B[UILD] SMART!

comfort, sicurezza, sostenibilità, innovazione

Maria Cruz Alonso

MISURARE E «MONITORARE» LA DURABILITA:

Predictive monitoring systems for rebar corrosion assesment in aggressive environments

DURABILITY IN THE SERVICE LIFE OF THE STRUCTURES

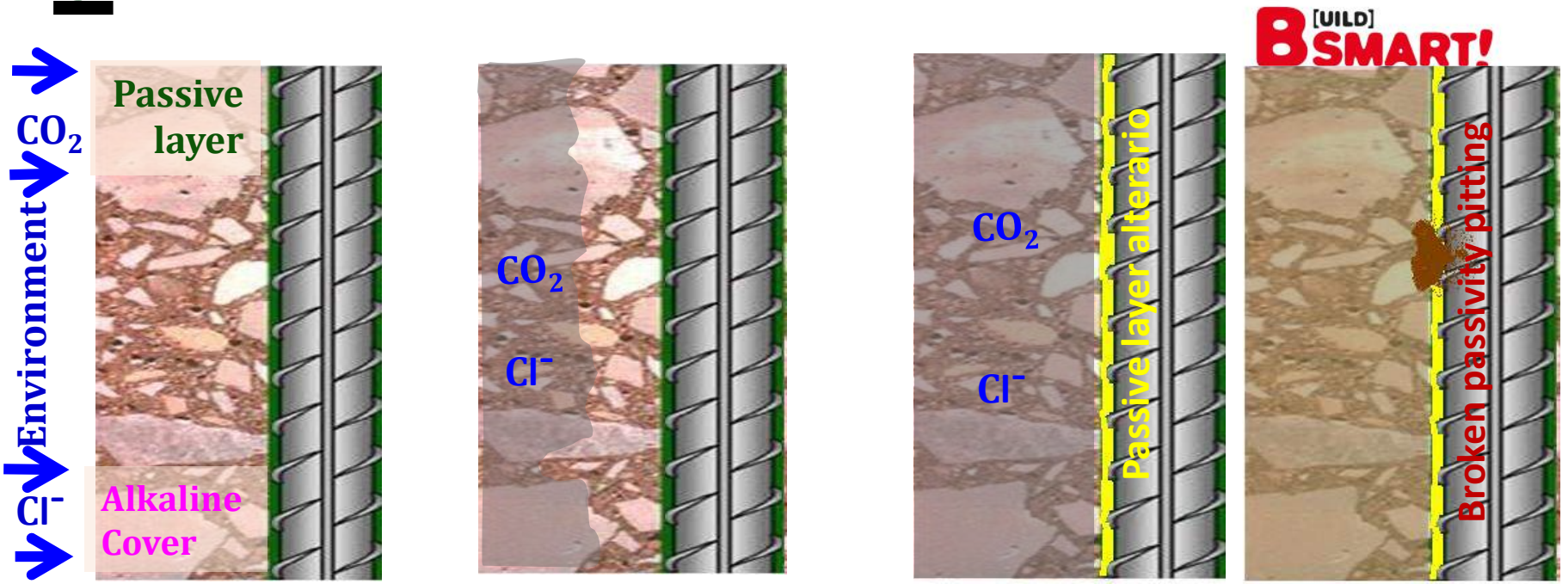
- **What are the aims for the service life of a structure?**
  - *Identification of the exposure site aggressiveness (Std. classification)*
  - *Recommendations from codes & standard for durability design*
  - *Identification of damage expectances*
  - *Service life estimation length at project design*

