

21 Years Composite Anode System for the Economic, Reliable Cathodic & Sustainable Corrosion Protection of Steel in Concrete

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COMPOSITE - ANODE - SYSTEMS GMBH

00 Content

01 Composite Conductive Coating

02 Sustainable Concrete Repairs

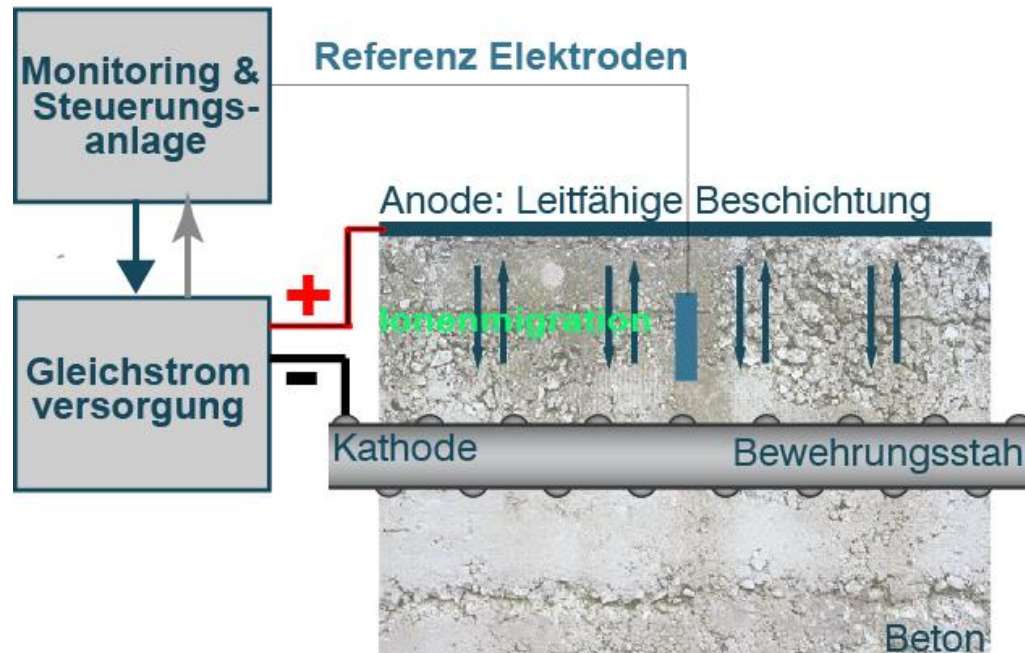
03 Selected Projects

04 CAST³⁺ Application Example

01 Conductive Coatings for CP

01.1 Principle

SCHEMATIC REPRESENTATION

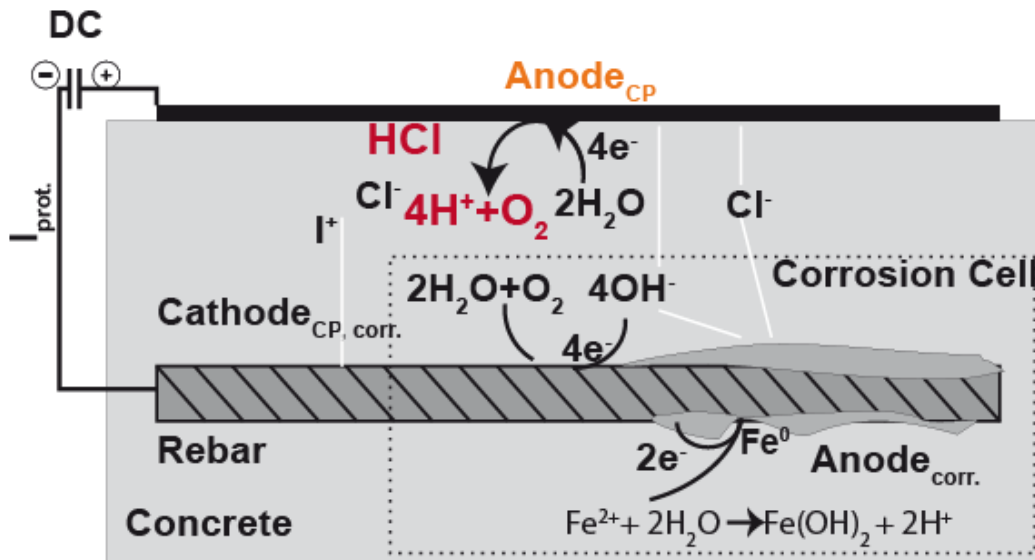


Conductive Coatings as Anodes for the Cathodic Protection of Steel in Concrete

Approved technology according to EN 12696

Resistivity to Anodic Reactions

- Oxidation
- Formation of Acids (HCl)



Requirements for the Application as Anodes for CP of Steel in Concrete

- Compatible with concrete
- Minimum layer thickness 250 μm
- High weathering resistance
- Resilient to anodic oxidation
- Prevention of acidification of the interface anode/concrete

01 Conductive Coatings for CP

01.3 Composite Anode System

CAS Composite Anode since 1998

CAST³⁺ & CAP 60 since 2011

- CAST³⁺ 2 component alumo-silicate & natural graphite based conductive aqueous paint
- May be applied by roller or airless spray
- $750 \text{ g} \pm 100 \text{ g/m}^2$
- 28 d adhesion strength 2 MPa – 4 MPa depending on concrete quality

CAS COMPOSITE-ANODE-SYSTEM
TECHNICAL DATA SHEETS
CAST³⁺ AND CAP 60



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01 Conductive Coatings for CP

