



Capacity for Rail

Remote monitoring, assessment and control of railway bridges

FFE (Madrid, Spain) – 22 September 2017

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Correspondent Mb.



Presentation through real examples

Needs and features of auscultation methods.

First approach under classic basis.

Auscultation techniques on real time.

New technologies and remote instrumentation projects.



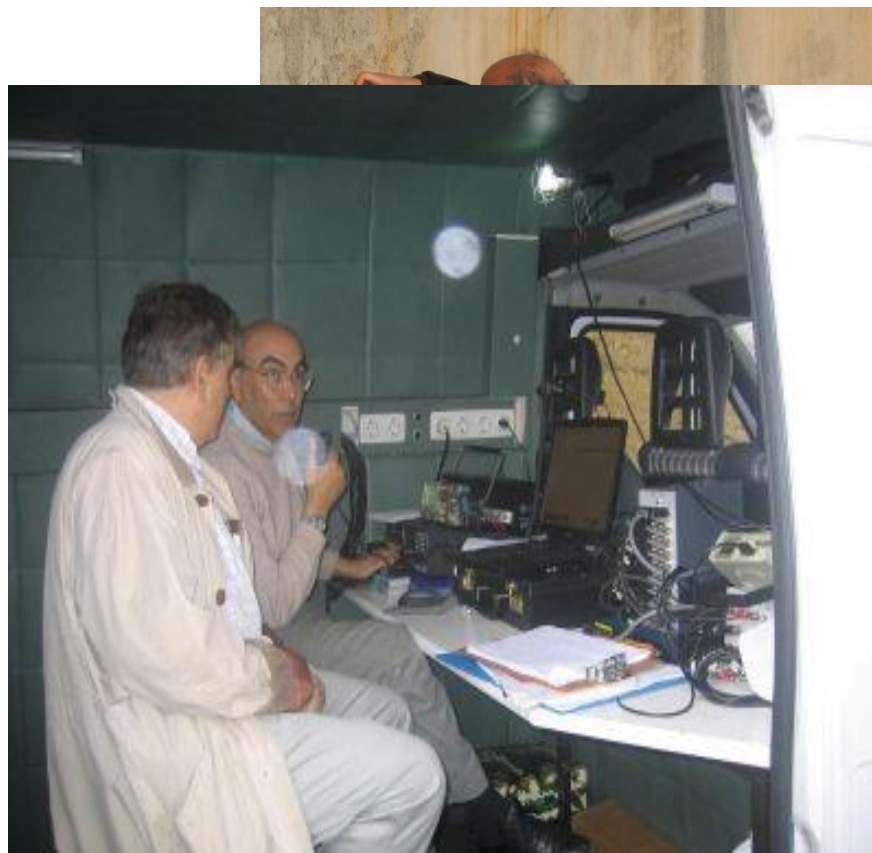
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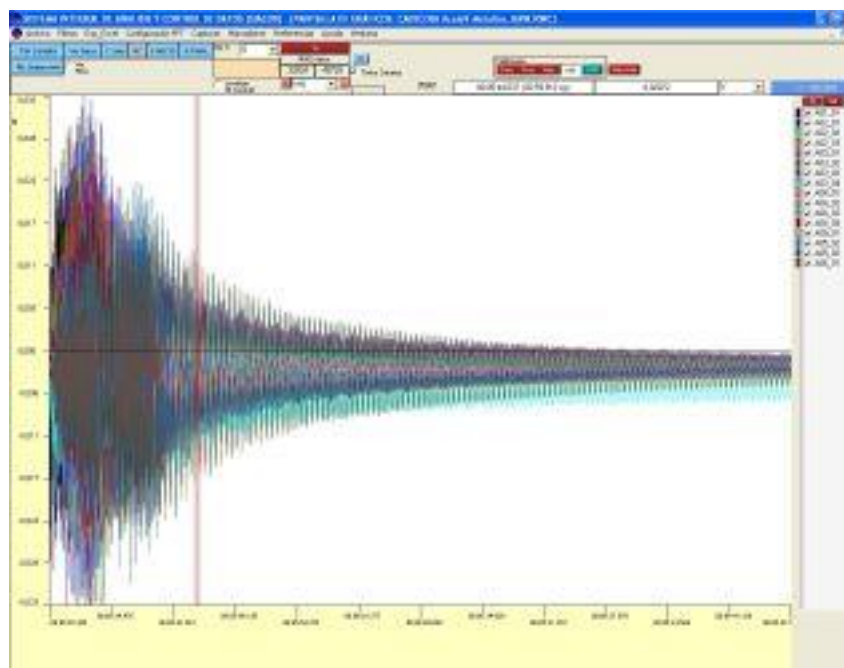
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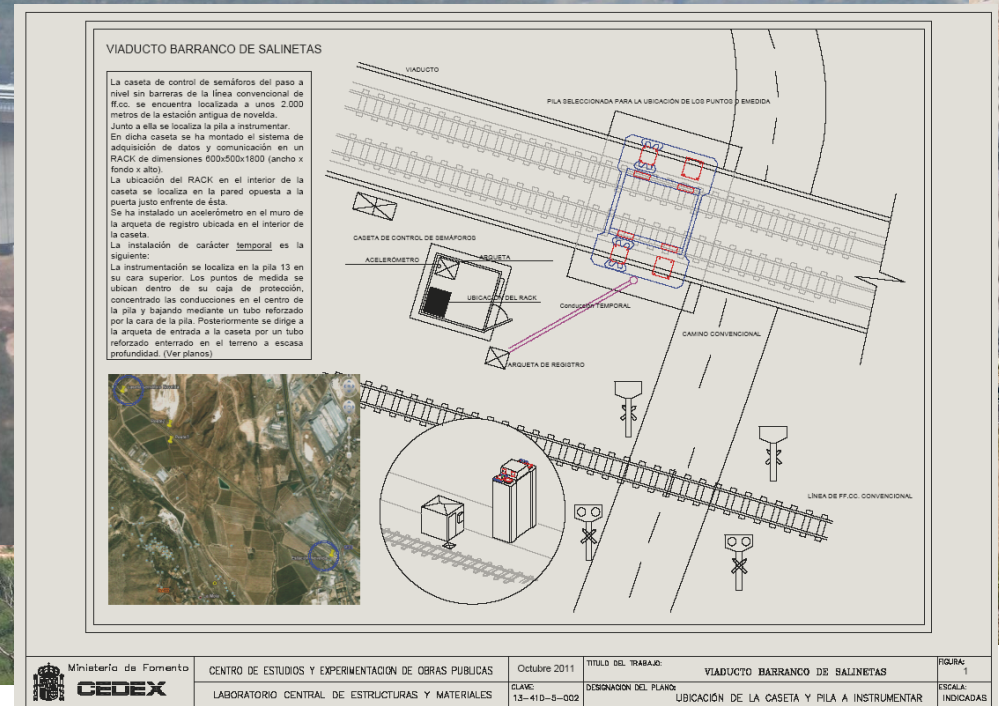
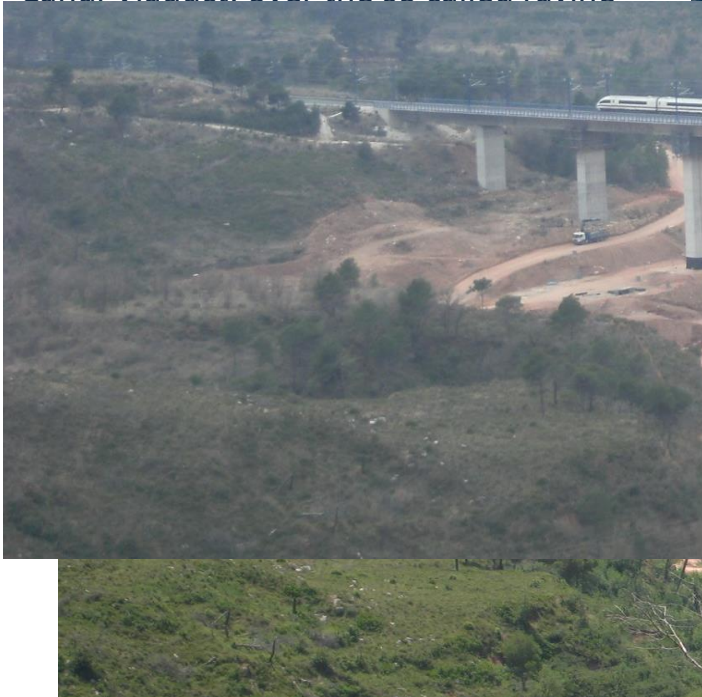
New technologies and remote instrumentation projects.



