



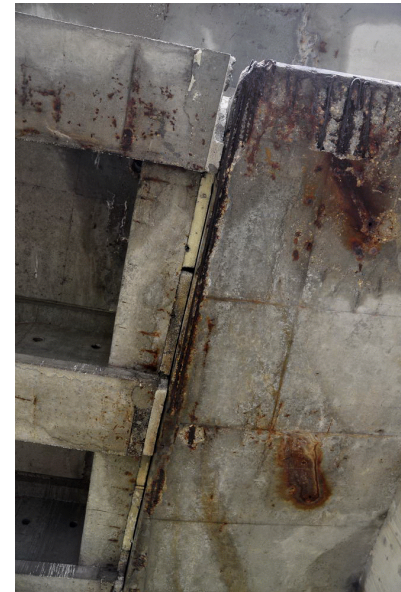
Cathodic Protection for extending the life of concrete bridges

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- **Corrosion of reinforcement due to chloride (de-icing, sea) → serviceability, ...safety**
- **Intervention options**
 - *Do nothing*
 - *(Conventional) Repair*
 - *quick&dirty (short life!)*
 - *full, thorough*
 - *Cathodic Protection, CP (repair)*
 - *Replace structure (element)*







Slovenia

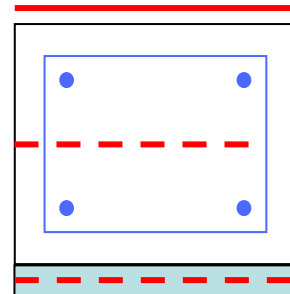
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- *Stops corrosion (electrochemical process)*
- *Needs low V DC power, "anode" material on surface, circuit (cables, steel, concrete)*
- *Test proves corrosion absent, 2 – 4 / year*
- *Life (NL ~125) 90% > 13 y; titanium > 25 y*
- *Costs less over total bridge life..*
- *Causes lower out-of-service time..*
- *..than conventional repair*

- **Check safety (CP \neq structural)**
- **Locate corrosion & damage**
- **Check continuity (steel, concrete)**
- **Choose anode location & material**
- **If critical: model performance**

- **conductive coating**
- **titanium mesh,
strip, shotcrete**



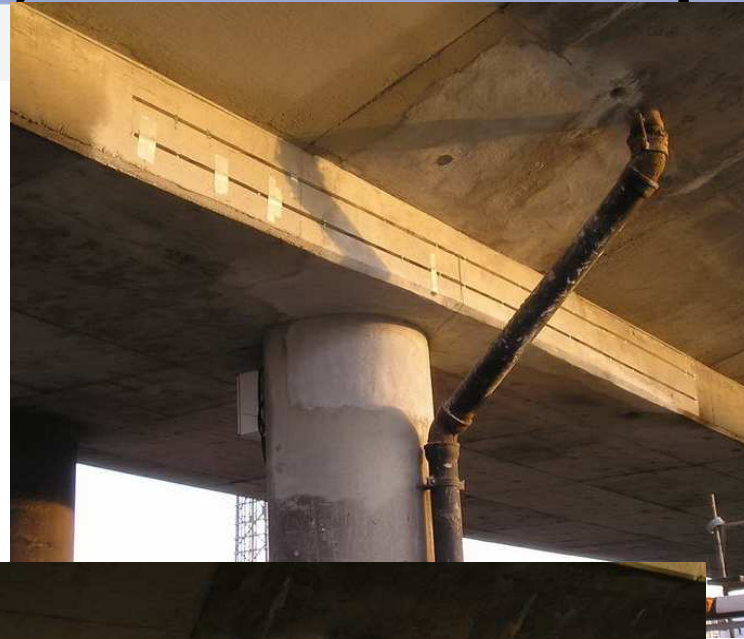
Prepared surface, titanium mesh, shotcrete

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CP trial Poland, titanium strip