01.3 Composite Anode System

CAS Composite Anode since 1998

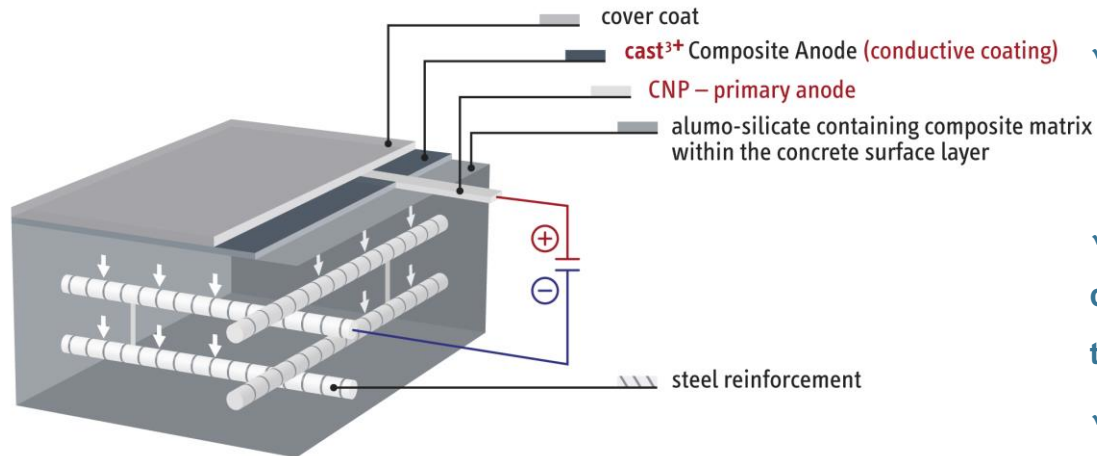
Weathering Resistance

- ✓ - resistant to humidity/penetrative moisture since 2011
- ✓ - resistant to frost/thaw cycles
- ✓ - resistant to frost/thaw salt since 2011
- ✓ - resistant to UV radiation

Resistance to Anodic Reactions

- ✓ - resistant to acidification: the micro-capillary matrix soaks up alkaline pore solution towards coating/concrete interface
- ✓ - Matrix resistant against oxidation
- ✓ - Natural graphite pigment resistant against anodic oxidation: proved by AIF-project conducted by RWTH Aachen/BAM Berlin 2012-2015

The cast³⁺ Composite Anode System



Required Installation Works – 1000 m²

- **Concrete Preparation:** Sandblasting or water jetting (500 – 800 bars), concrete repairs limited to spalled, cracked concrete, correction of concrete cover (minimum 1 cm).

about 2 weeks

- **Installation of Control Sensors:**

Reference cells, macro cell sensors,
electric connections to the steel reinforcement

about 1 week

- **Installation of the Composite Anode:**

- 4 concrete paints or 2 applications by airless spray (composite anode/cover coat), Primary Anode

about 1,5 weeks

- **Electroinstallation:** cables, distributor boxes, control units

max. 1,5 Wochen

SUSTAINABLE REPAIR AND MAINTENANCE OF CONCRETE STRUCTURES

- I. **Limited Obstruction of Traffic**
- II. **Low Demand in Materials**
- III. **Minimum Load of Waste Materials**
- IV. **Minimum Requirement for transport traffic to and from the site**

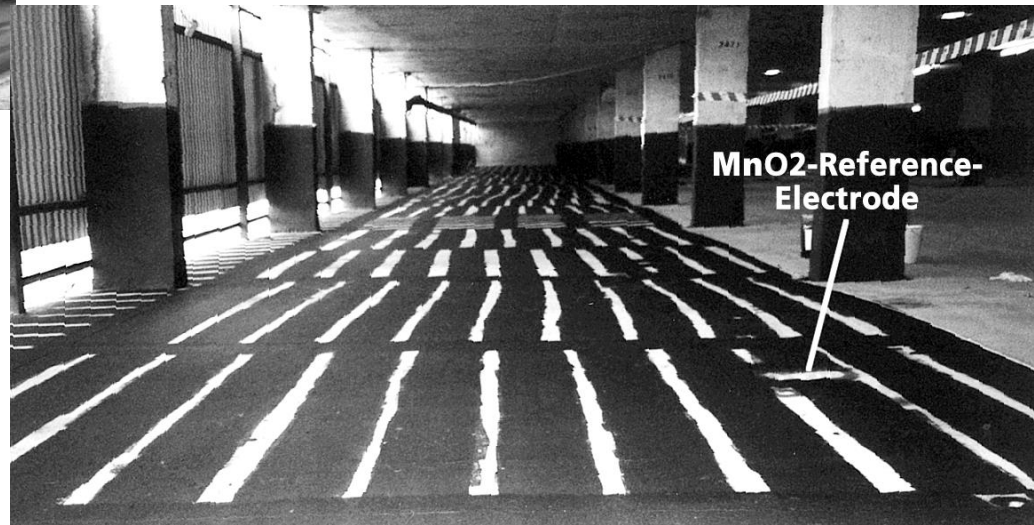
03 Composite Anode Applications

03.1 Parking Deck 1998



1st application of the composite anode system on a parking deck in Hagenstua/OSLO 1998

Composite Anode applied on the parking deck and columns – total surface 2500 m²



MnO₂-Reference-Electrode

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03 Composite Anode Applications

