



Konferencë vjetore ndërkombëtare shkencore e UET / Annual International scientific conference of EUT

DSSH VIII/ 2021
DITËT E STUDIMEVE SHQIPTARE
albanian studies days / journées d'études albanais



**Universiteti
European i
Tiranës**

maiora premunt / gjëra të mëdha na presin

NEW NORMAL CHALLENGES AND OPPORTUNITIES

European University of Tirana (EUT)

29 - 30 APRIL 2021, Tirana, Albania

IV- INFLUENCE OF TECHNOLOGICAL INNOVATIONS ON INDUSTRY AND SERVICES

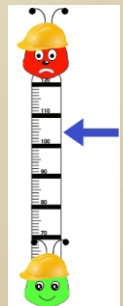
The permanent monitoring of civil infrastructure via IoT technology

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* **Moni2BSafe** Project

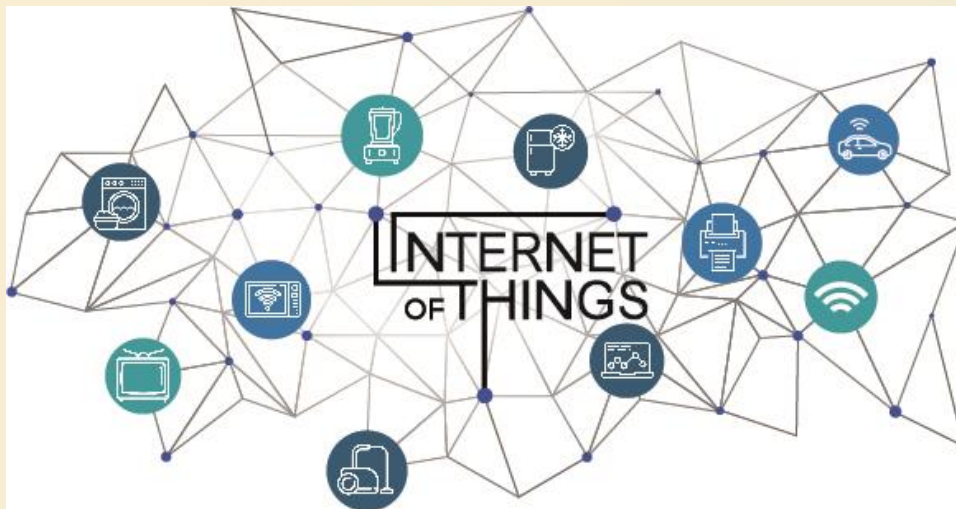




IoT

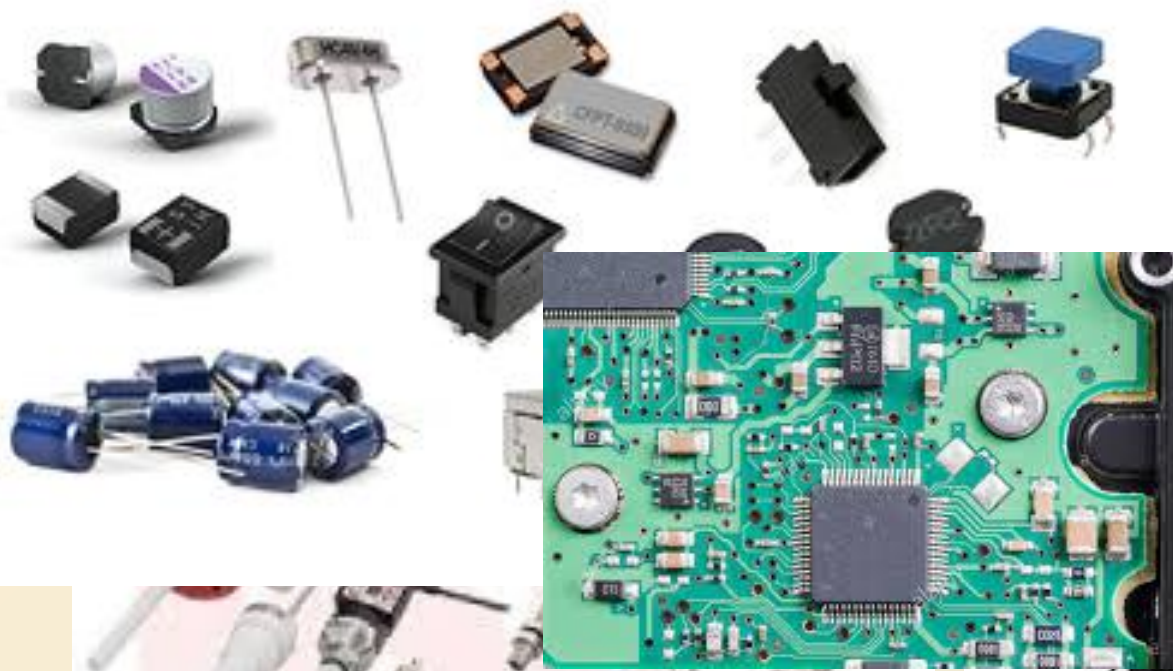
«Internet of Things»