- Some instances on High Speed Railways Bridges

Sant Boi Bridges, over the Llobregat River

Candí Viaduct, over the so called ravine



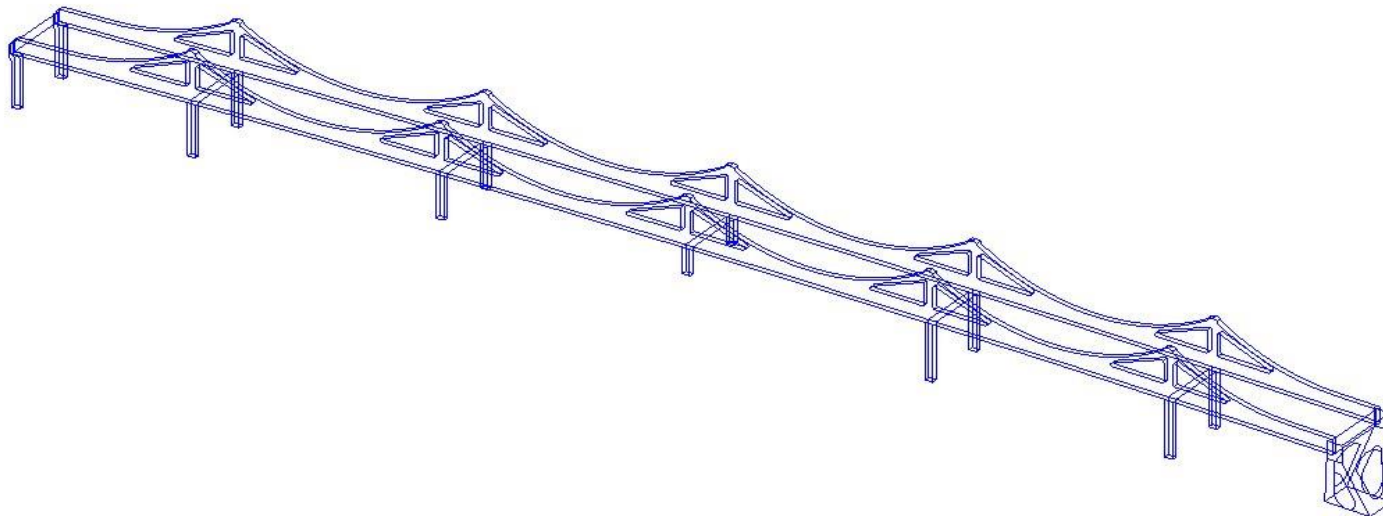
- Metallic Bridge on Sant Boi de Llobregat

6 spans: 44+4*63+44. L.O.A.:

340 m.

