

Convegno Sezione Automazione ANIMP

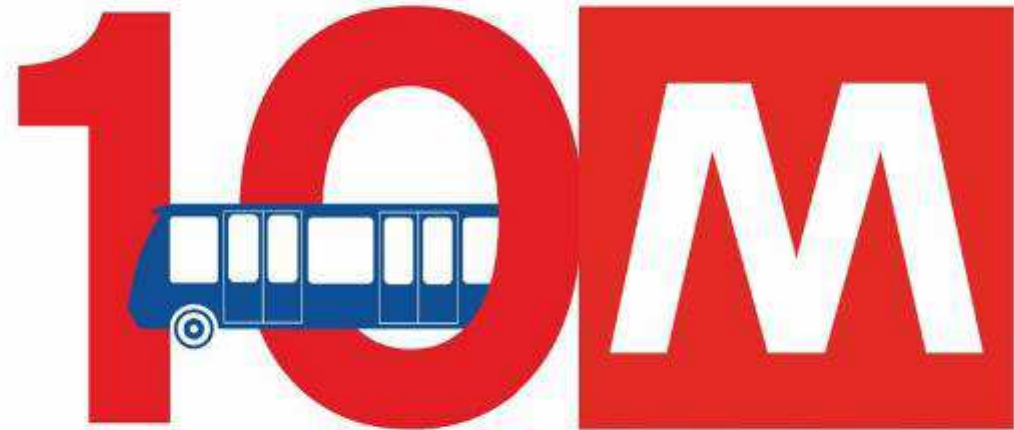
SISTEMI DI AUTOMAZIONE: NUOVE SFIDE E OPPORTUNITA'