03.2 Highway Bridge in Carinthia/Austria

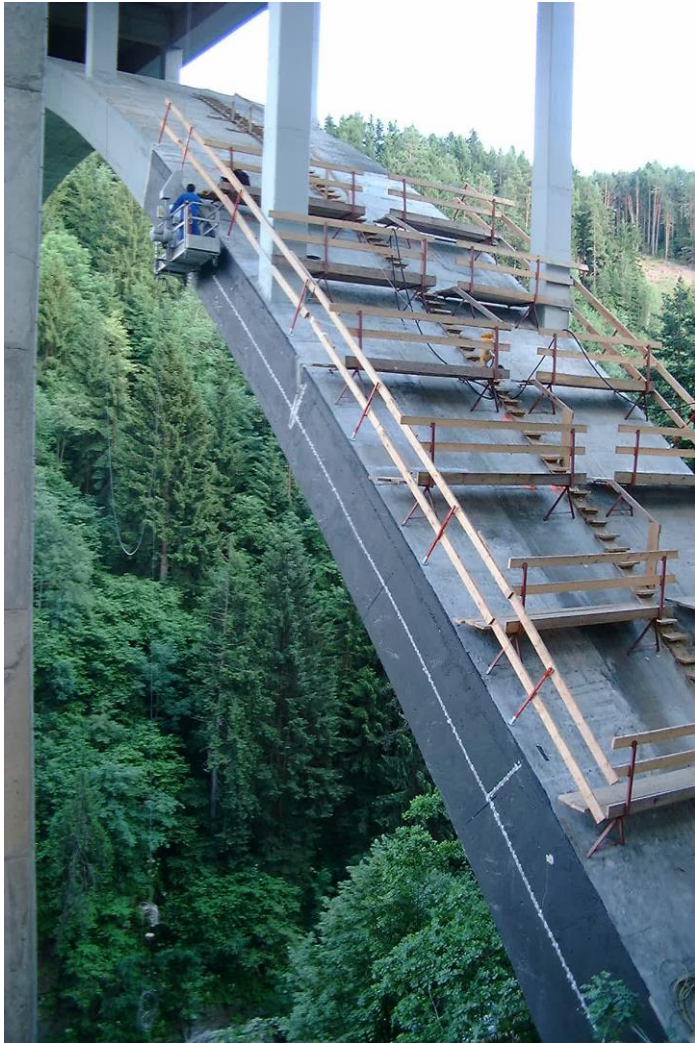
Application of the Composite Anode System on:

- bridge arches,
 - Bridge columns
 - Bridge deck cantilevers
-
- Project realized 1999 - 2001



03 Composite Anode Applications

03.2 Highway Bridge in Carinthia/Austria



Application:

- Concrete Preparation: water-jetting at 800 bars
- short circuit control
- 2 layers of CAS-T
- embedded Cu/Nb/Pt-primary anodes
- Cover Coat: Sikagard 670W Color

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03 Composite Anode Applications

03.2 Highway Bridge in Carinthia/Austria

COLUMNS 2000 - 2001



CANTILEVERS 2000 - 2001



03 Composite Anode Applications

03.3 Highway Bridge Uttrichshausen/Germany

Feasability Study

**Corrosion Protection of the
Outside Steel Reinforcement by CP Applied
at the Inside Walls of the Box Girder**

**Project Management: Frank Dumat,
Construction Materials Testing Institute,
Road & Highway Administration, Kassel,
Hessen, Germany**

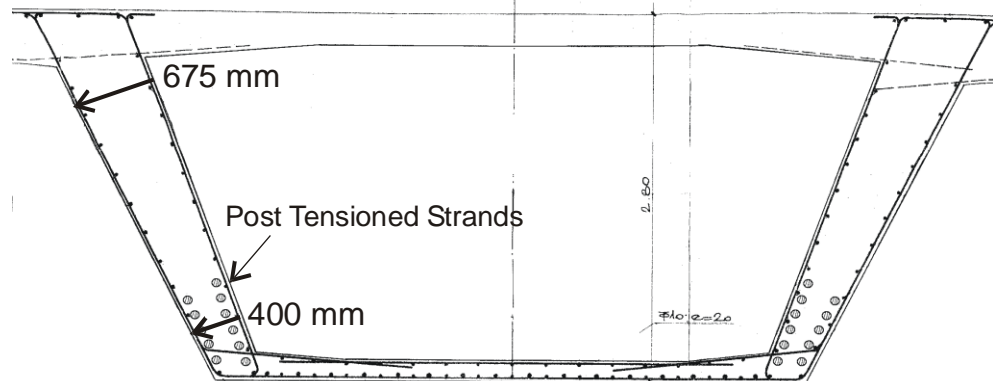
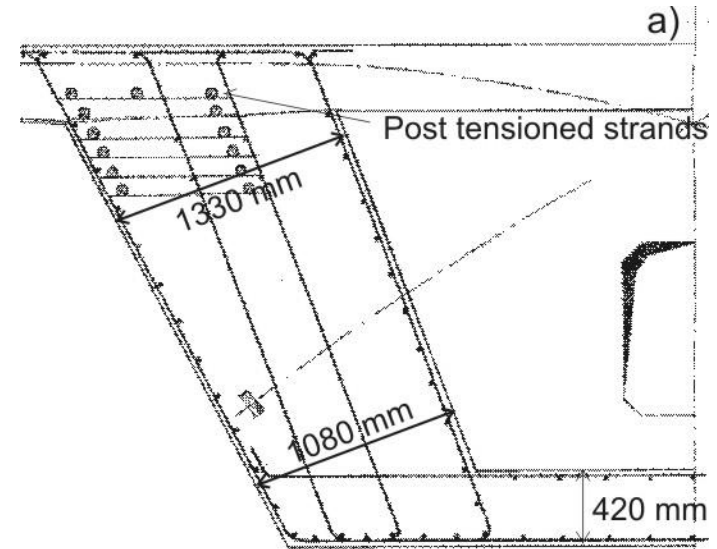
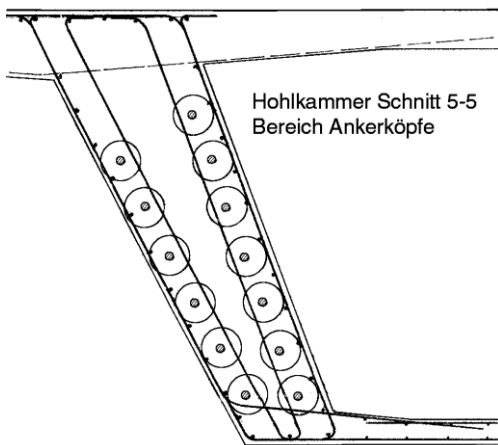
Installation: July – August 2002



