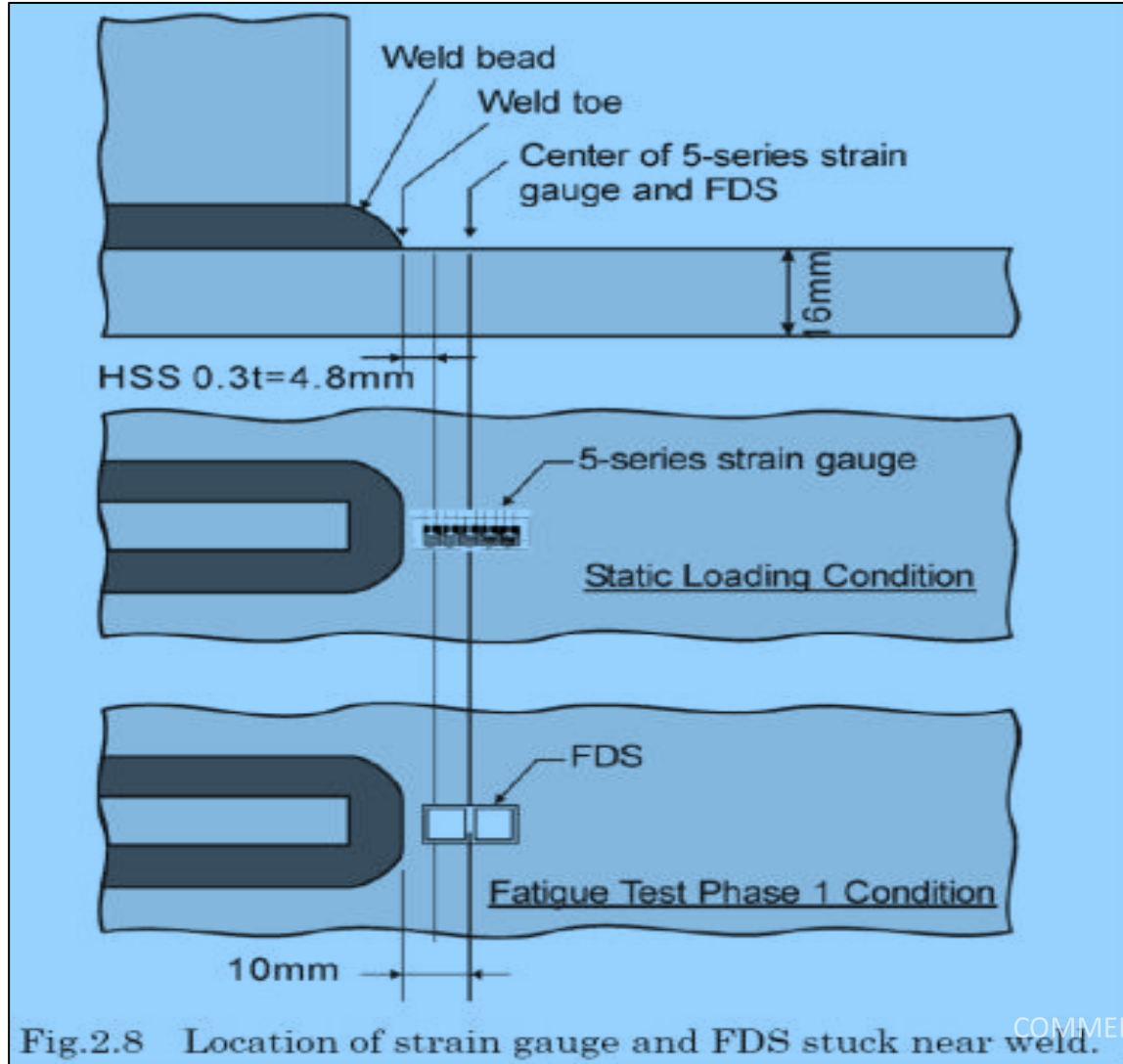


CIFIE '2010, March 17-19, Porto, Portugal

Fatigue sensitive regions, locations under high loads, predetermined and formerly known-experienced spots on the structures and mechanical components such as Riveted, Bolted and Hole Type Connections etc..