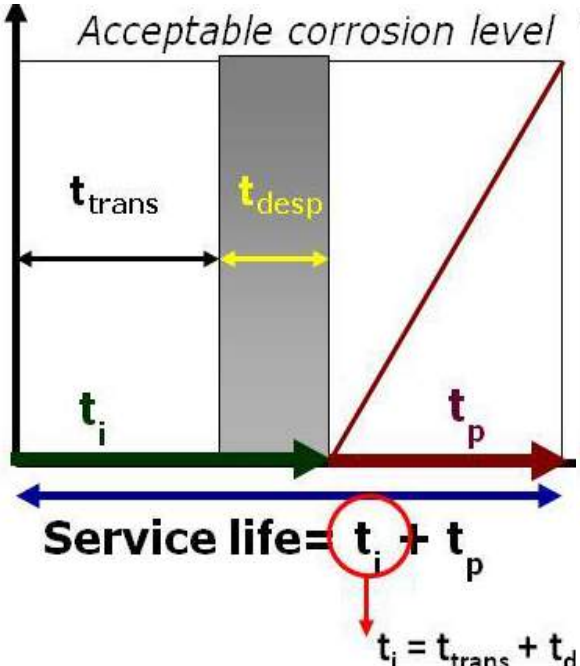
- **When a structure should be monitored?**
  - *Who takes the decision*
  - *Additional monitoring measures during the service life*

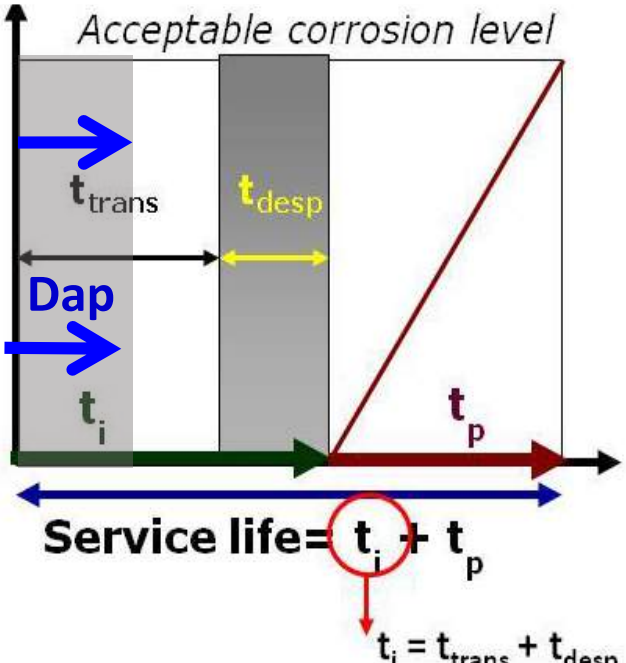
- **How to select the most suitable monitoring system?**
  - *Location of the structure and structure typology*
  - *Monitoring length and time scale*
  - *Durability of structure vs. durability of the monitoring system*

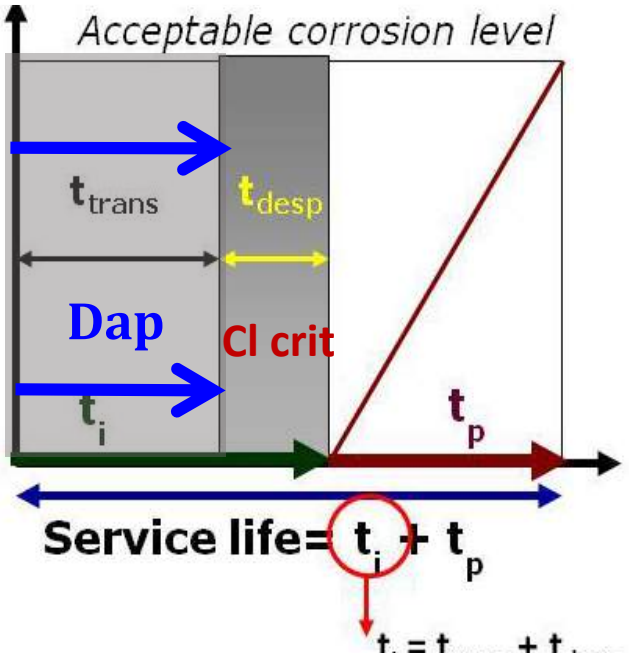
- **What expectances of the owner from monitoring system?**

Why rebar corrosion is a risk in service life of structures?