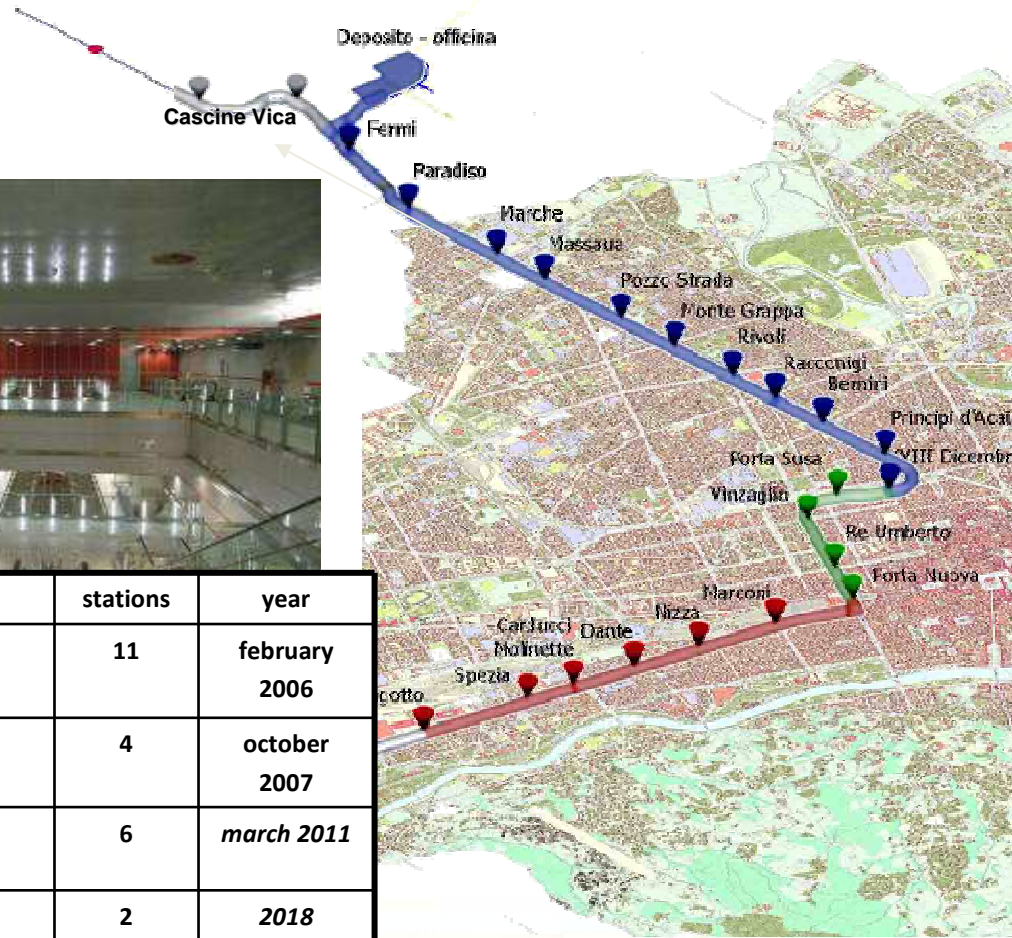
6 ottobre 2016

c/o Auditorium Maire Tecnimont (Milano)

Topics

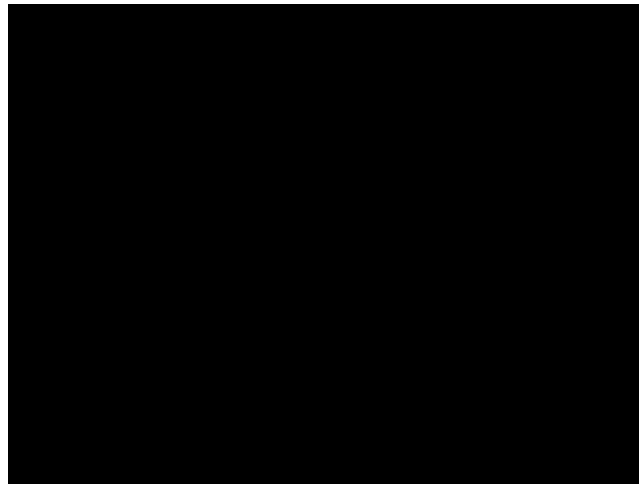
- 2006 – 2016
- Exploitation
- “Innovation”
 - “Laws”, regulations
 - Direct inn
 - Indirect inn
- Maintenance
 - Make or buy
 - Evolution
 - Obsolescence