A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor

(BRIDGE APPLICATIONS-WELDED JOINTS)



Fatigue sensitive regions, locations under high loads, predetermined and formerly known-experienced spots on the structures and mechanical components such as Welded, Riveted, Bolted and Hole Type Connections etc..

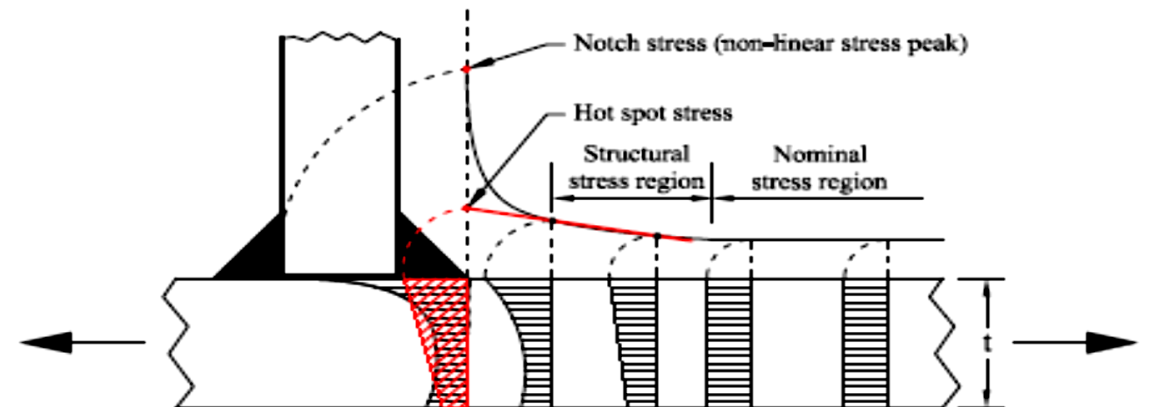
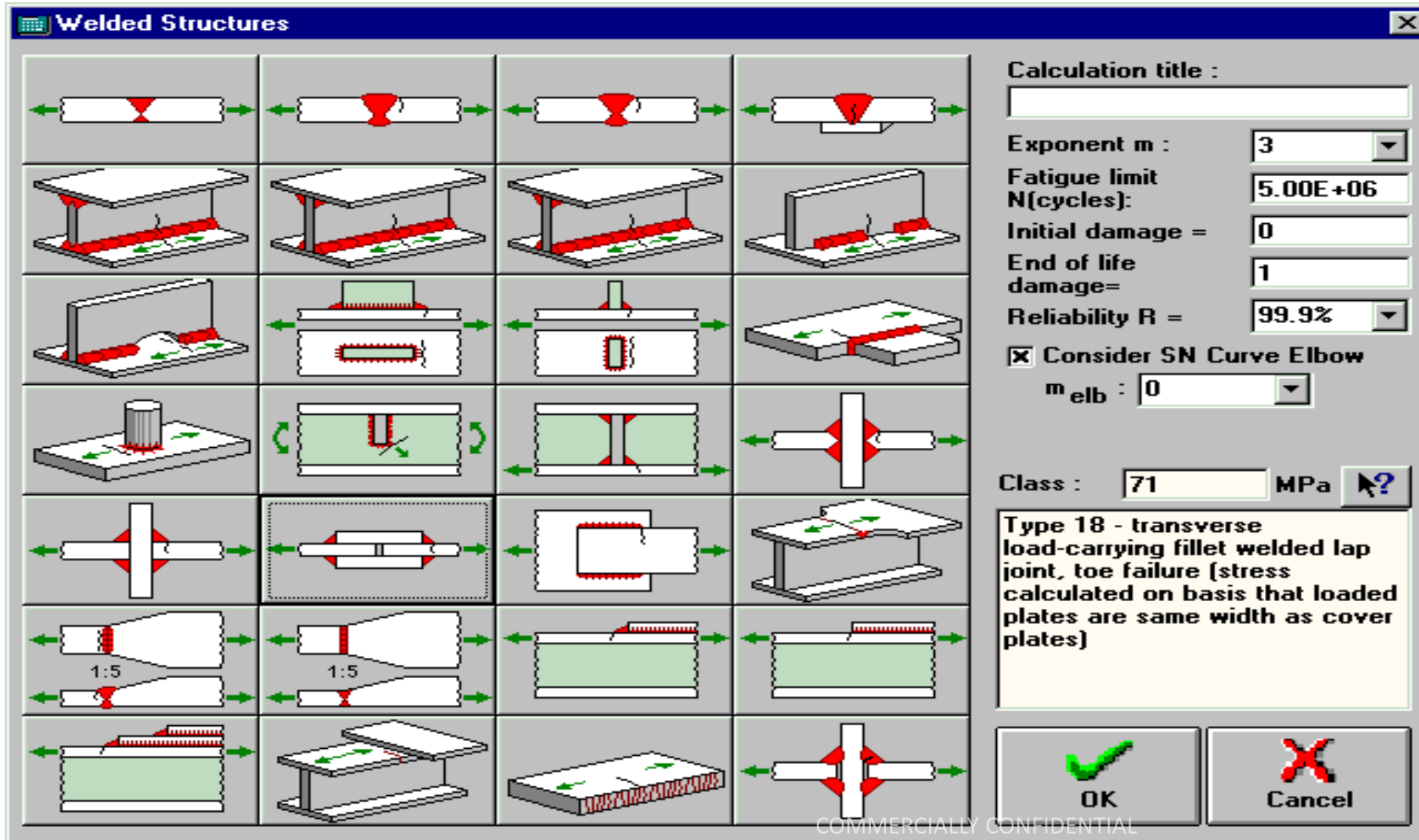