03 Composite Anode Applications

03.3 Highway Bridge Utrichshausen/Germany

- Box Girder Floor thickness: 170 mm – 420 mm
- Box Girder Wall dimension: 400 – 1330 mm
- 13 Prestressed Strands in the Walls
 - 6 prestressed strands outside wall
 - 6 prestressed strands inside wall
- 13 densely packed anchorheads at the „coupling joint“



03 Composite Anode Applications

03.3 Highway Bridge Uttrichshausen/Germany



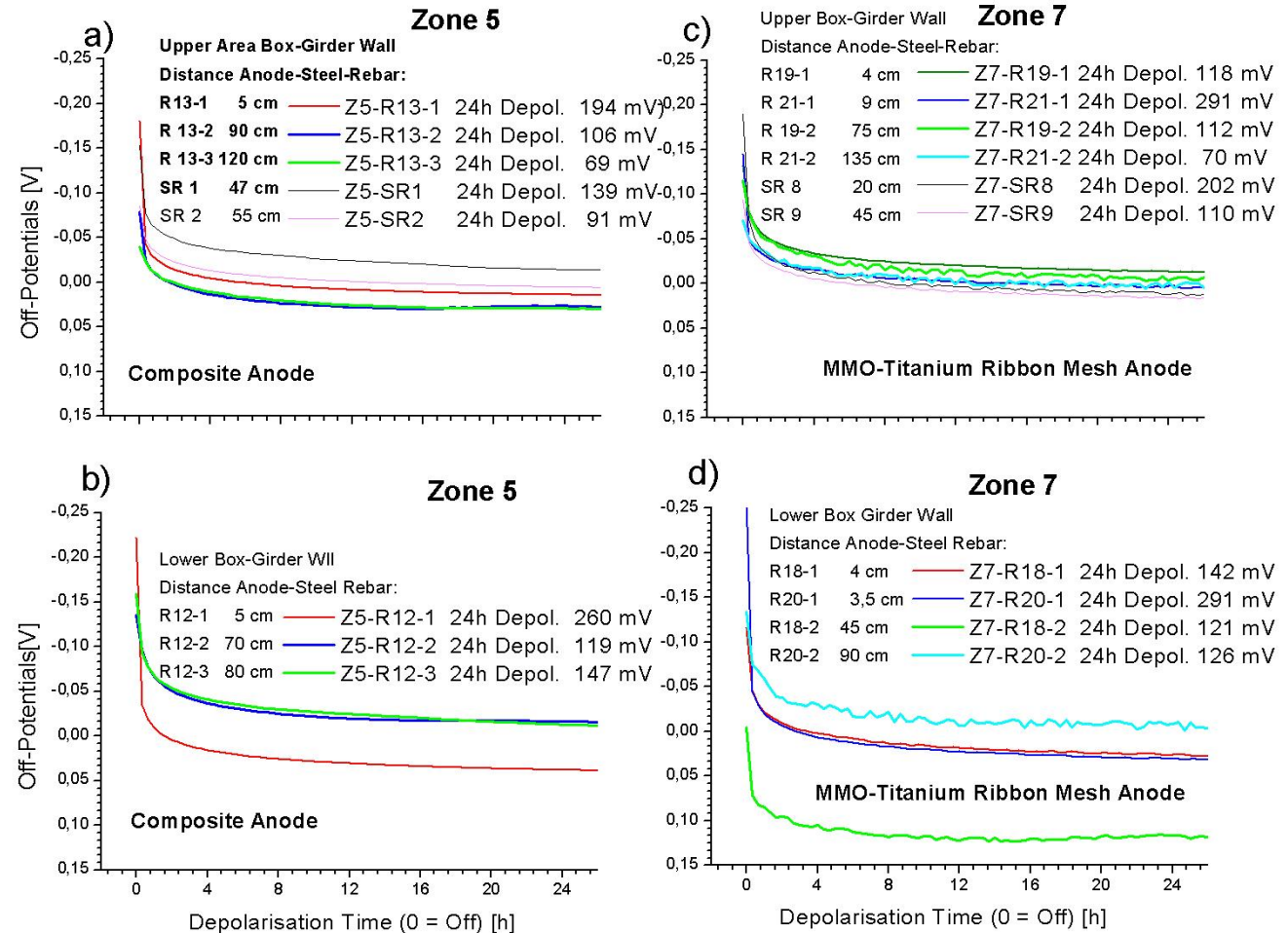
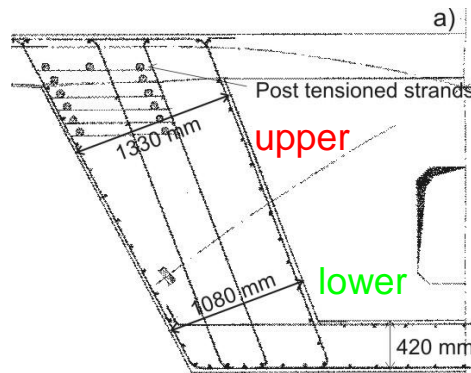
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03 Composite Anode Applications

03.3 Highway Bridge Uttrichshausen/Germany

Depolarisation of Steel Rebars in the Box-Girder Wall, Zone 5 & 7



03 Composite Anode Applications

03.4 Parking Deck of Central TV-Station



**Application of Composite Anode on
Parking Deck Soffits and Undersides**

Start: 2002

Final installation 2008

Total: 2500 m²

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03 Composite Anode Applications

03.4 Parking Deck of Central TV-Station



**Application of Composite Anode on
Parking Deck Soffits**

Start: 2002

03 Composite Anode Applications

03.4 Parking Deck of Central TV-Station



Application of Composite Anode on Parking Deck Soffits

Start: 2002

03 Composite Anode Applications

03.4 Parking Deck of Central TV-Station



**Application of Composite Anode on
Parking Deck Ramp Soffits and Beams**

Start: 2004

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03 Composite Anode Applications

03.5 Polder Bridges in Netherlands

Polderbridges in the Netherlands:

Solar power driven CP – bridge is used for energy storage (condenser) for CP during night time.