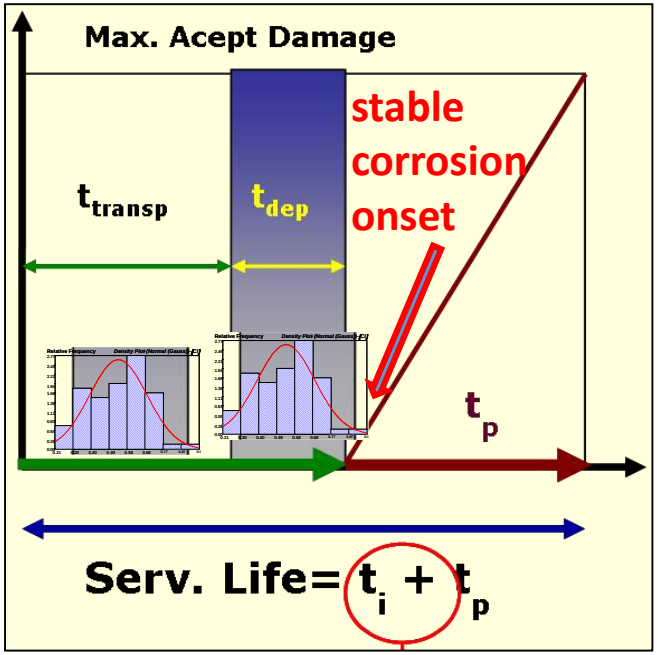






Parameters to monitor service life of concrete structures

CHANGES IN CONCRETE AND REBAR OCCUR DUE TO AGGRESSIVES ENTRANCE



CONCRETE MONITORING

- Electrical resistivity
- pH changes
- Cl content

REBAR MONITORING

- Corrosion potential
- Corrosion rate

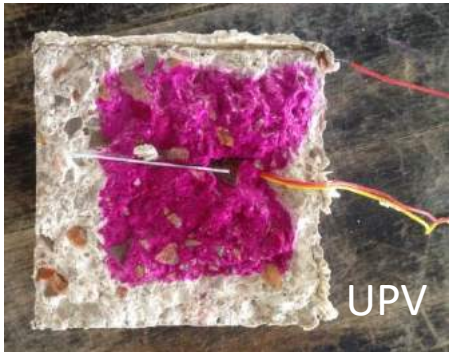
Initiation period ends with corrosion onset: $t_i = t_{transp} + t_{dep}$

- Monitoring with **surface** electrodes → **Periodic** measurements
- Monitoring with **embedded** electrodes → Periodic vs. **continuous** (remote)

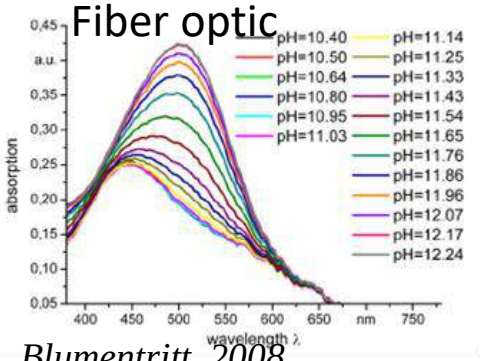
Sensor durability

Concrete monitoring of durability through embedded sensors

pH change

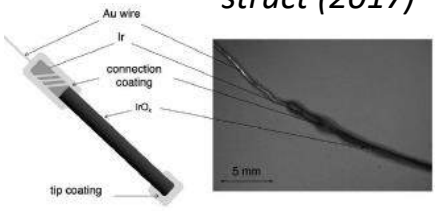


Fiber optic

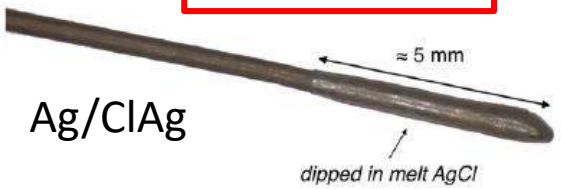


Blumentritt, 2008

Segui Y. et al, mat & struct (2017)