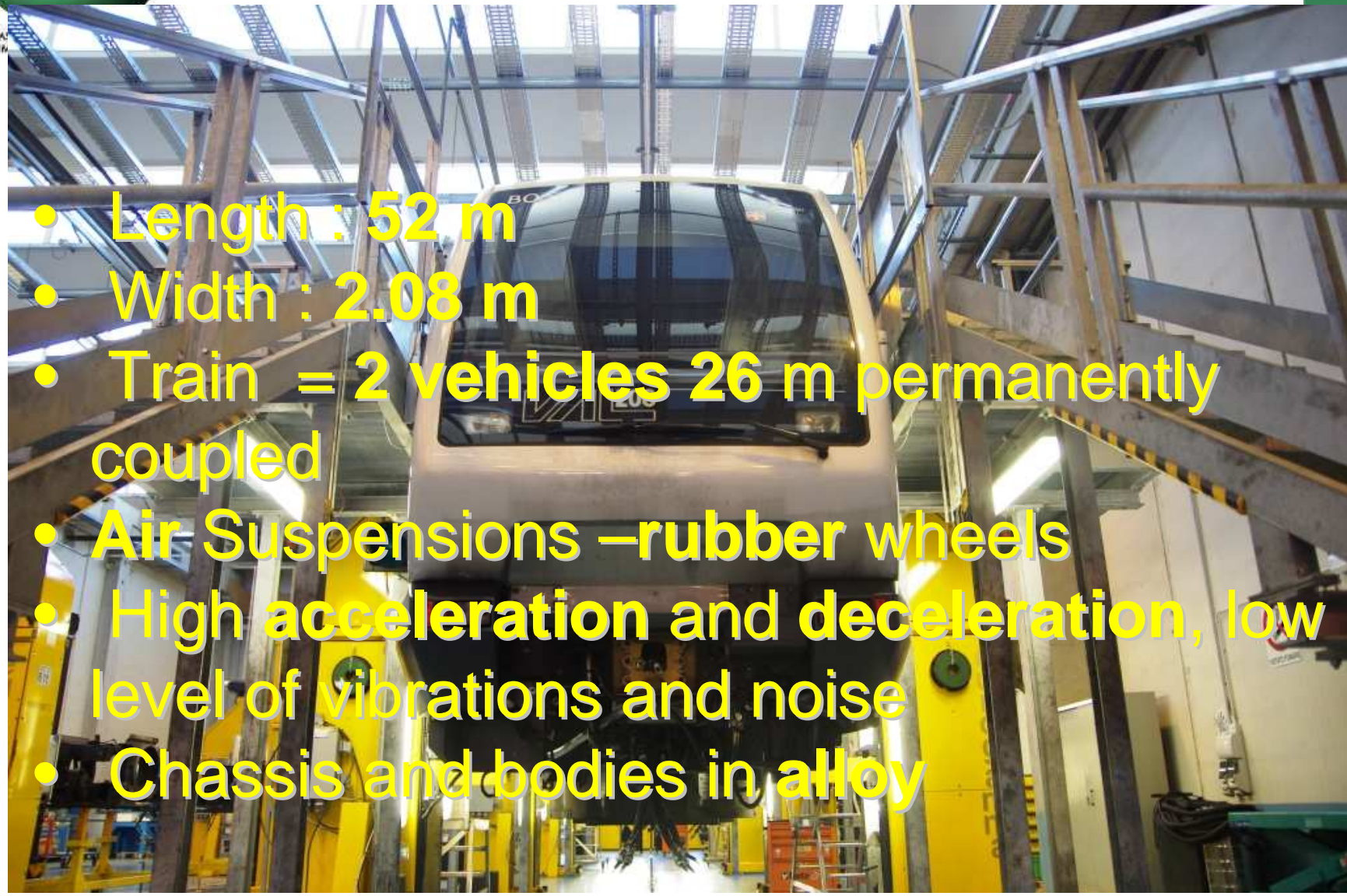


step	length	stations	year
Collegno Dep. – XVIII Dicembre	7,2 km	11	february 2006
XVIII Dicembre – Porta Nuova	2,3 km	4	october 2007
Porta Nuova - Lingotto	3,6 km	6	march 2011
Lingotto – Bengasi	1,9 km	2	2018





- Fermi /Porta Nuova/Lingotto : **12,5 km in 22 minutes**
- Stations: **21**
- Max n. of trains in duty: **25**
- Speed: **60 - 80 km/h**
- Headway: **2 minutes**
- Max loading: **30.000 pax/h**
- Max train loading: **440**
- Daily passenger traffic : **135.000 → 160.000**
- Yearly passenger traffic: **40.000.000**
- Availability (punctuality): **99,80%**
- Accidents: **none**



- Length : 52 m
- Width : 2.08 m
- Train = 2 vehicles 26 m permanently coupled
- Air Suspensions –rubber wheels
- High acceleration and deceleration, low level of vibrations and noise
- Chassis and bodies in alloy

“innovations” : Law & regulation context

- **Automatic system**

- unattended on board
- unattended stations
- driverless
- automated
- centralized
- Manual actions required in disruptions

- **Existing Rules**

– Fire prevention
dm n°11 / 1988

– EXPLOITATION metro
/ trains / fixed infrastr.
dm n°753 / 1990
UNI5189 + UNI5890

**Unclear and un-easy match between legislation and
authorization process of the implementation**

Authorization process: critical issues

- **Unattended trains:**
 - Detection / Intervention in failure or fire; passenger evacuation management
- **Unattended stations:**
 - Detection / Intervention in failure or fire; passenger evacuation management
- **Automatic train operations**
 - How to investigate? How to authorize?
- **Personnel**
 - Who are they : train drivers ? (5.000 km!), stationmasters? experts ?

Solutions

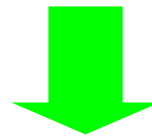
- **Commissione Nazionale di Sicurezza**
 - Composed by Ministero dei trasporti, Fire brigades, Città di Torino, exploiter, ecc.
- **Goal**
 - “to learn to approve”
 - Project explanation and concertation during whole realization phase
 - Continuously periodic visits and review
 - Extended and detailed functional test grid
- **Project Upgrade**
 - Automatic fire detection in train and station by fibrolaser “virtual portals”
 - Exhaustive integrated set of emergency procedures
 - Real condition tests and simulation scenarios

“Innovations” - management

Driverless ≠ Unmanned

Unattended ≠ Unmanned

Automatic ≠ Unmanned



“ ≠ ” *means*

- More specialized exploitation
- More specialized maintenance
- Procedures / integrations /
returns of experience /