Realized 2003



03 Composite Anode Applications

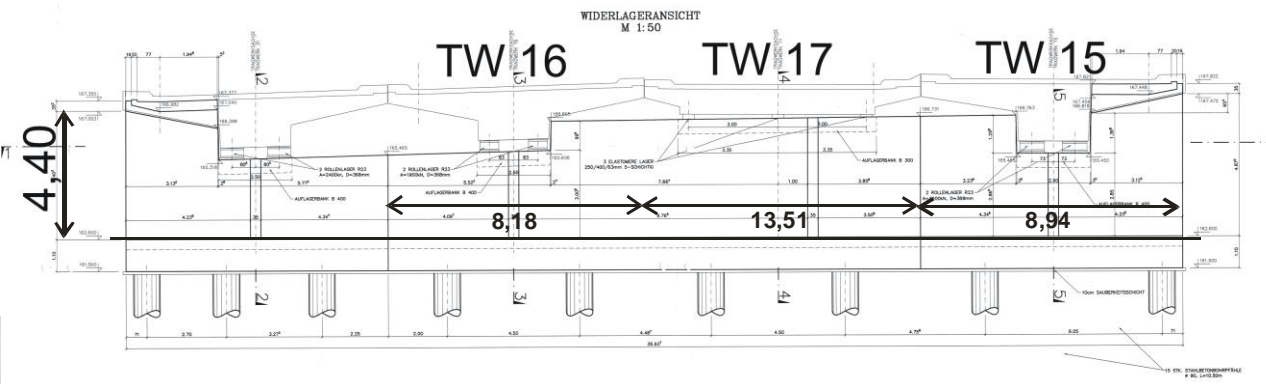
03.6 Highway Bridge St. Marx A23/Vienna



**Application of Composite Anode on
abutment, soffits and hollow box girder
underside exposed to high salt water
loads due to leaking joints**

Realized 2005 - 2006

Widerlager - Ansicht



03 Composite Anode Applications

03.6 Highway Bridge St. Marx A23/Vienna



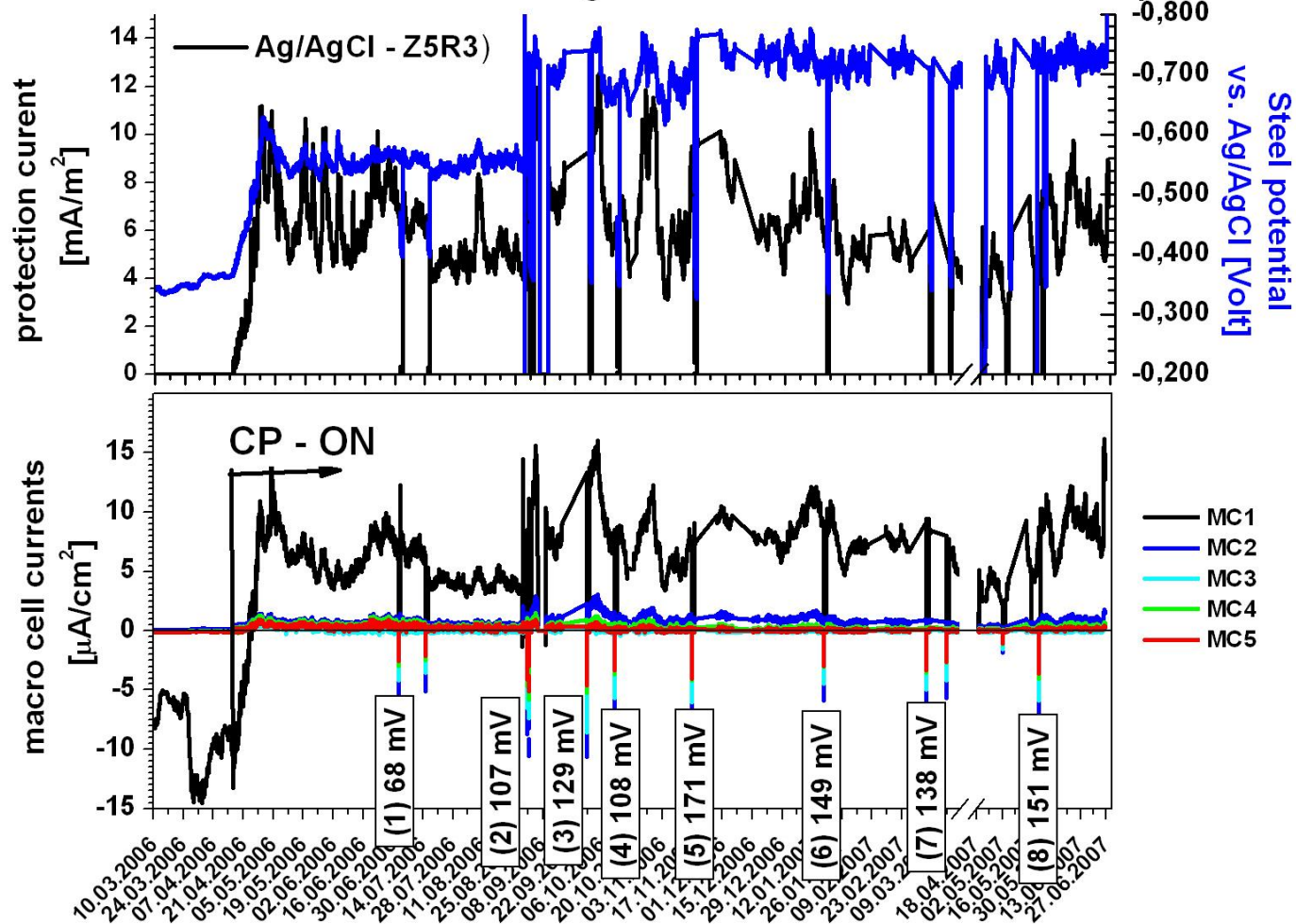
First Application and Use of Macro-Cell & Concrete Resistivity Sensors