To bring into the digital networks the things surrounding us during our life. To bring some objects in order to make them communicate between themselves and then with us. .

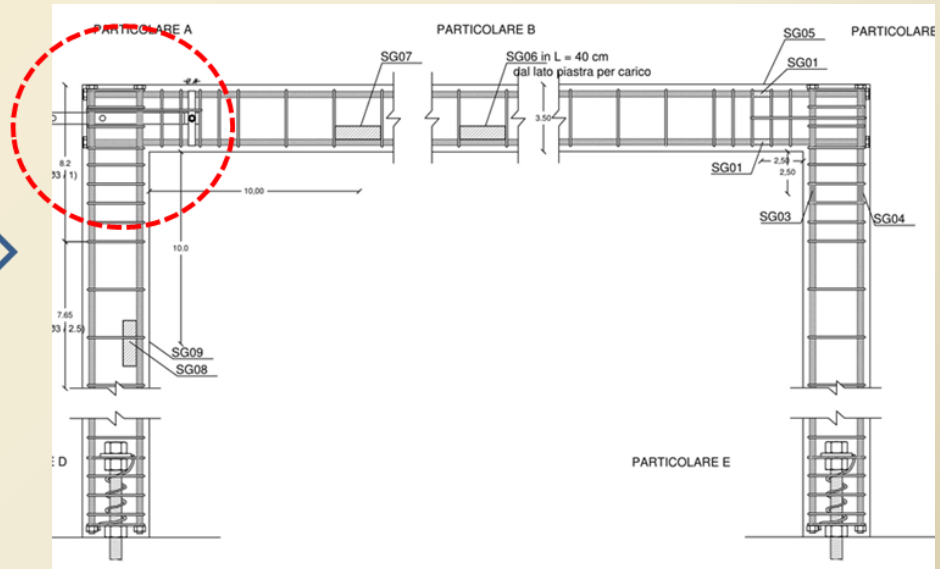
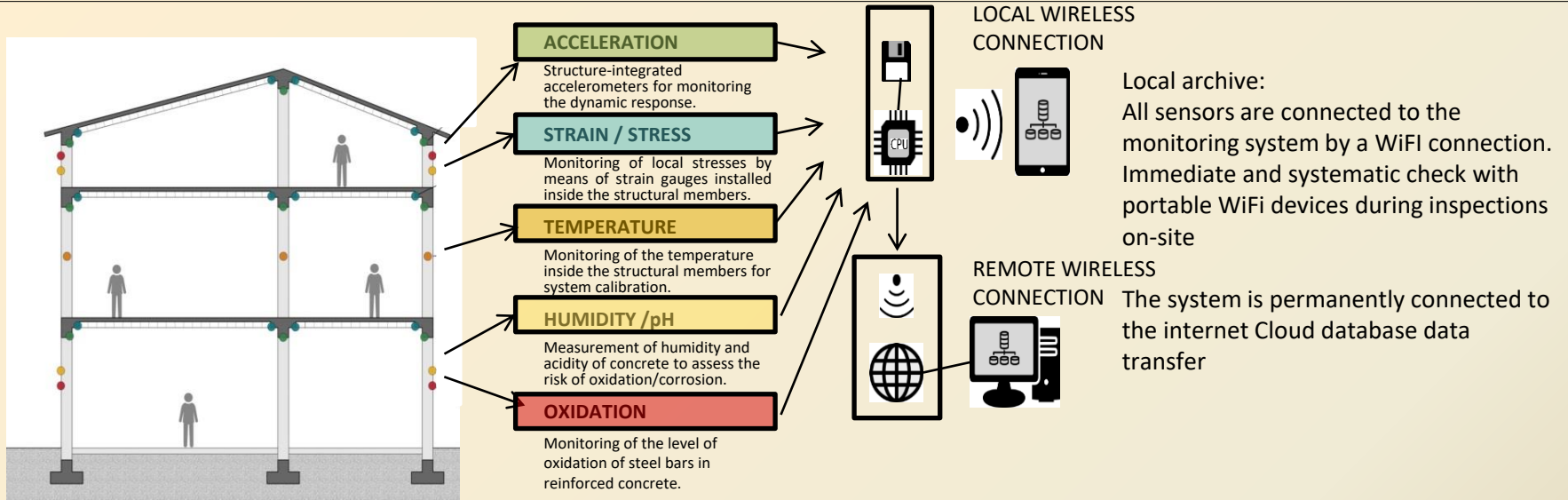