“Innovations” – Platform doors and station tunnel



SEZIONE AUTOMAZIONE
ANIMP



Tunnel and station had separated fire risk and protection evaluation:

Station built as open spaces without barriers and fire doors

“Innovation: acces control (ticketing)”



40% -> 85% contactless

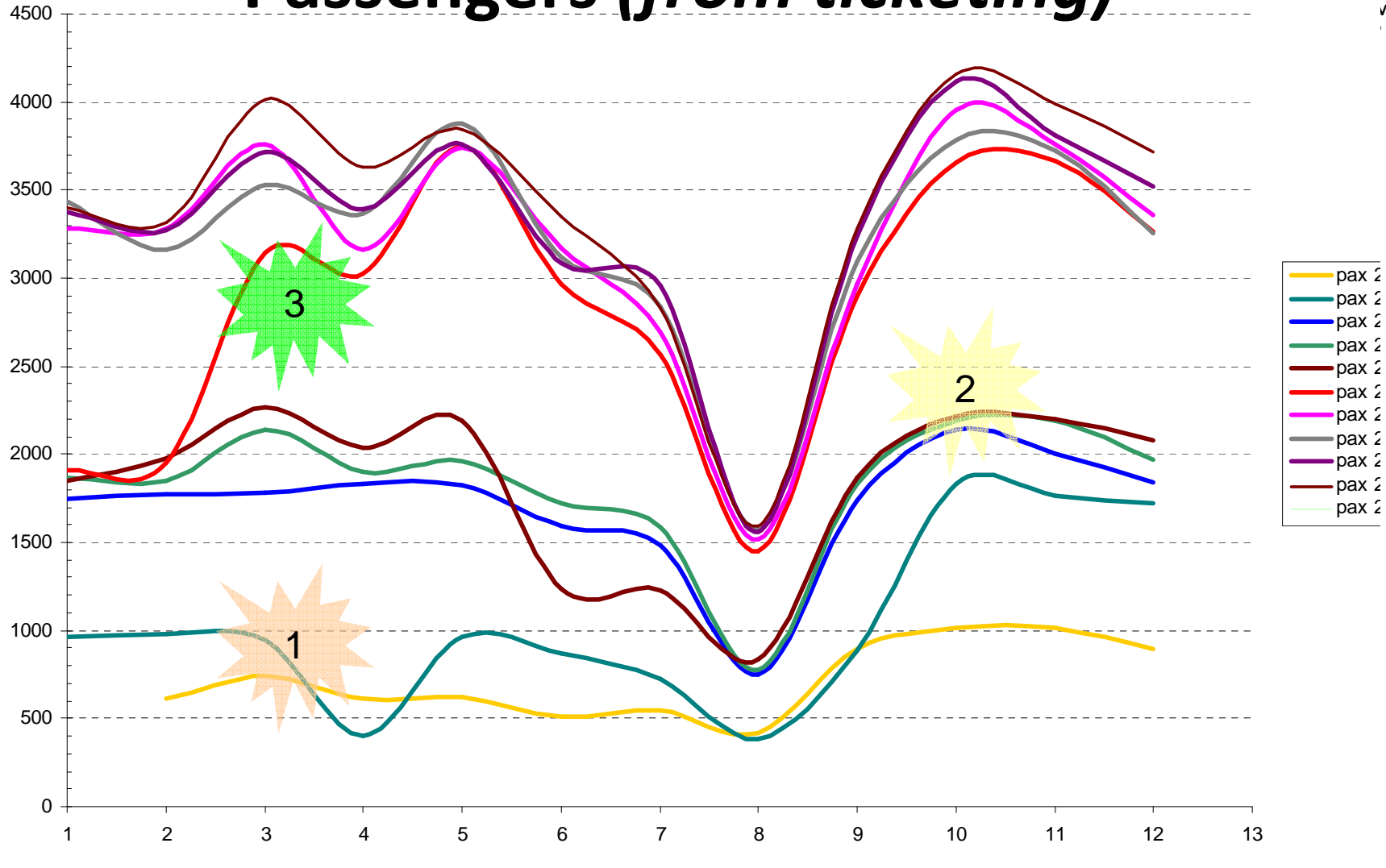
ISO 14443 A e B

Mifare

CD21

GTML2

Passengers (from ticketing)