03 Composite Anode Applications

03.6 Highway Bridge St. Marx A23/Vienna

CI-MC3 in abutment wall 317 under leaking crossover: macro cell currents vs. steel potential



03 Composite Anode Applications

03.7 Seaside Apartment's in NL

**Repair and Maintenance of Balconies and
Columns of Seaside Apartements in
Scheveningen/Netherlands**

PROJECT REALIZED 2008

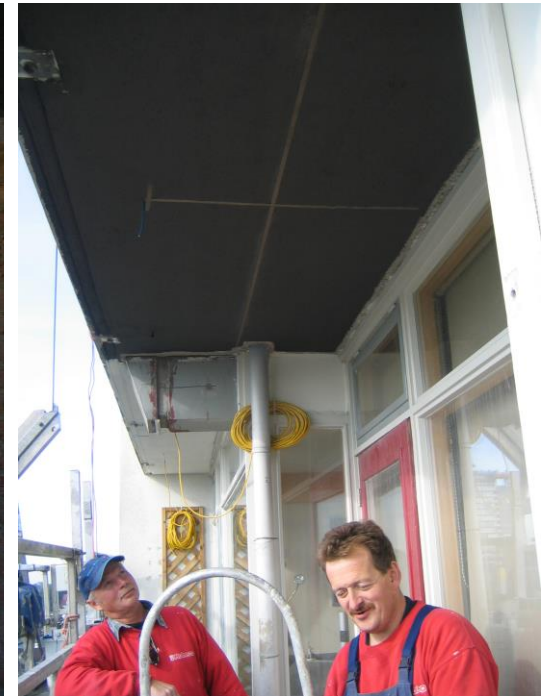


03 Composite Anode Applications

03.7 Seaside Apartment's in NL

**Repair and Maintenance of Balconies and
Girders of Seaside Apartment's in
Bussum/Netherlands**

PROJECT REALIZED 2008



03 Composite Anode Applications

03.7 Seaside Apartment's in NL

Repair and Maintenance of Balconies and
Girders of Seaside Apartment's in
Zandvoort/Netherlands
PROJECT REALIZED 2008



03 Composite Anode Applications

03.7 Seaside Apartment's in NL

Repair and Maintenance of Balconies and
Girders of Seaside Apartment's in
Zandvoort/Netherlands
PROJECT REALIZED 2011



03 Composite Anode Applications

03.8 Danube Bank Highway A22 Bridges



Repair and Maintenance of Highway Bridge Concrete Members by Composite Anode System