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HRL



ARCHES

CERTAIN

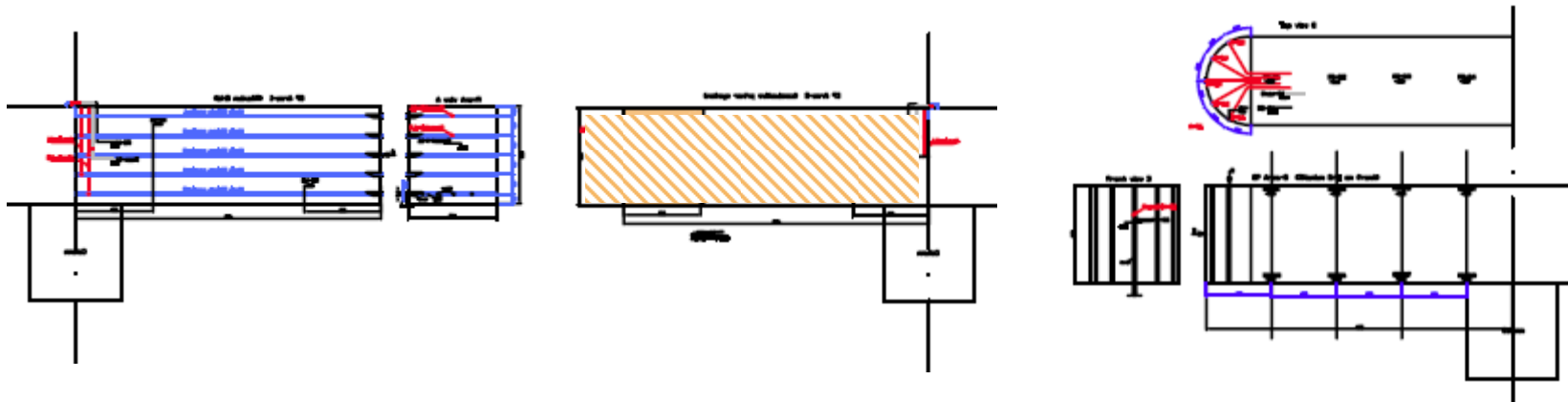
CP trial Slovenia



**Repair work
(quick & dirty = OK!)**

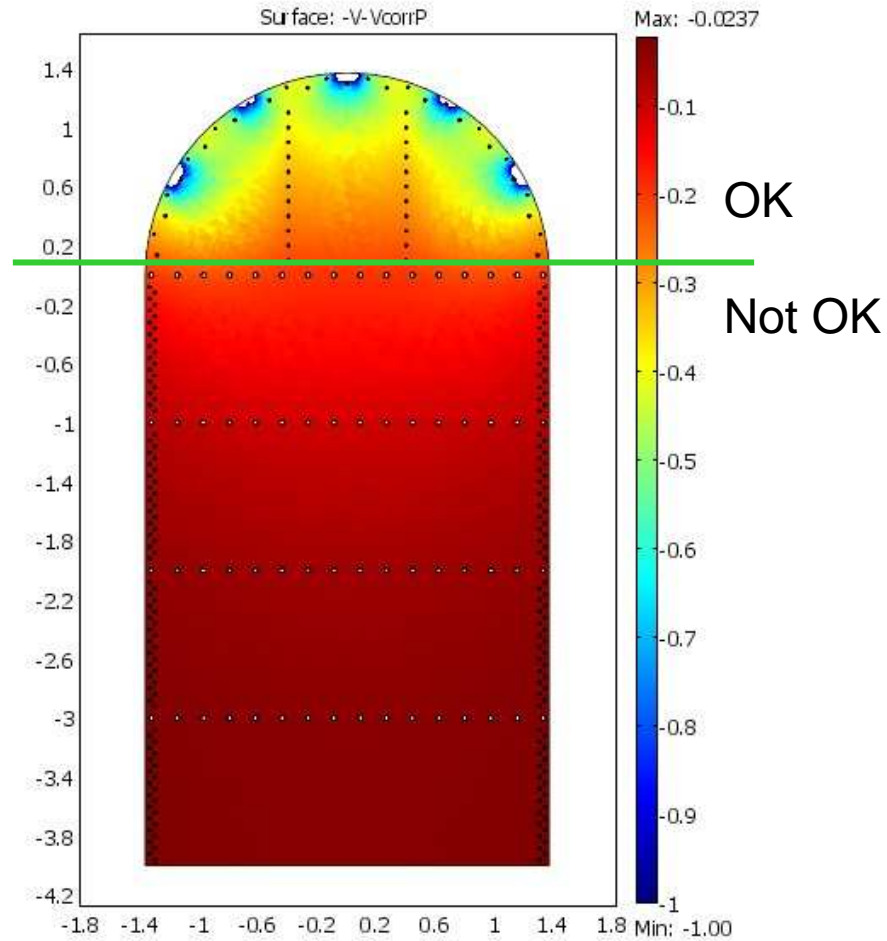
CP trial SLO, 3 test areas

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- *test different anode materials & configurations*
- *check with FE modelling*

- *Geometry, steel*
- *Parameters*
- *2-D model*
- *Voltage, resistivity*
- *Output I,E (x,y)*
- *Agreement OK*



Life cycle cost

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- **CP trial SLO (150 m²)**
- **Input**
 - full repair 540 €/m²
 - CP 405 €/m² + engineering 16 k€ + 1000 €/year
- **Output: CP saves 7000 € until year 13**
- **CP, Repair: maintenance after 13 years?**
- **Probability of failure: CP 10%; repair >50%?**

Conclusions

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RCHES

FEHRL

- ***CP proven technique: corrosion is stopped***
- ***More effective than conventional repair***
- ***Prolongs lifetime of repair works***
- ***Lifetime > 10 .. 25+ year***
- ***Flexible design & materials and components***
- ***Modelling beneficial in critical (slender) cases***


SPENS


RCHES

 CERTAIN

- ***Advantages of CP***
- ***Less demolition (out-of-traffic, waste)***
- ***Reliable & safe***
- ***Lower maintenance costs***
 - ***cheaper than replacement***
 - ***more durable than conventional repair***
- ***See ARCHES Guideline (soon)***