Cl content



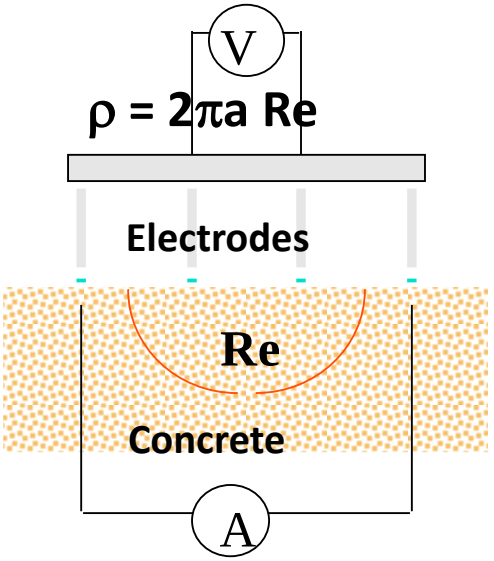
Segui Y. et al, mat & struct (2016)

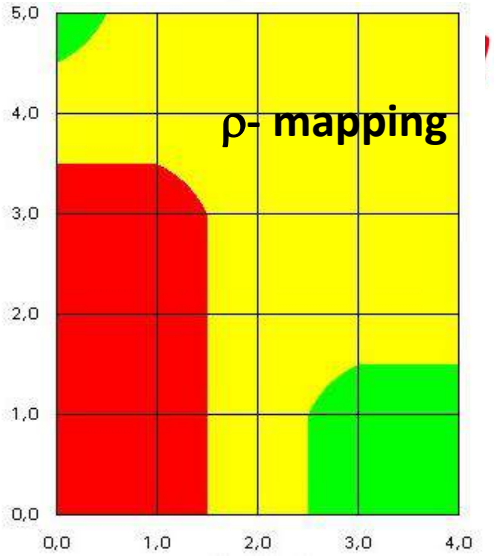
Electrical resistivity

SMARTBOX
(Giatec)

- Advantages : *Possibility of periodic or continuous monitoring.*
- Limitations: *Need to know the life expectances of the sensor respect the service life of the structure, pH and Cl sensors lack of market availability*

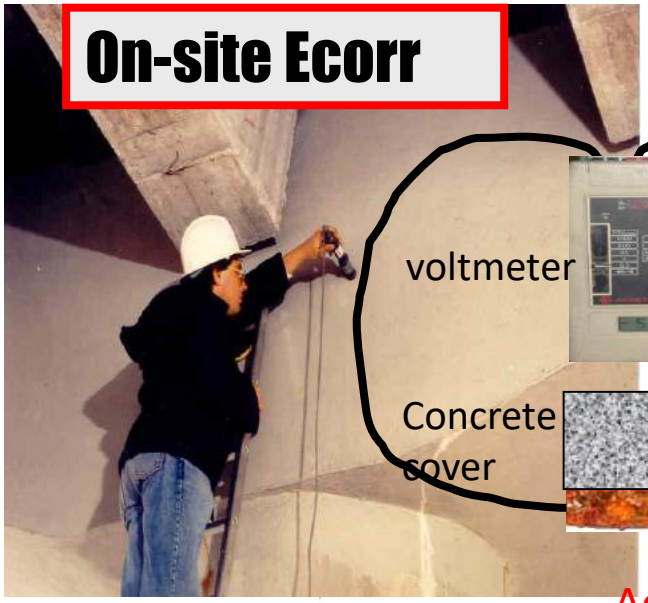
Concrete monitoring from surface sensors / Periodic