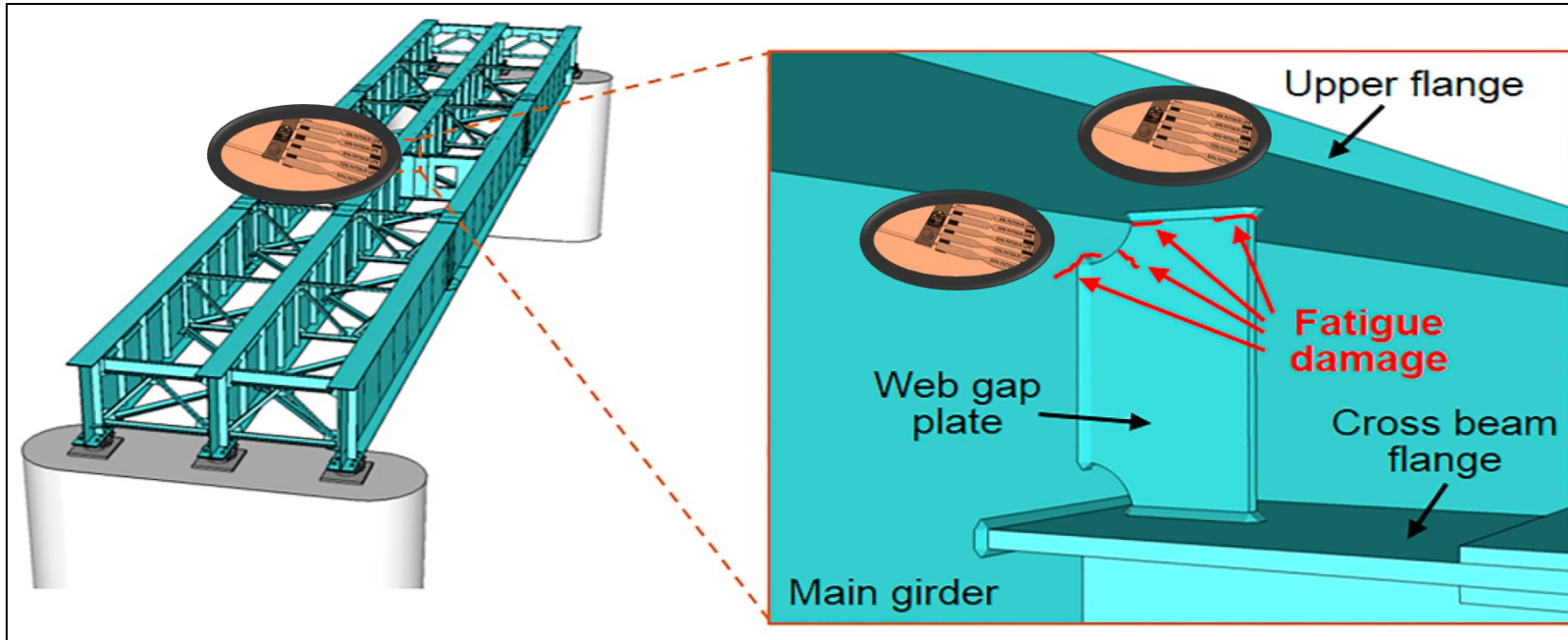
Figure 2-1 Stress distribution through plate thickness and along the surface close to the weld [5].