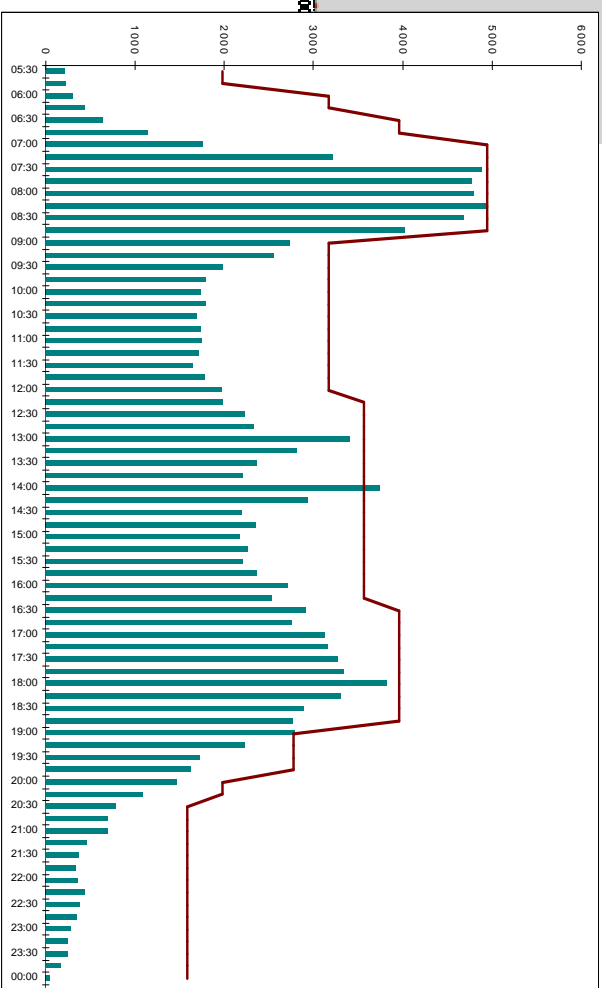
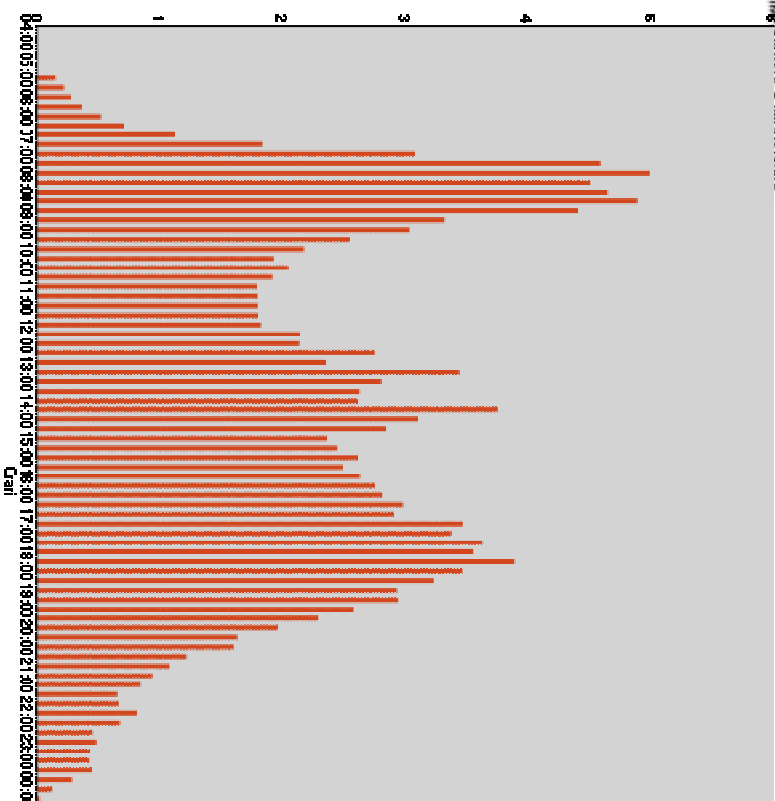
Statistics/expl.programmes (... tktg)