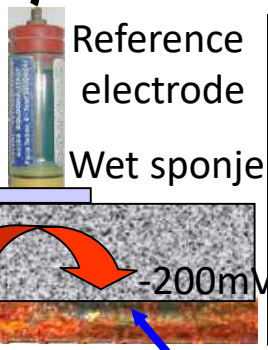


Commercial equipment available

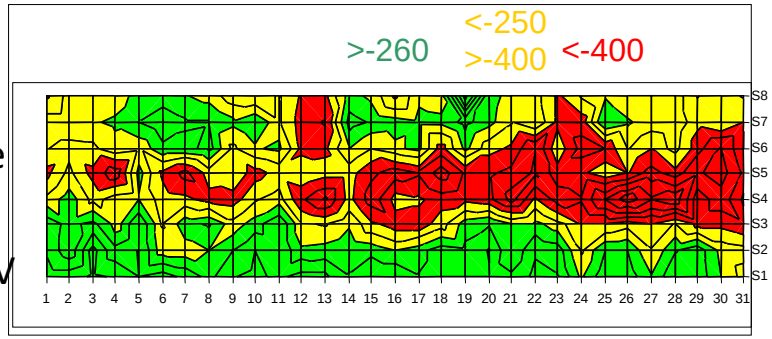
Rebar corrosion assessment with surface sensors/ Periodic



