## 2016 PTI Convention Long Beach, California

Technical Session 2 Bridge Design and Construction





## Experiences and reflections on EIT post-tensioning

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### **Presentation Goals:**



 Provide an overall view of EIT approach with key features and troubles

Experiences and notes taken from a massive project completed with EIT tendons.



### Standards background



Concepts for protection levels

- Fib bulletin 33 "Durability of post-tensioning tendons"
- PTI-ASBI M50.3-12 "Guide specifications for grouted post-tensioning tendons"

#### **Details for EIT**

- Swiss guidelines ASTRA "Measures to ensure durability of post-tensioning tendons in structures"
- ETAG 013 "Guideline for European Technical Approval on PT kits"
- FIB Bulletin 75 "Polymer duct systems for internal bonded post tensioning"



### **Concepts behind EIT**



 Provide highest level of corrosion protection to MTE (PL3) → full encapsulation

 Provide monitoring of tendons status anytime during project lifetime → detection system



### Keys to successful EIT - 1



- Full encapsulation of MTE is gained through a «stop drop» design approach.
  MTE must be completely isolated from outside environment, no chance to have corrosion agents
  - or stray currents reaching MTE.
- Substantial improvement of basic PT system through details, materials and connections: standard PT systems cannot meet the requirements











### Keys to successful EIT - 3



 Easy monitoring system, on each anchorage
Using EIT, the evolution of the resistance values over time can be used to control the integrity of the corrosion protection system.



Measuring electrical impedance of a tendon with LCR meter



### Keys to successful EIT - 4



- Deep analysis of installation processes and lessons learned through experience
- System works only if properly installed, higher requirements than standard PT
- PT field technicians crucial to success of works



### Projects



 High speed railway Milan – Rome (Italy) «Piacenza» viaduct

High speed railway Milan – Turin (Italy)
3 no. viaducts - «Greggio» «Chivasso»
«Marchiazza»







5,1 km viaduct – 150 No. single span simply supported (33,1 meters each) Worldwide biggest application of electrically insulated posttensioning







Bi-cellular concrete box girder 14 m top wide, 8 m bottom wide, 2.8 m height







#### Full span precast





POST-TENSIONING INSTITUTE Stressing the Stronger Concrete Solution™















Each span provided with 15 No. 19 strands EIT and 9 No. 12 strands EIT – TENSA MTAID electrically insulated PT system

150 no. spans led to installation of:

- 2250 no. tendons type 19-0.62" (4500 anchorages)
- 1350 no. tendons type 12-0.62 " (2700 anchorages) ALL tendons EIT
- 2300 tons of 0.62 "steel strand





















Measure of electrical resistance of 71 decks with 19 strands.

- Type of corrugated duct = Ø100mm
- Acceptable specific value of ρ=R\*L(Ωm)>300kΩm (according to Swiss guideline)
- Length of cable = 32,1m
- Limiting value  $R = 9 k\Omega$



### Conclusions - 1



- Assembling of EIT single components is critical to success
- Care in assembling the cages of reinforcement, attention in respecting the casting procedure, good curing of concrete, early prestressing and injection grouting are also decisive for good results of the impedance measurements



### Conclusions - 2



 For pre-cast elements there is enough time to take advantage of the results from the first elements to improve the overall quality during the follow-up of production; at the same time, the repetition of the same activities for a large number of times and over a long period of time may cause some drop of attention, especially when many elements have to be casted, stressed and launched in short time



### Conclusions - 3



POST-TENSIONING INSTITUTE Stressing the Stronger Concrete Solution"

- Sometimes, at the end of production, when the pre-casting plant is going to be dismantled, a slight drop of attention and of impedance is usually observed.
- For cast in situ PC decks or small production of precast elements, there is usually not enough time to take advantage of direct experience on site. Generally these kinds of applications need, since the beginning, the best-trained personnel available and with specific previous experience.

# Thank You! Questions ?



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