Composite deck section.

Reinforced concrete piles



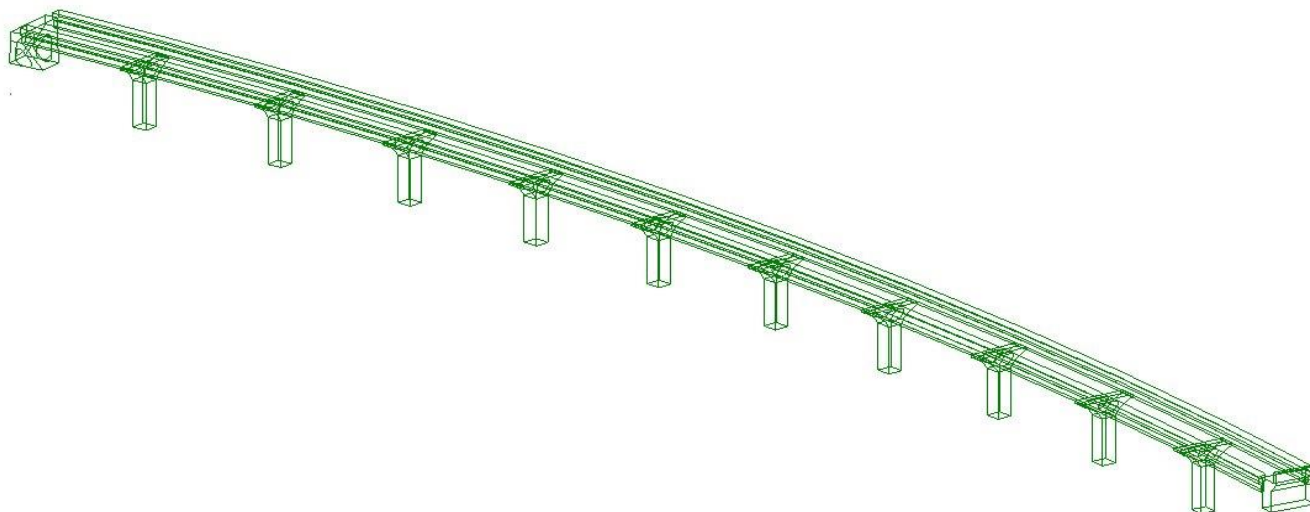
- Concrete Bridge on Sant Boi de Llobregat

11 spans 40+9*50+40. L.O.A.

530 m.

Prestressing concrete deck

Reinforced concrete piles (Y-Shape)



- Collected output

Long term evolution (rheologic, temperaturelinked parameters, etc...)
Dynamic response after traffic loads