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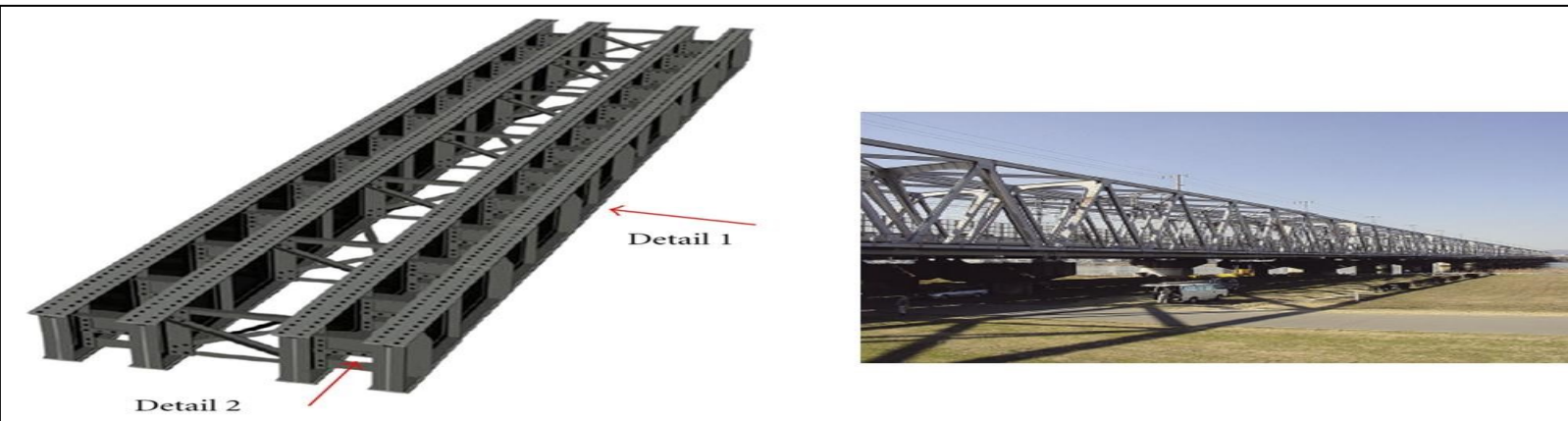


Fatigue sensitive regions, locations under high loads, predetermined and formerly known-experienced spots on the structures and mechanical components such as Welded, Riveted, Bolted and Hole Type Connections etc..