I. SUPPORT & RETAINING WALLS

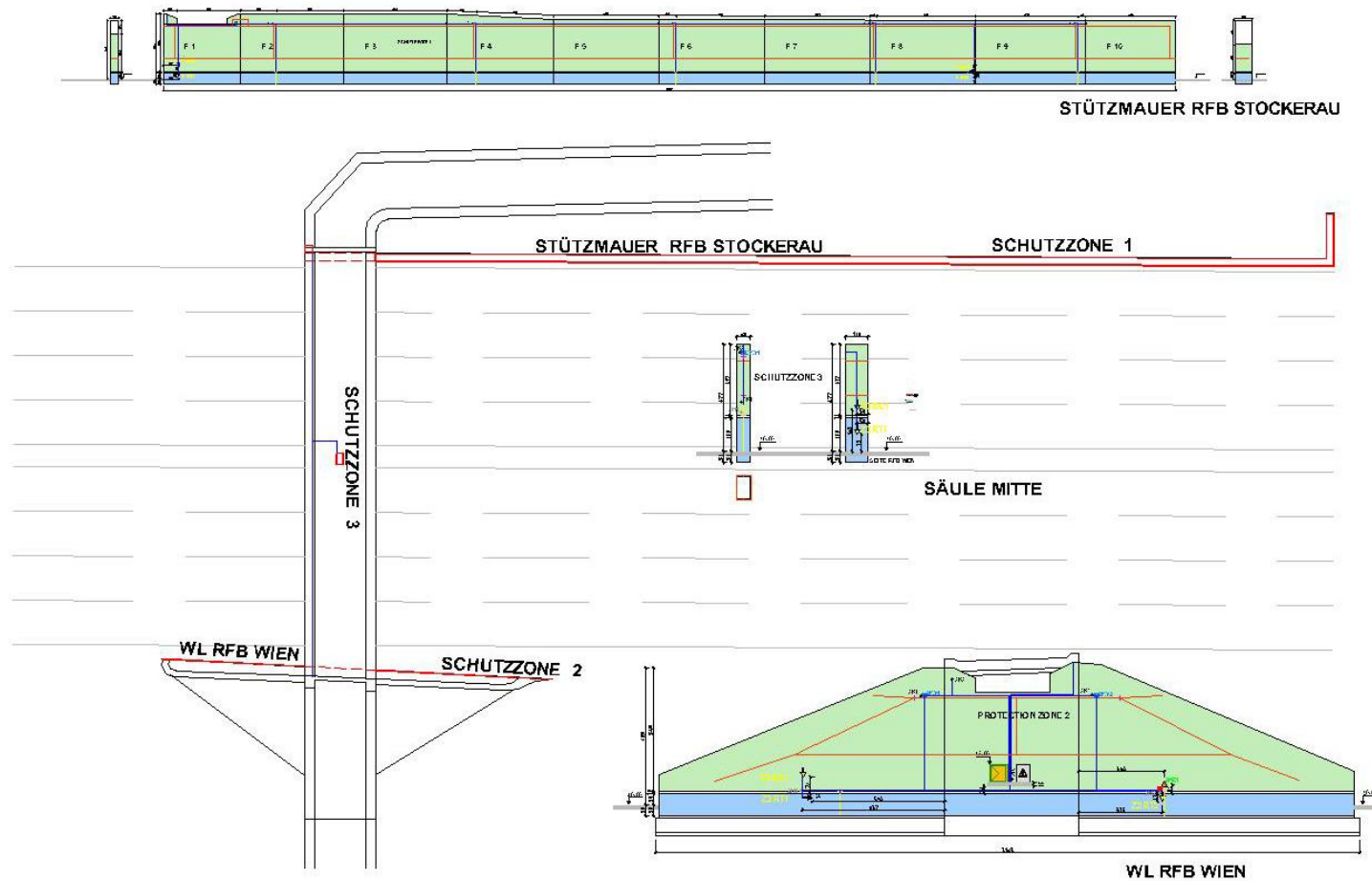
II. ABUTMENTS

III. COLUMNS

PROJECT REALIZED 2010

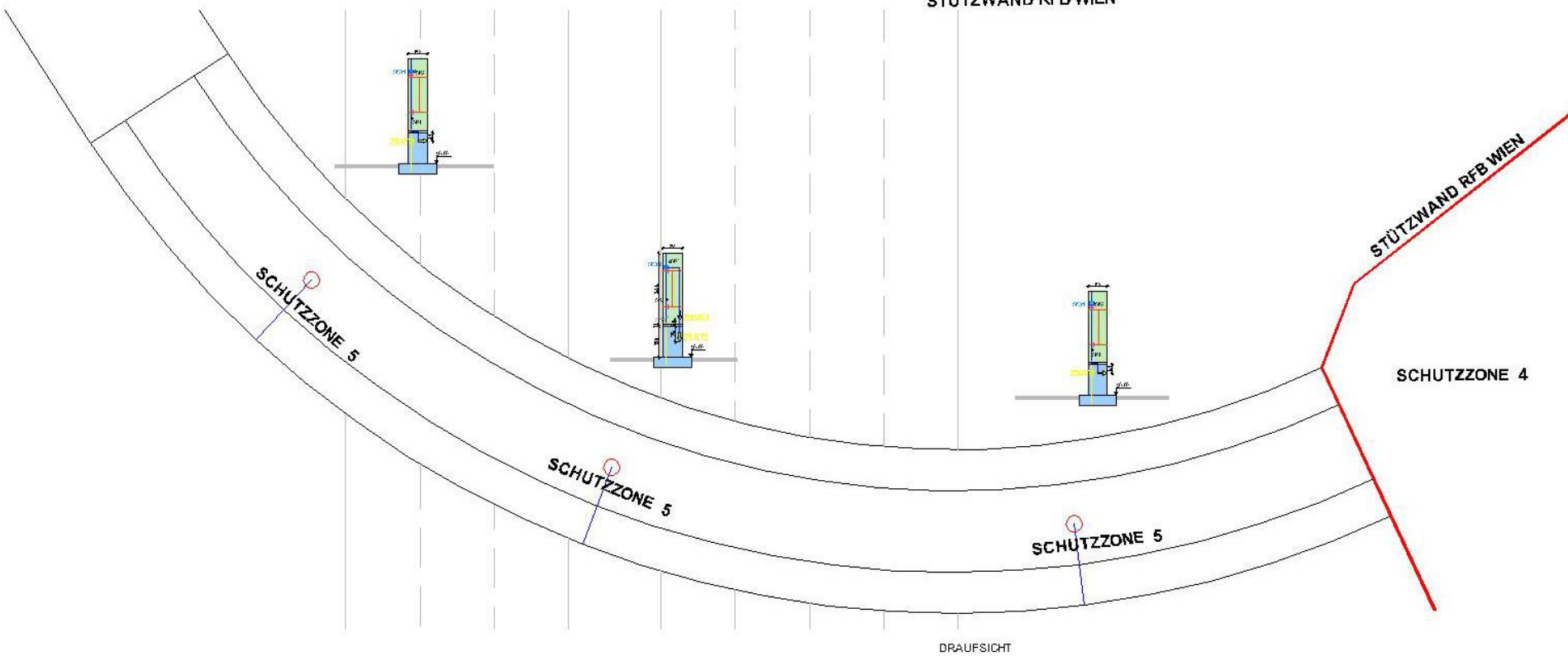
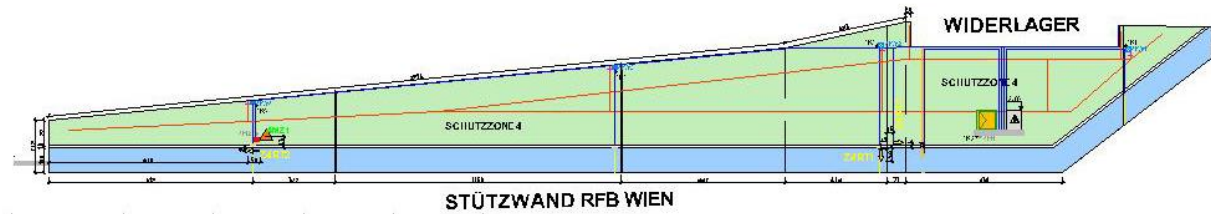
03 Composite Anode Applications