ASSOCIAZIONE NAZIONALE
INGEGNERI AUTOMOTRICE

Validazioni giornaliere per Sistema : 14052005

SEZIONE AUTOMAZIONE
ANIMP

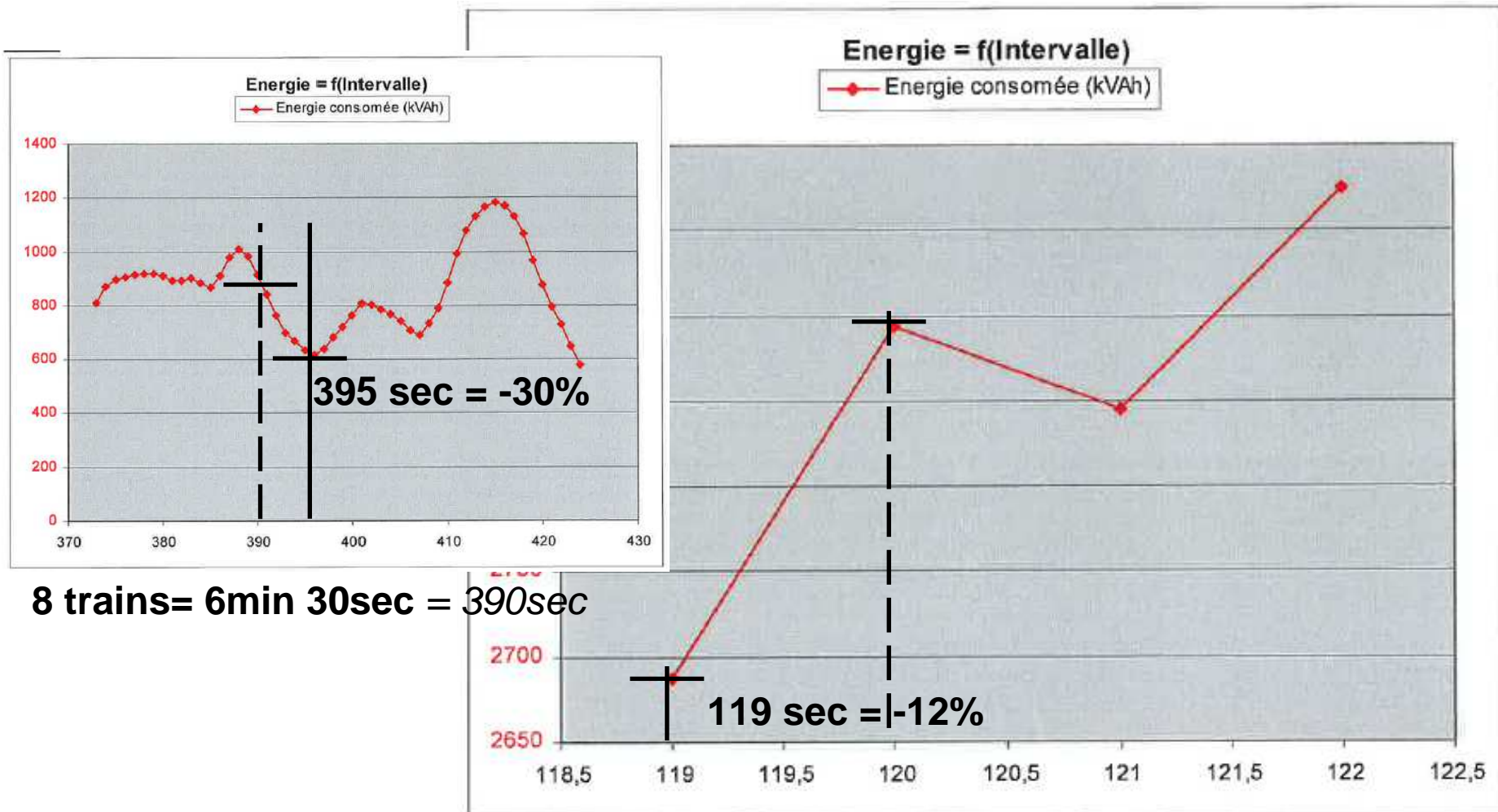


“Innovations” : regenerative electric braking

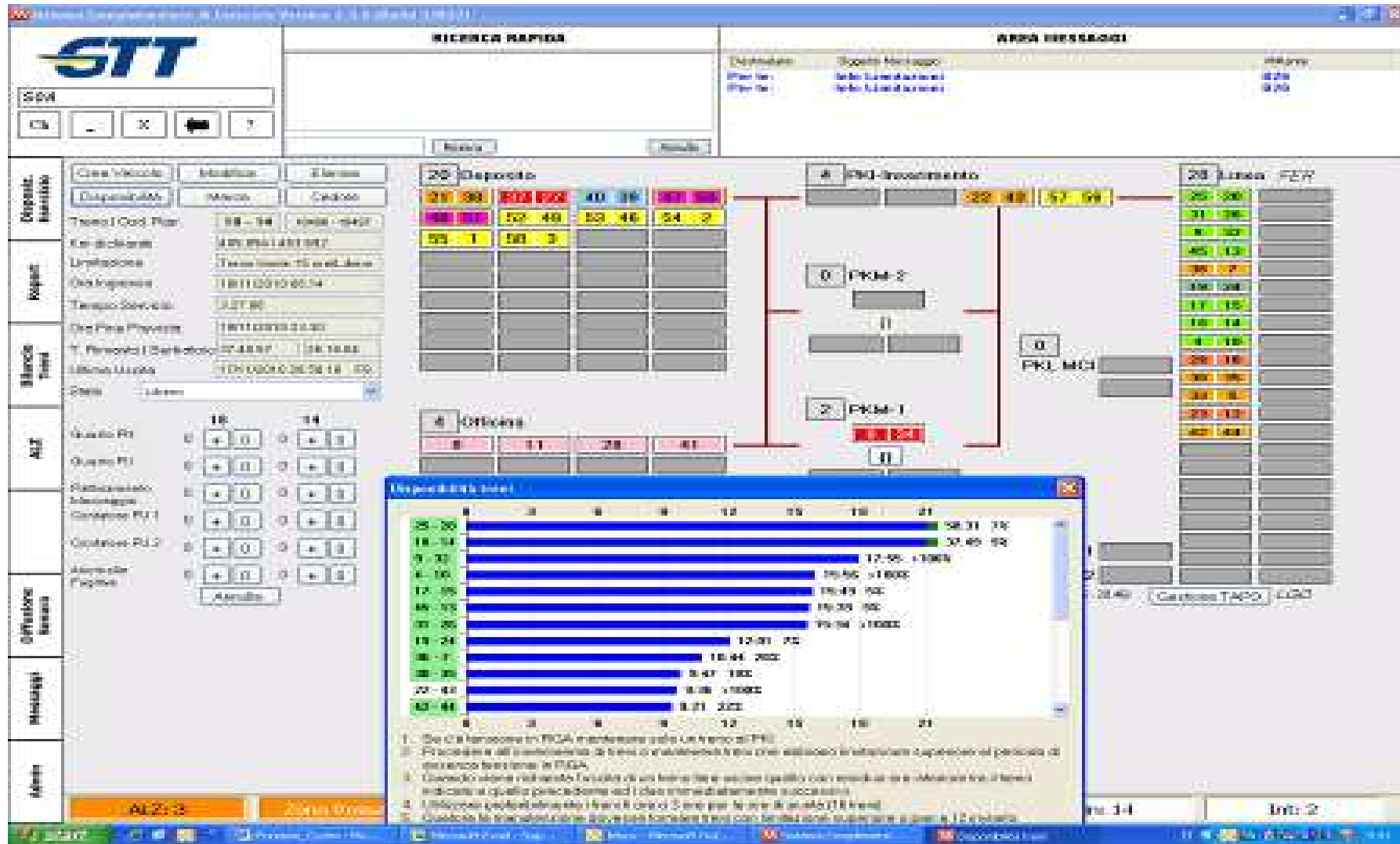
- **Train braking:**
 - Ascend ramps before stations
 - Electric braking to about 5 km/h
 - Target mechanical braking
 - Re-use of energy produced by electric braking
- **Train acceleration:**
 - Descend ramps after station
- **Balance of generated energy:**
 - Re-use of energy produced by other train engines
 - resistor dissipation

Departs / Arrival optimization for
Energy efficiency

→ headway optimization (for energy consumption)



