Dr John P. Broomfield
EurIng CEng, CSci, FICorr, FIM³, FNACE, FCS

Consulting Corrosion Engineer
Specialist in the Corrosion of Steel in Concrete Structures

30B Vine Road, East Molesey,
Surrey KT8 9HN, UK

Tel    +44 (0)20 8941 6696
Fax    +44 (0)20 8941 6696
Mob.   +44 (0)7711 006 197
JohnPBroomfield@aol.com
Ratio of Volumes of Iron to Iron Oxide

- Fe(OH)$_3$.3H$_2$O
- Fe(OH)$_3$
- Fe(OH)$_2$
- Fe$_2$O$_3$
- Fe$_3$O$_4$
- FeO
- Fe
The Corrosion Reactions For Steel in Concrete

Fe → Fe^{2+} + 2e^{-}

1/2O_2 + H_2O + 2e^{-} → 2OH^{-}

Fe^{2+} + 2OH^{-} → Fe(OH)_2  Ferrous Hydroxide

4Fe(OH)_2 + O_2 + 2H_2O → 4Fe(OH)_3  Ferric Hydroxide

2Fe(OH)_3 → Fe_2O_3.H_2O + 2H_2O  Hydrated Ferric Oxide
The Formation of Incipient Anodes after Patch Repairing

**B E F O R E**

- Concrete
- Cathode
- Anode

**A F T E R**

- Concrete
- Patch
- Anode
- Cathode

Corrosion at +ve Anode “Anode” is made non-corroding -ve cathode
Corrosion under failed waterproofing >0.5mm/year
Application to historic listed college campus buildings

- Reinforced concrete building façades
  - Carbonation
  - Some cast in
    CaCl$_2$ accelerator
- Elevated walkways and bridges
  - Carbonation
  - Deicing salt ingress
ICCP Applied To Biotower 2003
How Not To Maintain Your Car Park
1993 Car Park Collapse
Syracuse NY