- Register types

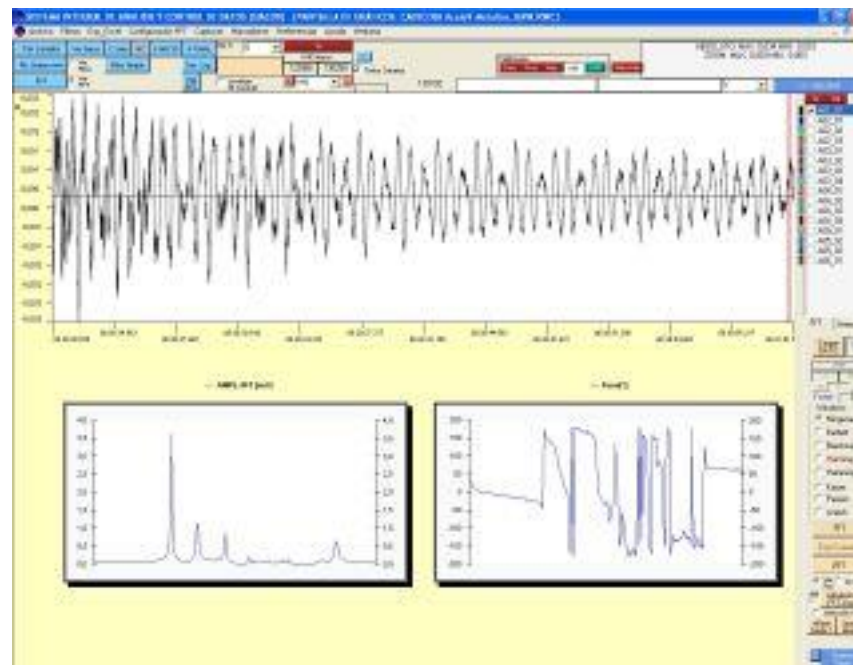
Static registers
Dynamic registers

- Software

IMC Devices; Famos y Famos OnLine
SIACOD (LCEYM), LMS

- Sampling frequency

200 data/sec. on each transducer



- Metallic Bridge (340 m. L.O.A.) sensors

LVDT'2 Accerometers Horizontal axis

16 Acce. Vertical axis

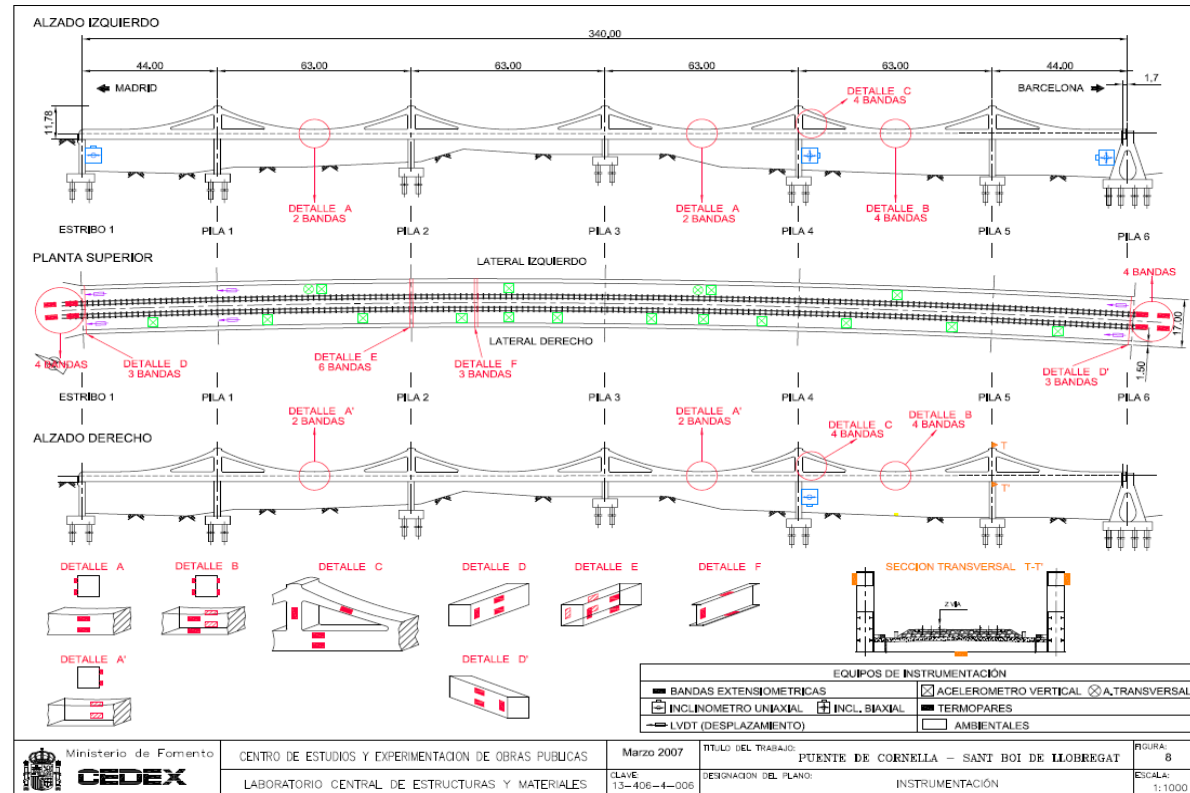
6 LVDT's

6 Clinometers

3 Thermo-sensors

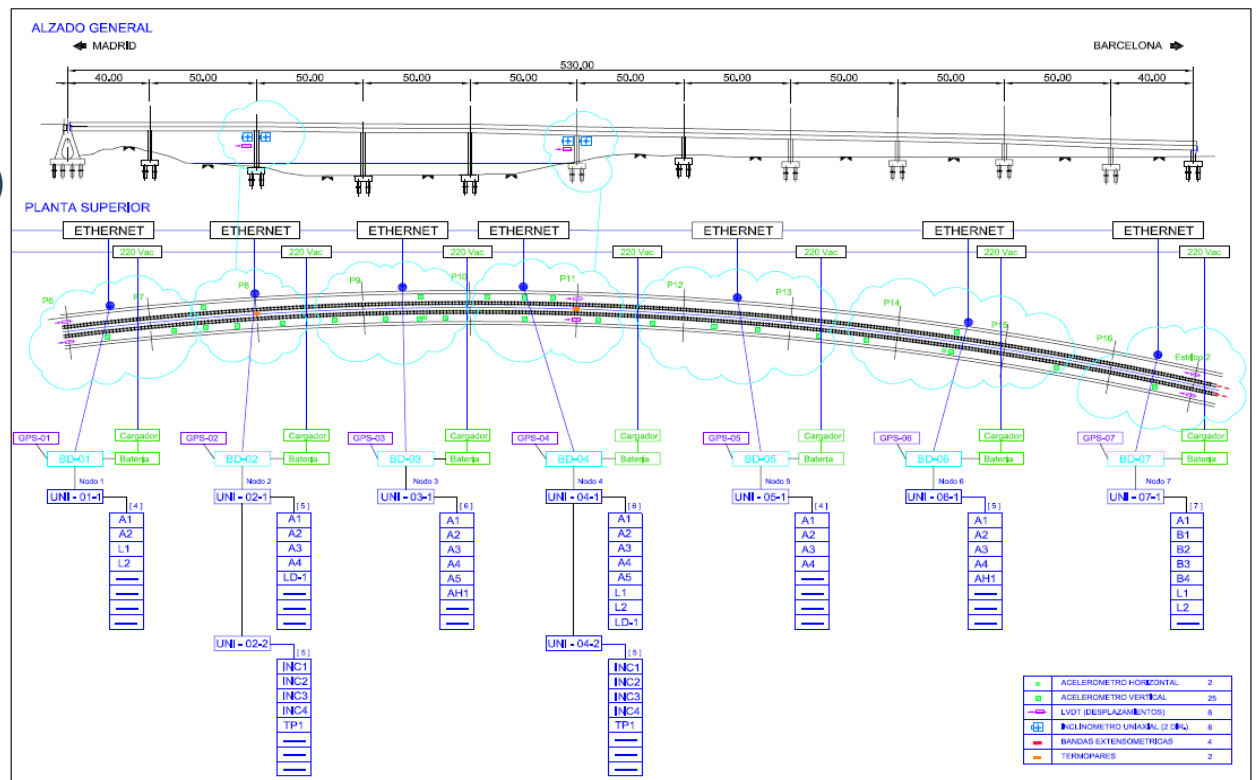
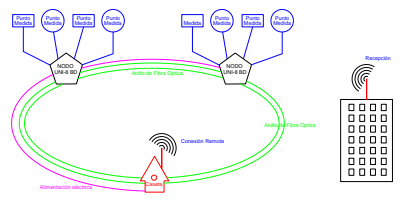
2 Enviromental