- The IoT approach and platform allows us to access any moment and from every where to the structure, and the structure transfer to us the information collected with sensors
- The control is facilitated. No need to be just on site to know what is happening
- It is possible also to connect the «**Smart Building**» functions;
- It is possible to plan more efficiently maintenance and recover in advance situation that could become worst.

ELECTRONIC MINIATURIZED COMPONENT AVAILABLE AND CHEAP (\$\$)



The buildings' structural safety today is for save money (maintenance, durability, efficiency) and to save life in the extreme environmental or anthropic actions



Permanent monitoring

at critical points of the structure, in order to give a continuous information of the stress level due to the acting loads and of the behaviour of the structure to the external events.



Examples of damage and decay in r.c. structural elements in bridges - RAM Project, Road Asset Management– Main Inspection Handbook (Anas- Italian FS Group)

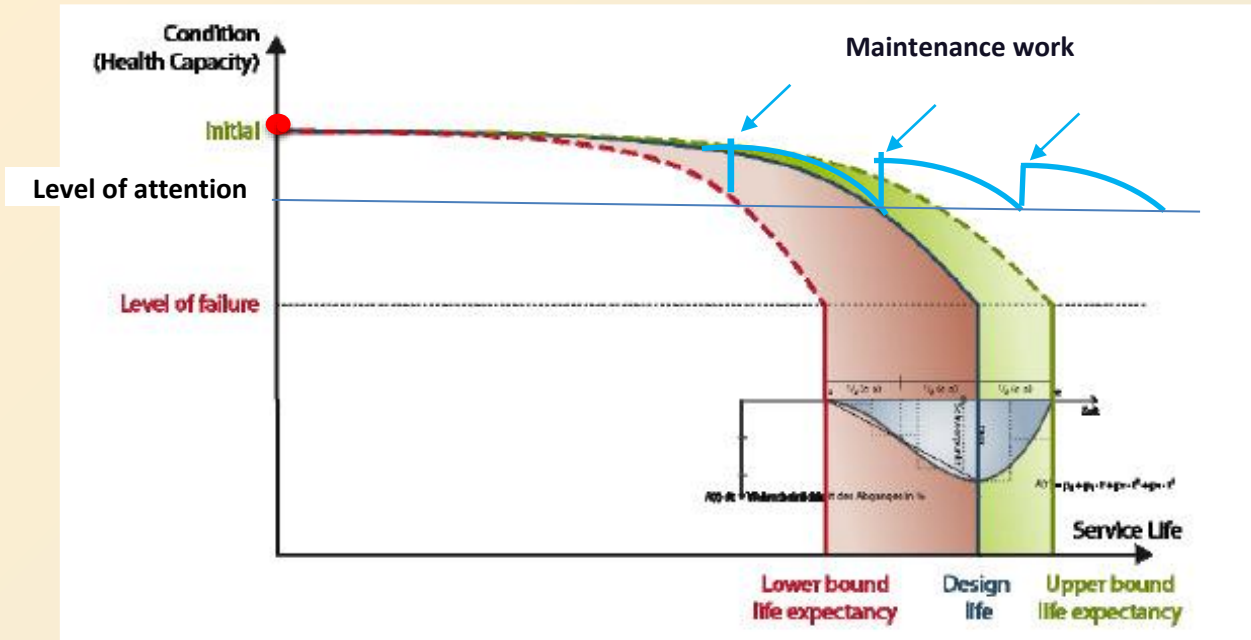


Ura e Bushtricës / Bushtricës Bridge
Albania (A.Lako)