03.8 Danube Bank Highway A22 Bridges



03 Composite Anode Applications

03.8 Danube Bank Highway A22 Bridges



03 Composite Anode Applications

03.8 Danube Bank Highway A22 Bridges



B 2134 – WIDERLAGER & MITTELSTÜTZE: CAS VERBUNDANODE + PRIMÄRANODEHOHE

03 Composite Anode Applications

03.8 Danube Bank Highway A22 Bridges



B 2134 – STÜTZWAND

CAS VERBUNDANODE

03 Composite Anode Applications

03.8 Danube Bank Highway A22 Bridges



FINISH – APPLIKATION DER DECKBESCHICHTUNG

03 Composite Anode Applications
03.8 Danube Bank Highway A22 Bridges



FINISH – APPLICATION COVER COAT

**B2136: SUPPORTING WALL,
COLUMN**

Total Project realized in 6 weeks

15 April – 31 Mai 2010

03 Composite Anode Applications

03.9 Swimming Pools on Apartment Decks



**Two Swimming Pools on
Apartment Decks in Vienna
realized with Composite
Anode System**

Project realized 2009 - 2011

03 Composite Anode Applications

03.9 Swimming Pools on Apartment Decks



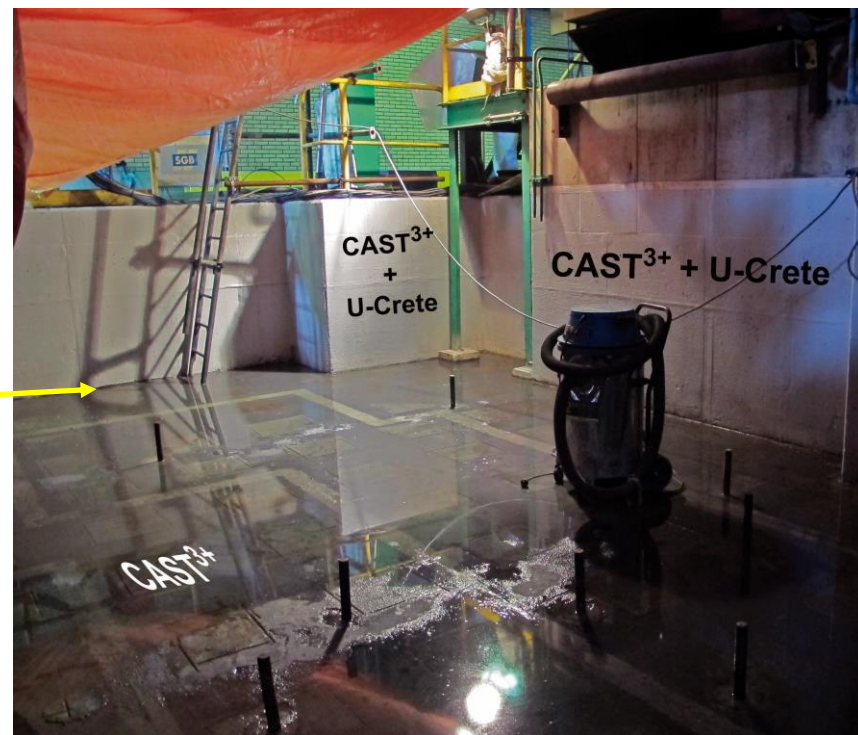
Pool Soffits and Walls

03 Composite Anode Applications

03.10 Steel Pickling Line at Tata Steel



Steel Pickling Line at Tata Steel in IJmuiden (NL) damaged by fire was corrosion protected by applying MMO-Ti ribbon mesh and CAST³⁺ in 2011



03 Composite Anode Applications

03.7 Seaside Apartment's in NL

**Repair and Maintenance of Balconies and
Columns of Seaside Apartements in
Scheveningen/Netherlands**

PROJECT REALIZED 2008



03 Composite Anode Applications

03.11 Swimming Pool Overbosch (NL)

Swimming Pool in Overbosch (NL):

CP with CAST3+ of the concrete basin
contaminated with chloride due to leakage of
water loaded with hypochlorite



Realized 2012 with CAST³⁺

03 Composite Anode Applications

03.12 Highway Viaducts (NL)

Prestressed highway beam heads of 30 viaducts have been protected by applying **CAST³⁺** in the Netherlands from 2013 – 2014 in the scope of a PP project: Maintenance contract over 40 years granted to Vogel Kathodische Bescherming B.V.



03 Composite Anode Applications

03.12 Highway Viaducts (NL)

The CAST3+ composite anode has been applied on a total of 1300 beam heads by airless spray.

2013 – 2014



03 Composite Anode Applications

03.12 Highway Viaducts (NL)

The CP systems are powered by photovoltaic devices, voltage is kept constant through buffer batteries.

2013 – 2014





**Parking Deck Soffits
an Beams**

**Project Realized by
iCOR 2015**



**Parking Deck Soffits
and Beams**

2015

One of several apartment buildings at which the CAST3+ has been applied 2019 to protect balconies and beams from corrosion caused by exposure to sea salt transported by aerosols



03 Composite Anode Applications

03.15 Highway beams Schiphol Airport (NL)

Corrosion protection of prestressed concrete beams supporting the highway decks serving as access to Schiphol Airport (NL) by applying the CAST3+ composite anode to a total of 1700 m² concrete surface



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03 Composite Anode Applications

03.15 Highway beams Schiphol Airport (NL)



Project realized 2019



04 Composite Anode Application Example

Parking Deck in Germany - Rostock



Parking Deck in
Rostock Germany,
Soffits an Beams

Project realized 2016