47 Strain gauges




- Concrete Bridge sensors

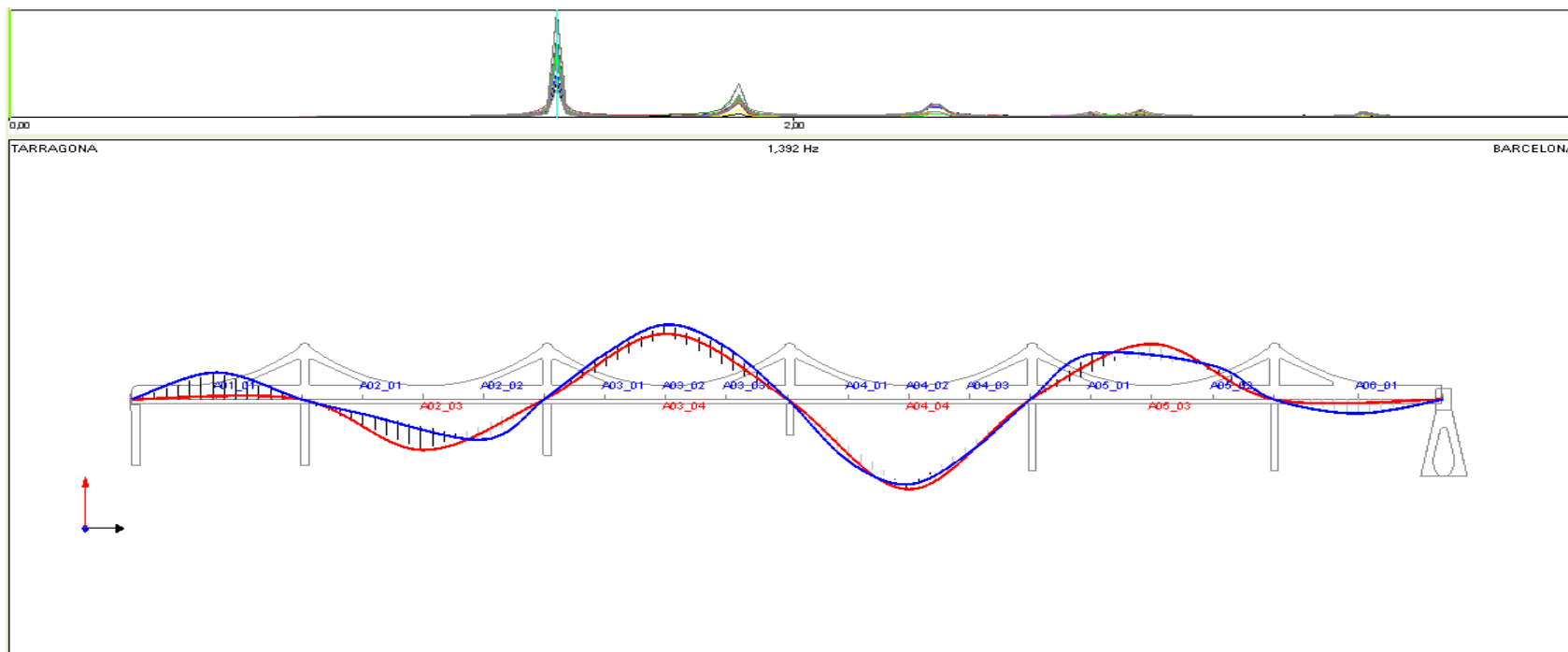
- 2 Acce. Horizontal axis
- 25 Acce. Vertical axis
- 8 LVDT's
- 8 Clinometers
- 2 Thermo-sensors
- 2 Environ (Anemo&Vane)
- 4 Strain gauges