Direct connection of the rebar



Ecorr- mapping

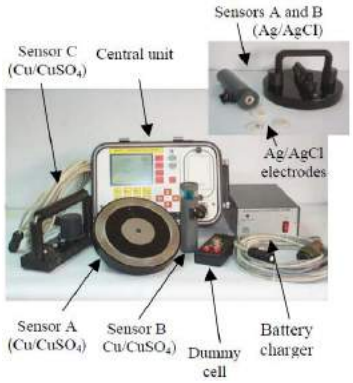


CSIC
Consejo Superior de Investigaciones Científicas

Rebar corrosion assessment from surface sensors / Periodic

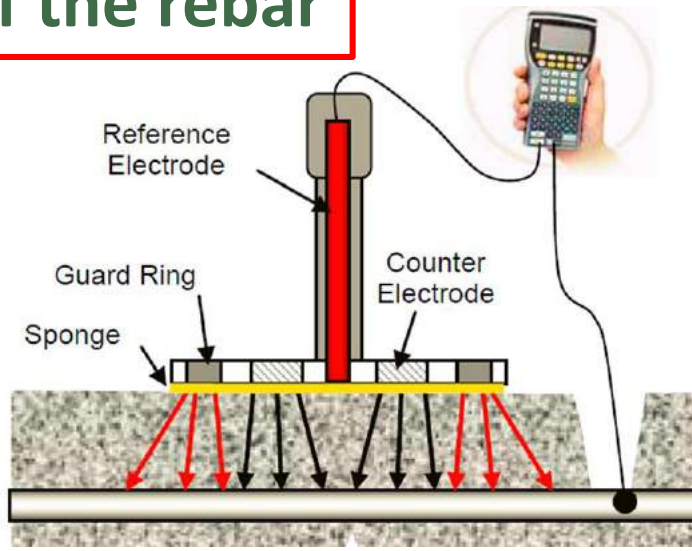
Ecorr/icor/ρ

Direct connection of the rebar

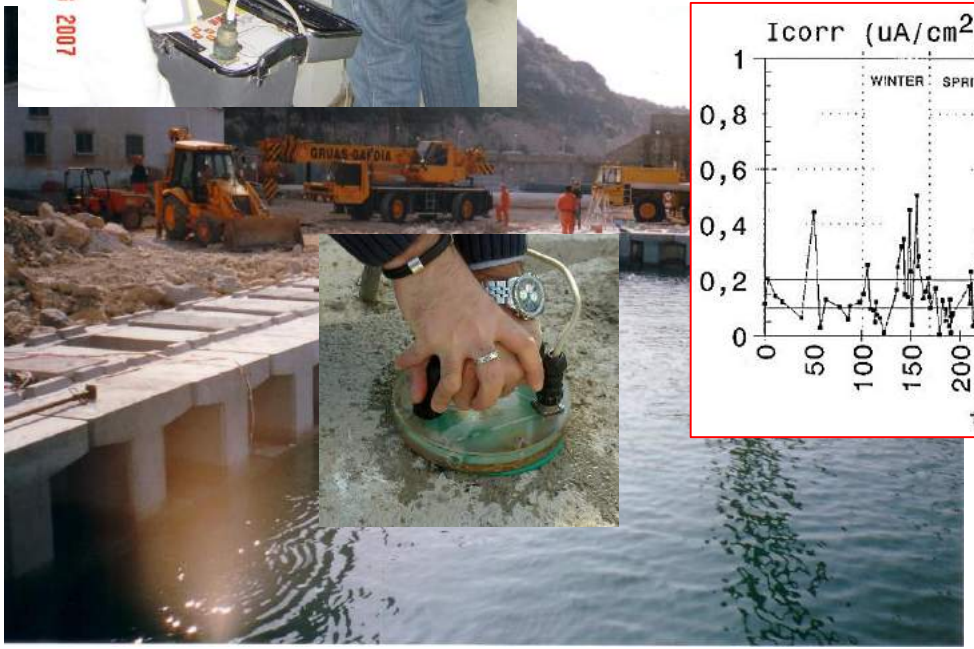


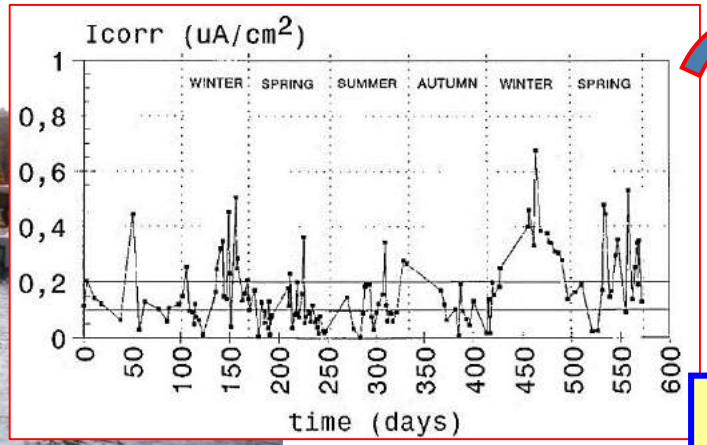
GCOR-8 (Geocisa)

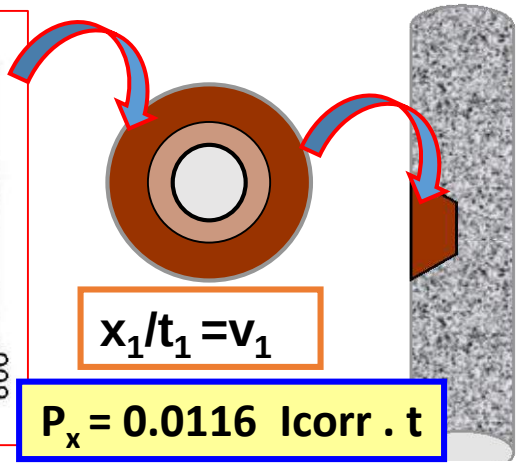
Commercial equipment available



GALVAPULSE (German instruments)







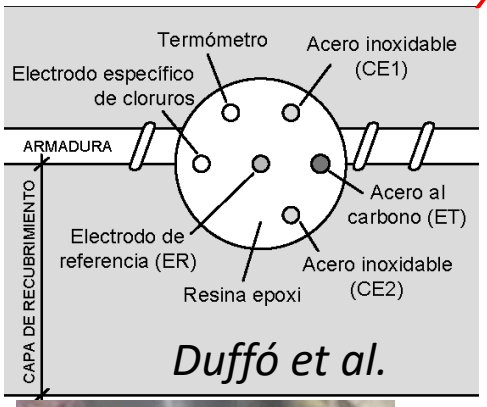
Cross section or radio loss (P_X = attack penetration) per unit of time (t) & unit of total Surface ($2\pi rL$)

Rebar corrosion assessment from embedded sensors /Continuous

Direct on the rebar

Multisensors

No market availability



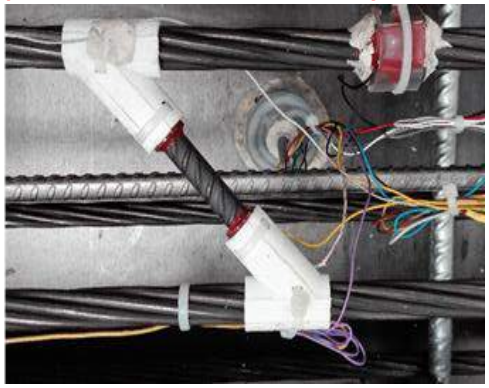
Duffó et al.