Damage on the Lekli Bridge, Albania

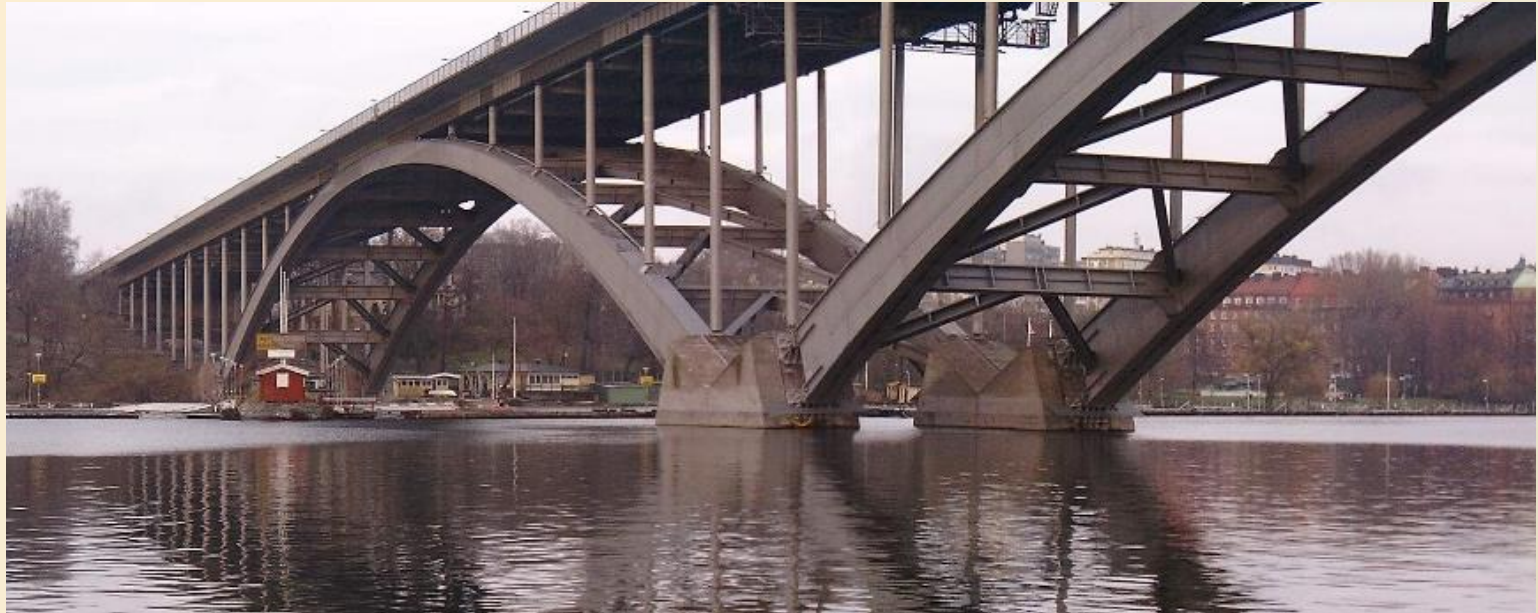
(Study Design of bridges of Lekli, Autoriteti Rrugor Shqiptar, Albanian Road Authority, 2019)



*Typical decay curve for reinforced concrete bridges
(revised from UNI EN 16991:2018)*

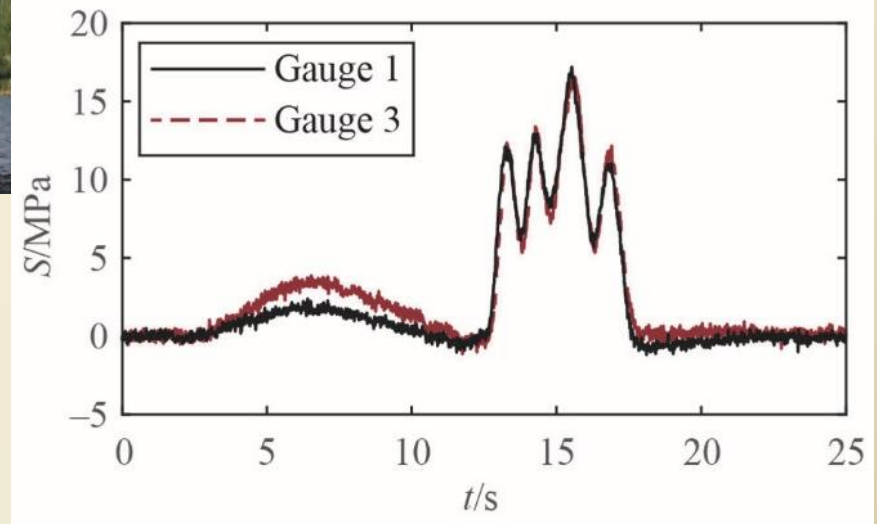


*Available device and application on infrastructure on the IoT platform
(IoT Bridge-AB, Sweden, P. Rosegren,2017)*