⊞	ACCELEROMETRO HORIZONTAL	2
⊟	ACCELEROMETRO VERTICAL	25
→	LVDT (DESPLAZAMIENTOS)	8
↖↗	CLINOMETRO UNIDIRECCIONAL (2-AXIS)	8
⊞	BANIDAS EXTENSOMETRICAS	4
⊞	TERMOPARES	2

 Ministerio de Fomento CEDEX	CENTRO DE ESTUDIOS Y EXPERIMENTACION DE OBRAS PUBLICAS	Marzo 2007	TITULO DEL TRABAJO: PUENTE DE CORNELLA - SANT BOI DE LLOBREGAT	FIGURA: 14
	LABORATORIO CENTRAL DE ESTRUCTURAS Y MATERIALES	CLAVE: 13-406-4-006	DESIGNACION DEL PLANO: TOPOLOGIA PROVISIONAL DE DISTRIBUCION DE NODOS	ESCALA: ---

- “On-line” post-processing
- FFT conducted analysis (1st experimental frequency (1.39 Hz))



Theoric value: 1.33 Hz

- Candí Viaduct

Transducers rewired

Nodes&Dataloggers reinstalled
and auscultation settled up..

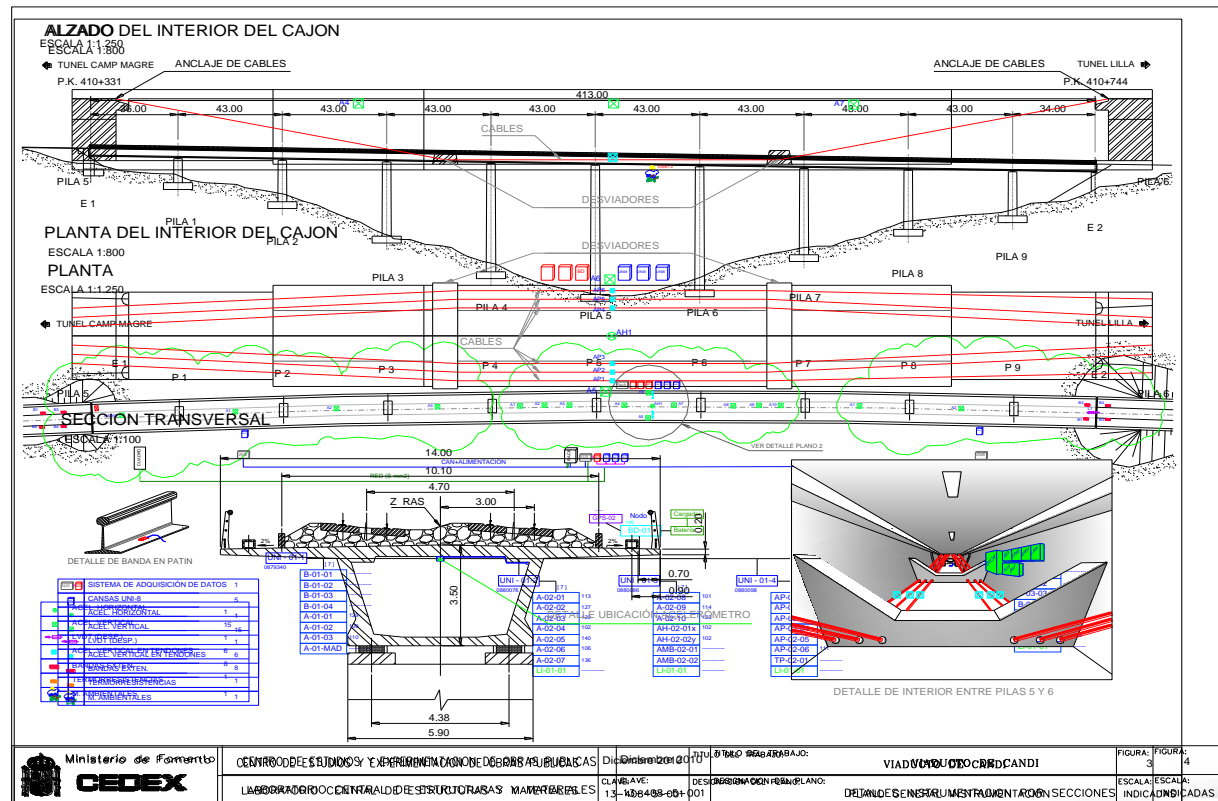
... inside the internally
prestressed box girder.