Electronic Tongue

INESSCOM (UPV)

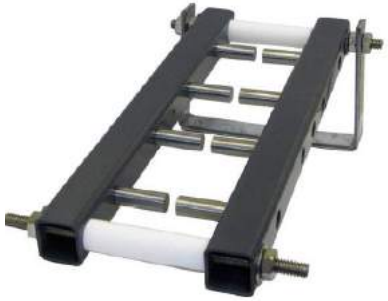
Icorr on embedded probes

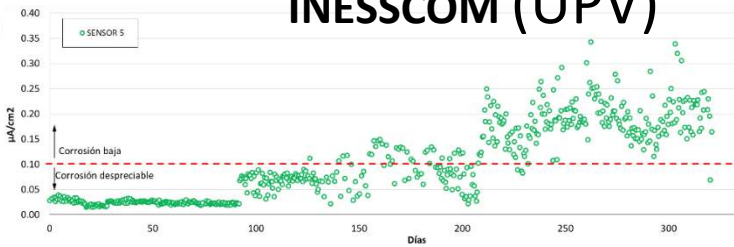
Commercial equipment availability



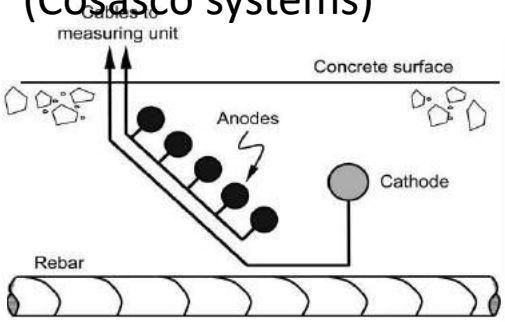
CORROSOMETER 650c
(Cosasco systems)

INESSCOM (UPV)

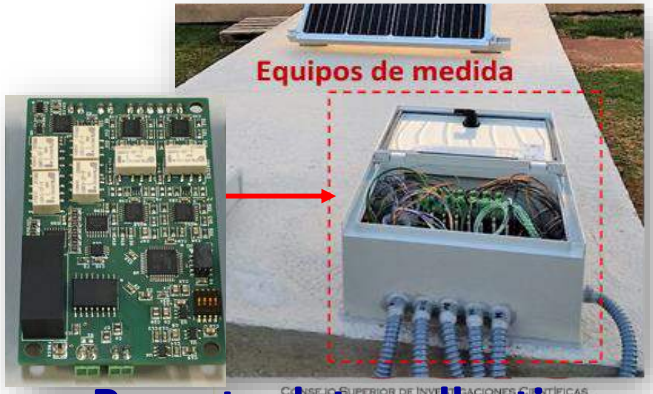




CONCRETE MULTI-DEPTH
(Cosasco systems)



Galvanic sensor



Remote data collection

- **What expectances of the owner from monitoring?**
  - Reassesment of service life prediction respect to design
  - Identification of damage, location severity
  - Identification of optimal time for maintenance measures
  - Take corrective measures in structure and in monitoring system

  - Need of multidisciplinary analyses of performance:
    - *Rebar corrosion especialisation*
    - *Structural background performance*
    - *Electronic and data base management*

B[UILD] SMART!

Padiglione 4
B[UILD] SMART! INVOLUCRO

Padiglione 10
B[UILD] SMART! COSTRUZIONI

GRAZIE PER L'ATTENZIONE

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MADE EXPO

agorà