The Västerbron bridge, in Stockolm, built on 1935, equipped with IoT devices (IoT Bridge-AB, Sweden, P. Rosegren, 2017)

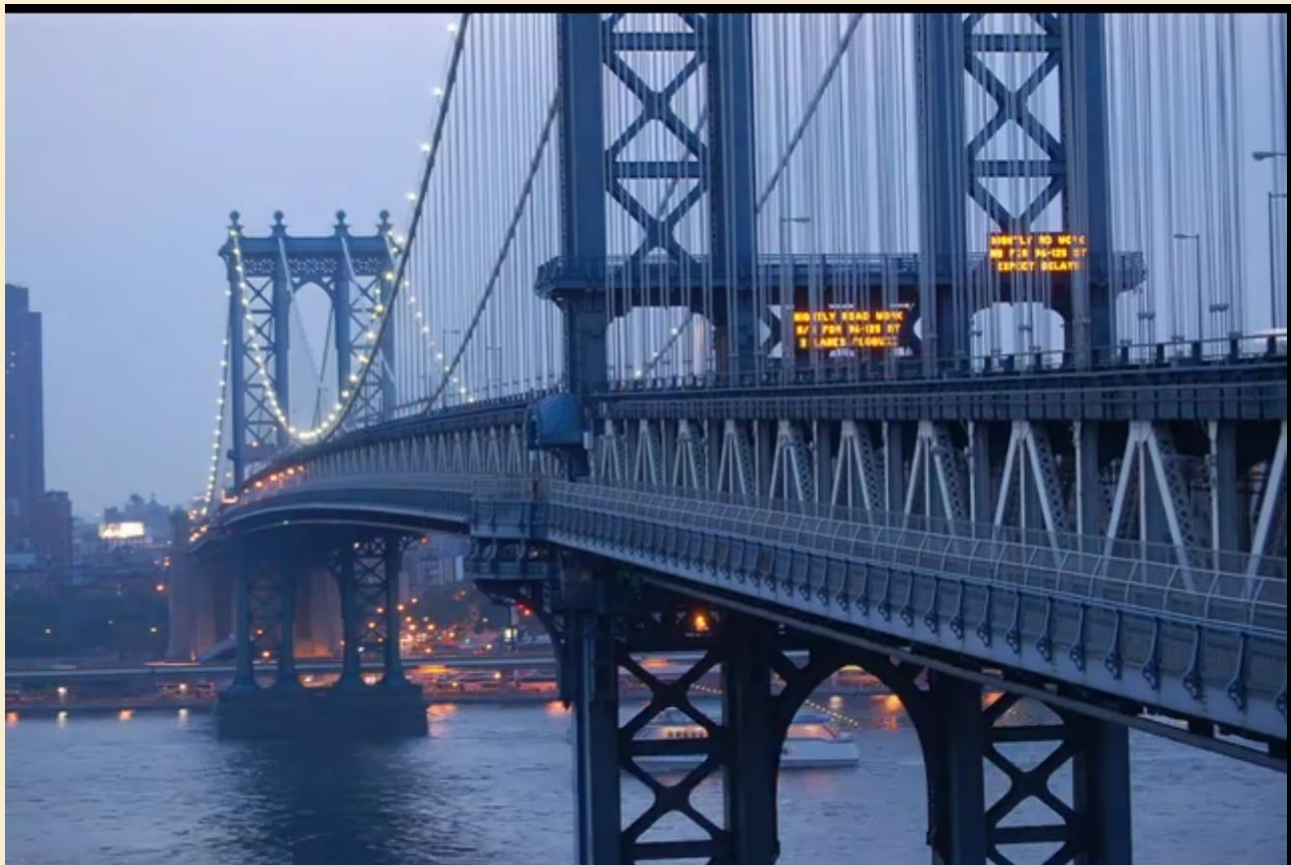
Old Lidingö
Bridge, Stockholm
1925



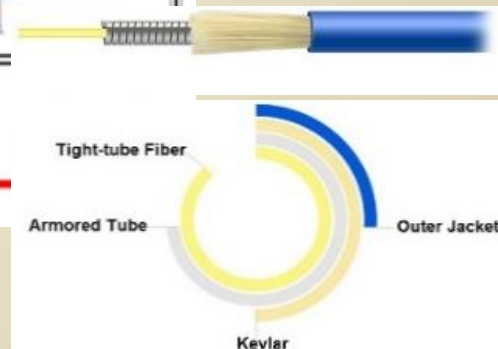