- Candí auscultation plan

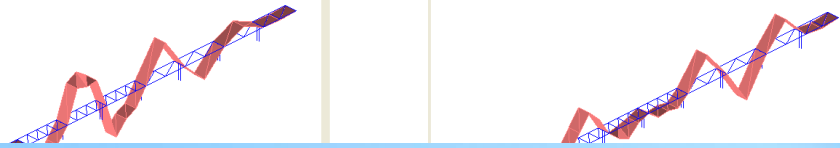
Modal operational scheme

Prestressing tendons system

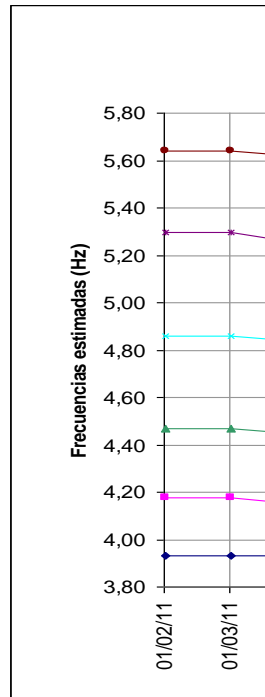


- Candí Viaduct Modal Analysis

Modal Shapes

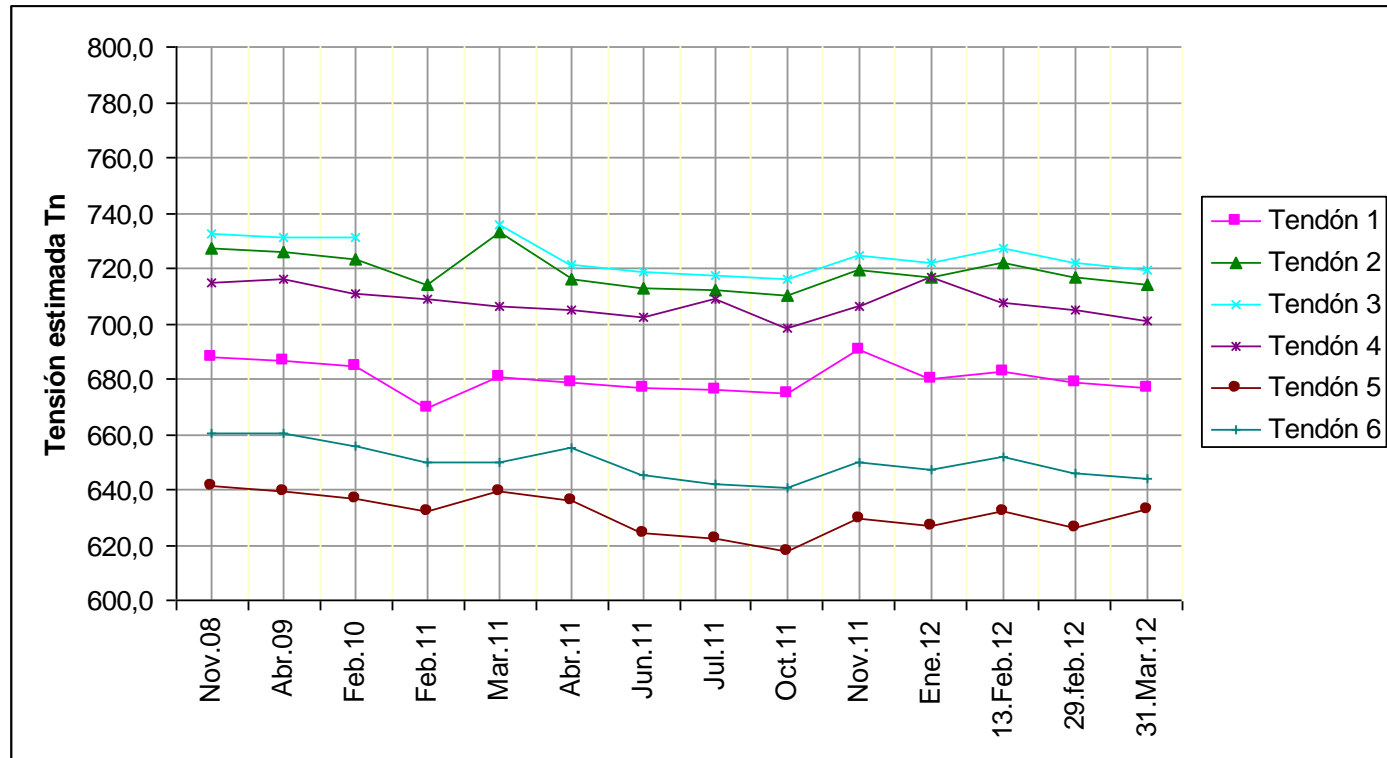


Eigenvalues (frequencies)



- Candí Viaduct Tendons


Steel Stress evolution



- Salinetas Bridge (Alicante)