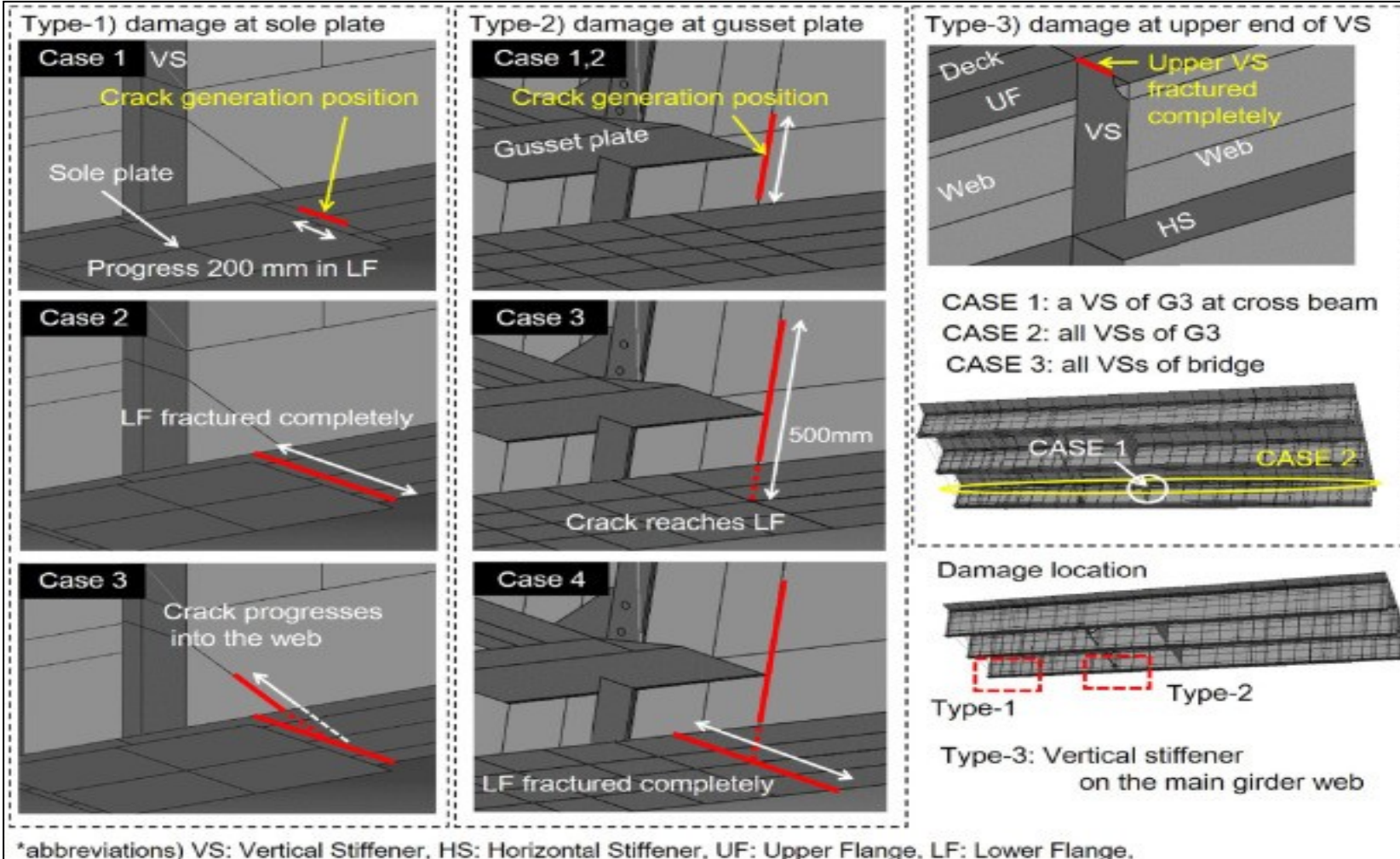
A Novel Wireless Enabled SHM-RFID-IoT Smart Fatigue Damage Sensor (RAILWAY BRIDGE APPLICATIONS)