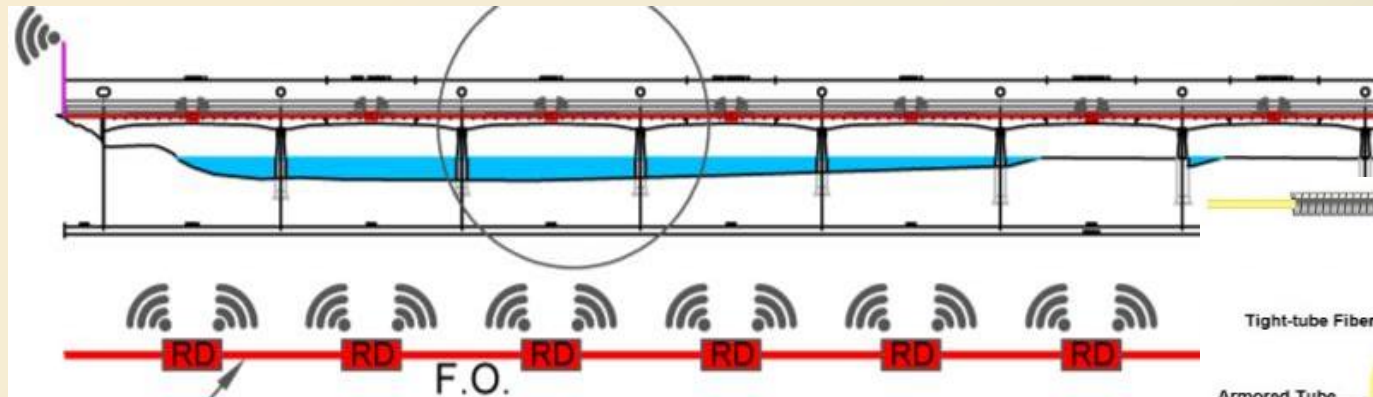
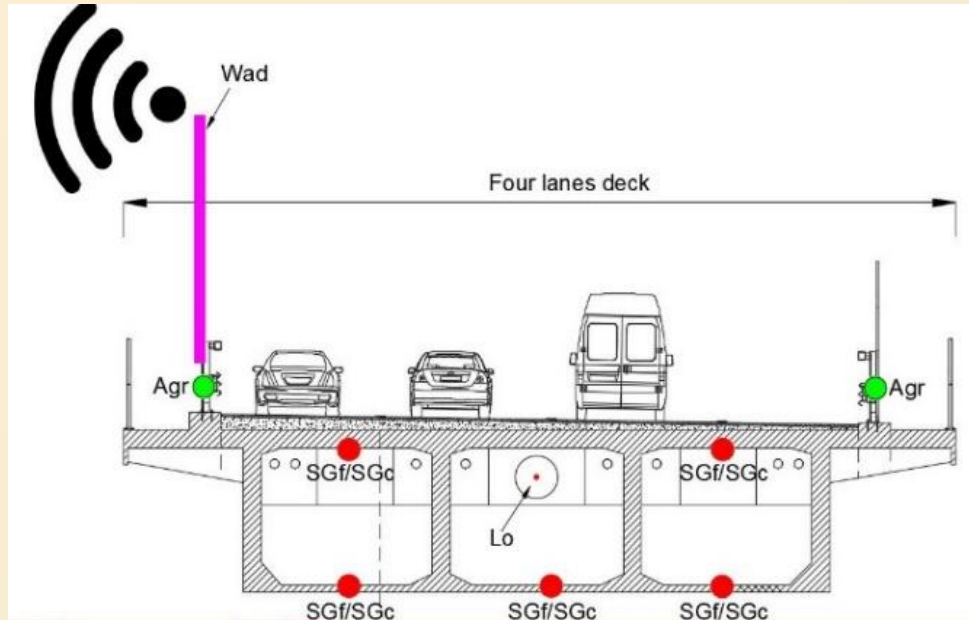
An energy harvester prototype, installed on the Old Lidingö Bridge (Rosengren et al., 2017)

Stress history at the passage of a train on a bridge (Rosengren et al., 2017)