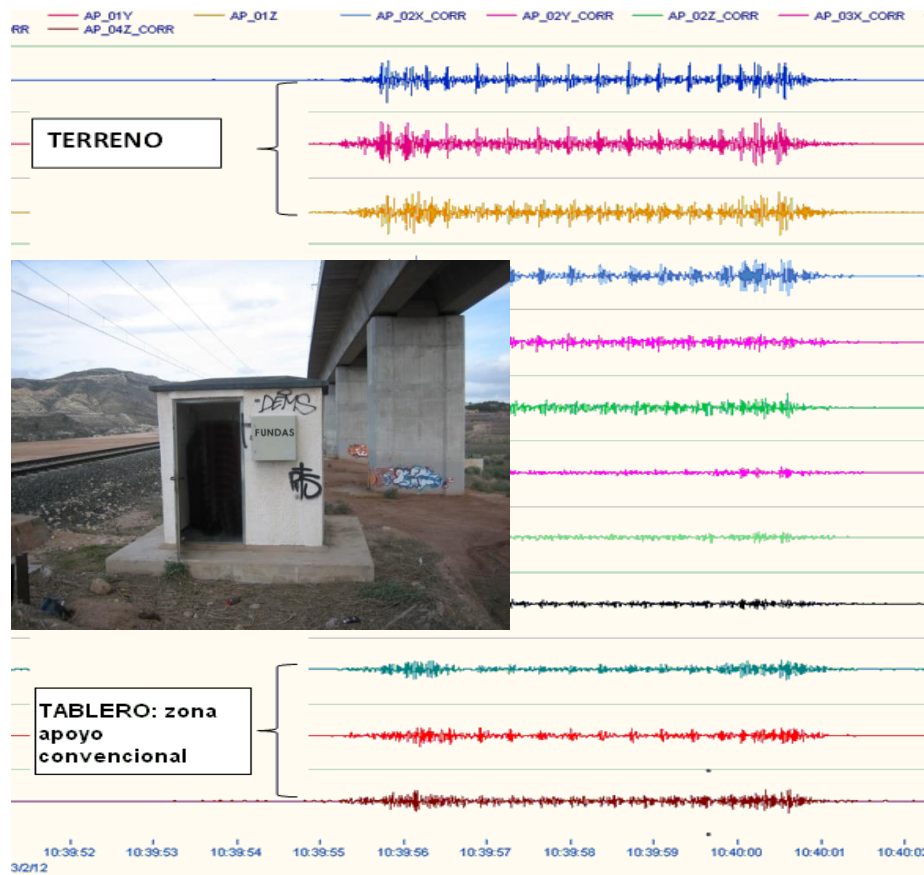
Extensive seismic bearing sensoring



 Ministerio de Fomento COEX	CENTRO DE ESTUDIOS Y EXPERIMENTACION DE OBRAS PUBLICAS	Octubre 2011	TITULO DEL TRABAJO: VIADUCTO BARRANCO DE SALINETAS	FIGURA: 2
	LABORATORIO CENTRAL DE ESTRUCTURAS Y MATERIALES	CLAVE: 13-410-5-002	DESIGNACION DEL PLANO: LOCALIZACIÓN DE LA INSTRUMENTACION	ESCALA: INDICADAS

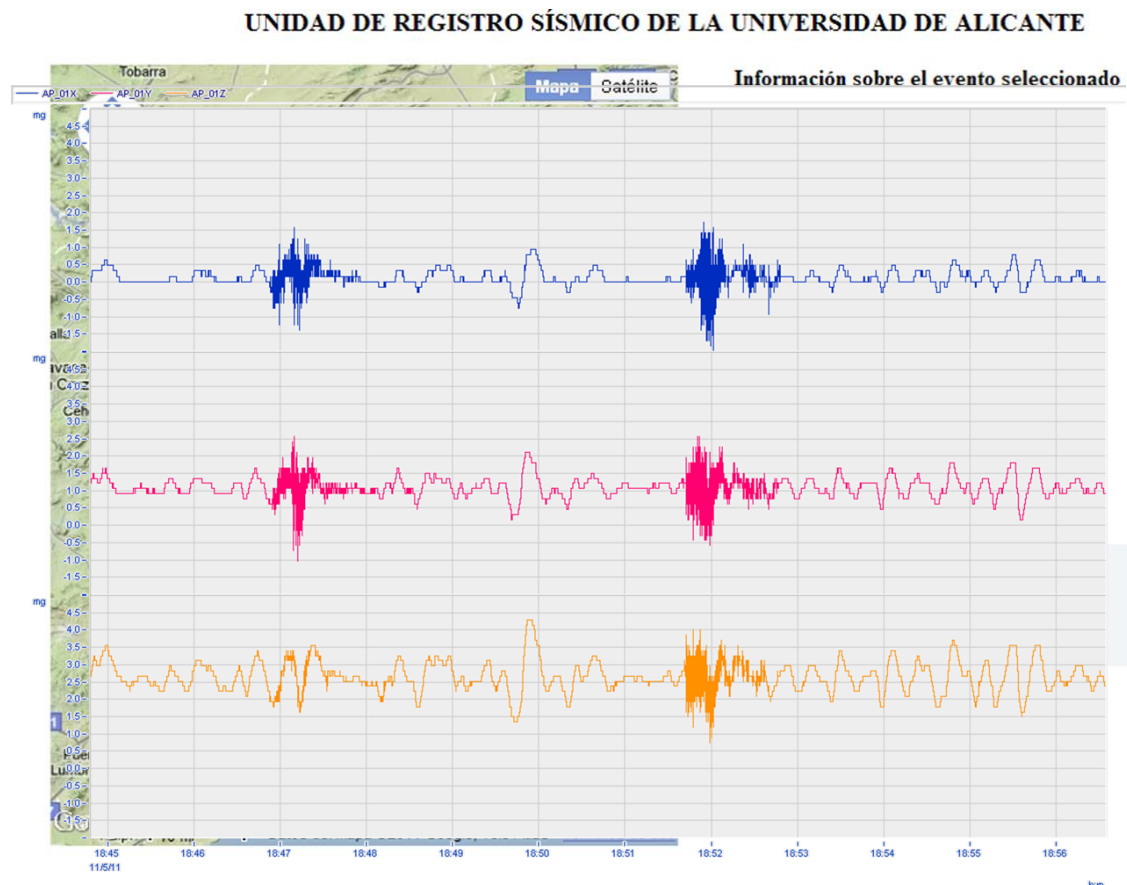
- Salinetas auscultation

Data-logging&processing



- Lorca earthquake

Recorded data



Thank you for your kind attention

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