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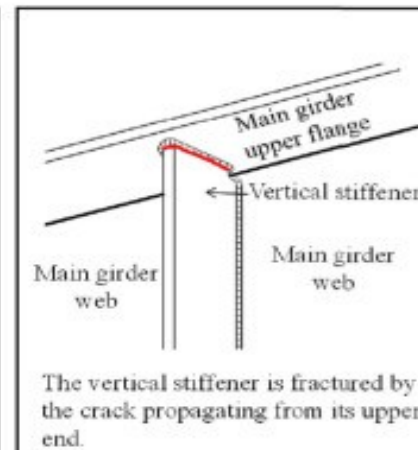
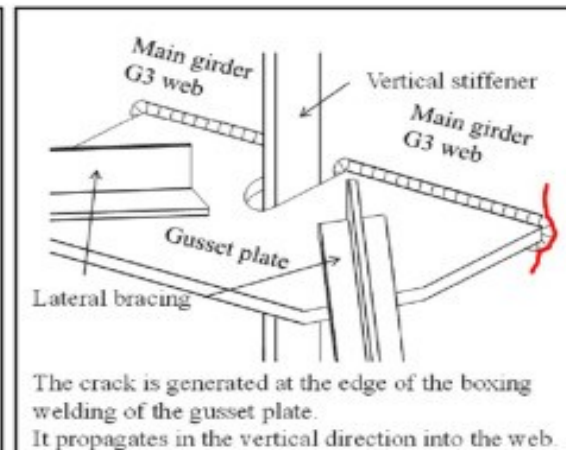
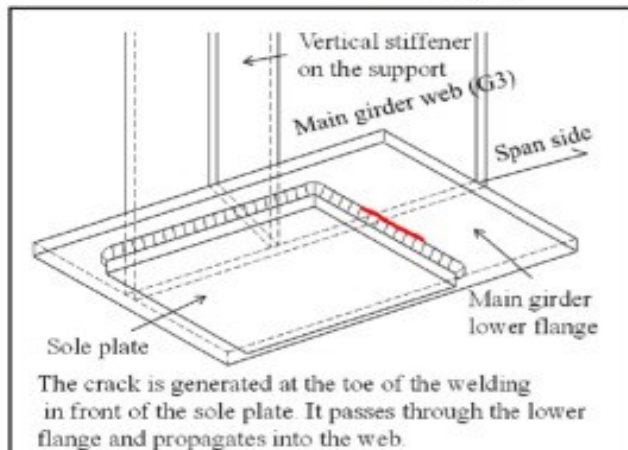
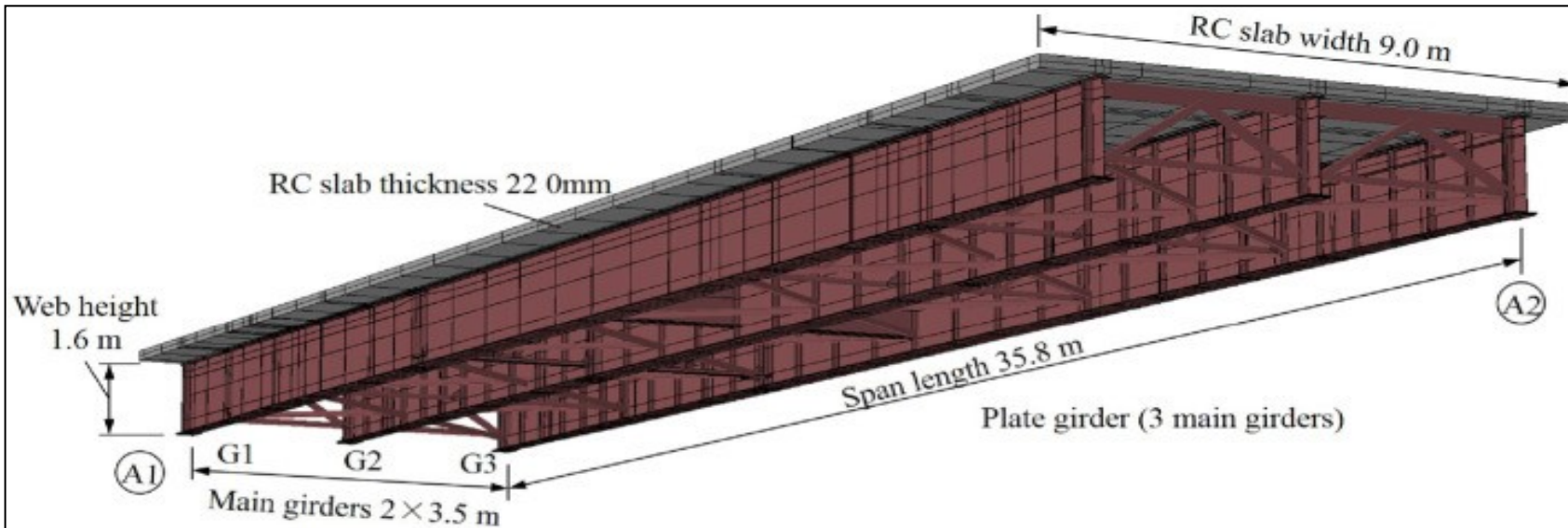


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