Manhattan Bridge displacement at night under the traffic

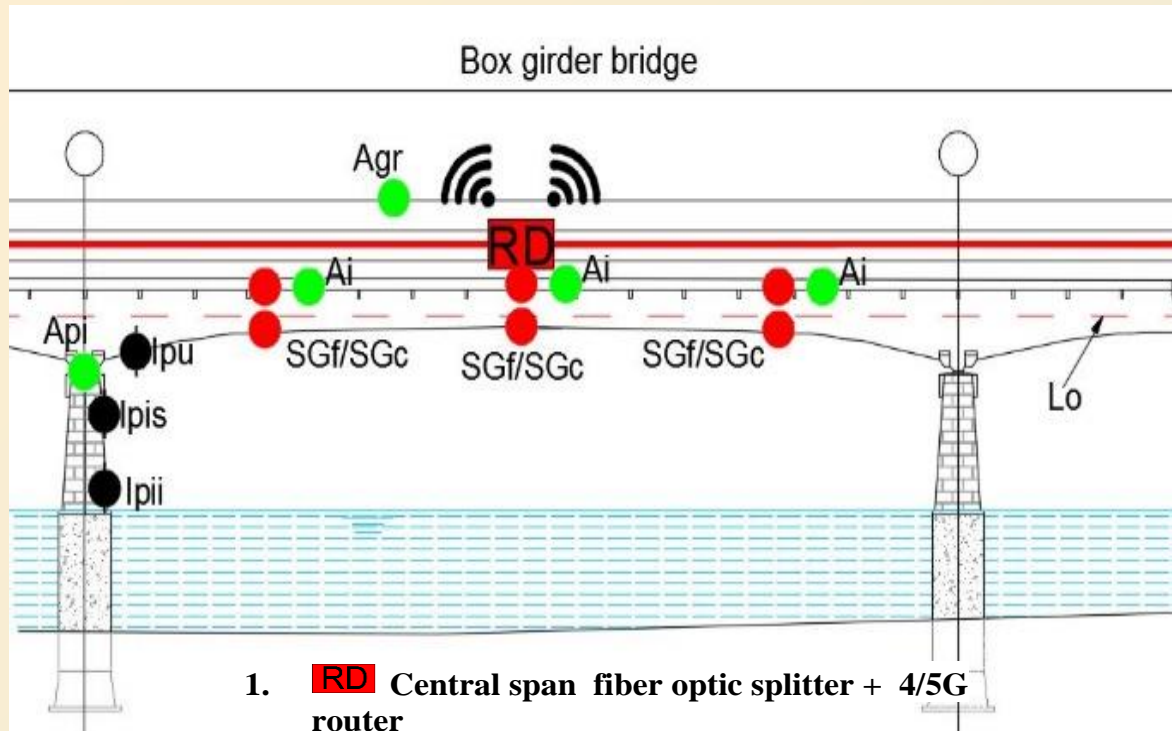


Suggested sensors and location on a multibox bridge



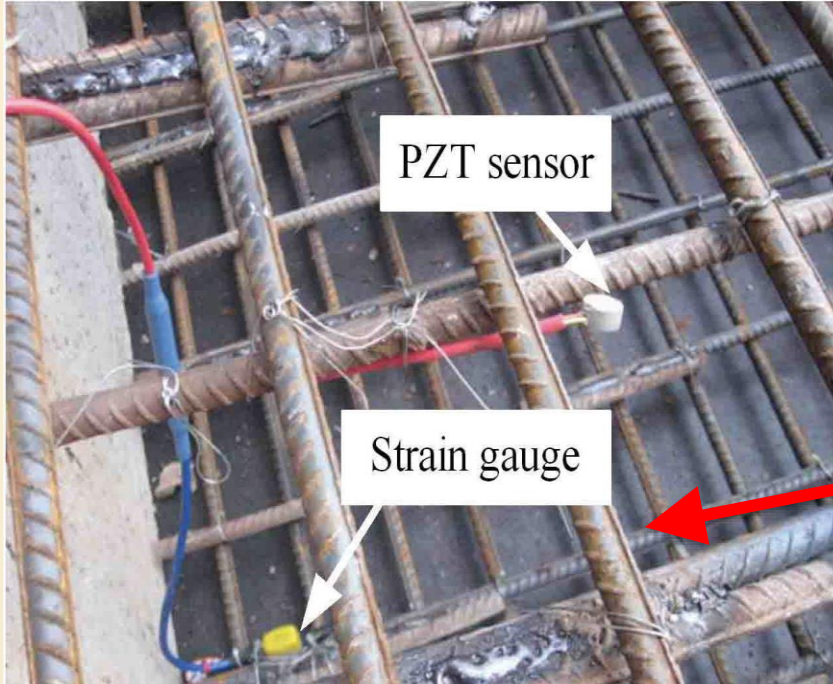
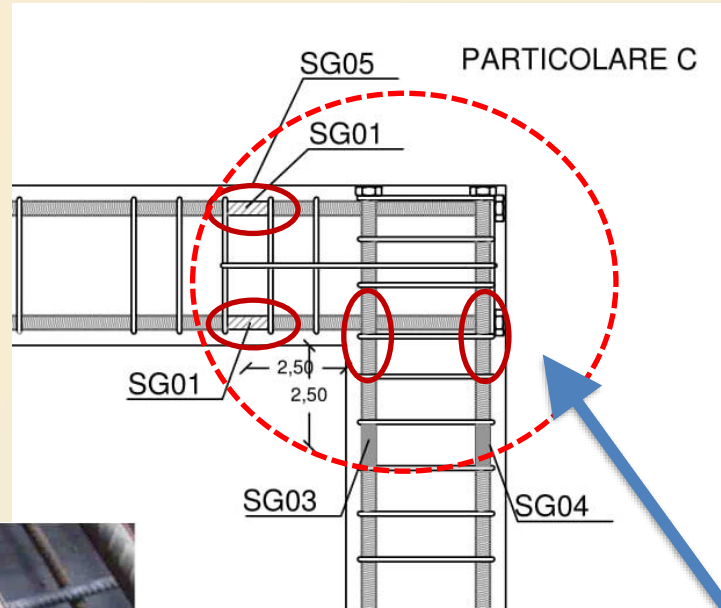
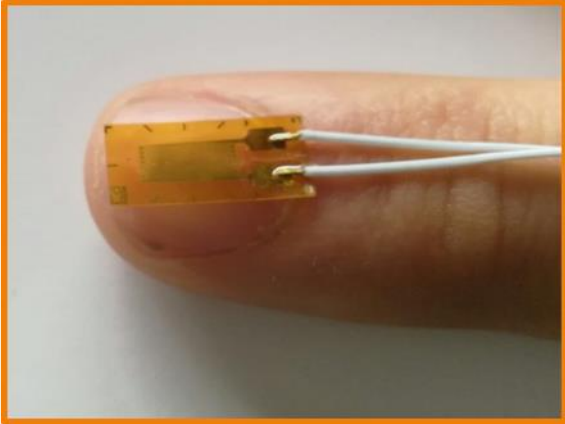
armoured optical fiber backbone
for transmission data

Detail of sensors on the bridge



1. **RD** Central span fiber optic splitter + 4/5G router
2. **●** (SGf/SGc) Strain Gauge – measuring stress in the concrete and in the rebar
3. **●** Ipi/Ipii : Upper/Lower Inclinometer on the abutment/pier
4. **●** Api: Accelerometers on the head of the pier
5. **●** Ai: Accelerometers inside the box girder
6. **●** Agr : Accelerometer on the guard-rail- for impact
7. **---** Lo : Optic laser beam to control the deformation through 6 target/span
8. **Wad** : Wide lan – 1 Gb

PERMANENT **IoT** MONITORING - Realistic - Real time - Affordable - Flexible - Low cost



Embedded sensors

CONCLUSION

IoT technology for Infrastructure Structural Health Monitoring

Advantages:

- to permanently assess the health of the structure through embedded monitoring
- chance to define, design and realize tailored devices suitable for the monitored infrastructure, in order to achieve a lifelong health
- to collect all the results outside of the bridge, in a remote digital storage area, where different Authority can read and elaborate the data
- extremely low cost system, encouraging to use sensors in number never imagined until now
- chance to improve, modify, update the sensors network, according to the needs and the improved quality of the sensors.
- reduced maintenance costs, since the alerts will inform anticipately of some deficiency in progress.

Disadvantages:

- to equip the system with a reliable BMS – Bridge Management System, it means a good software, probably including AI approach, able to manage the BIG DATA
- risk that the “infrastructure health control” will be given in the hand of computer science experts or just road managers, who, remotely, believe to control everything just trusting the AI of the Bridge Management System, but without engineering judgement.



To control the BRIDGE as we control our car

SMART STRUCTURES -> SAFE STRUCTURES

!! Faleminderit !!

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