“innovations” – tool for train management



Dispositivo

20	30	50	40	30	20
10	20	30	40	50	60
50	1	50	3		

Linea F2R

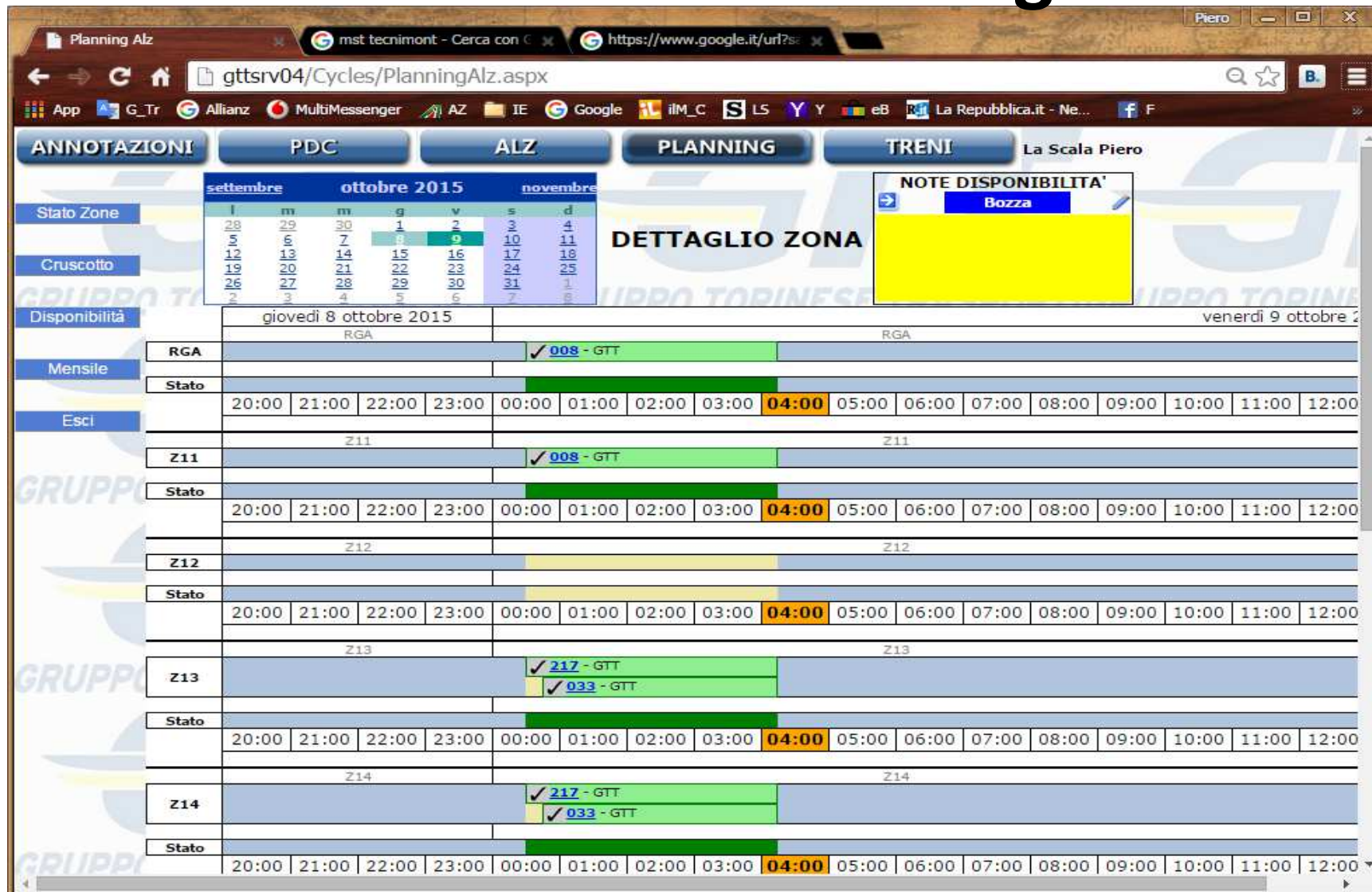
20	30	
30	40	
40	50	
50	60	
60	70	
70	80	
80	90	
90	100	
100	110	
110	120	
120	130	
130	140	
140	150	
150	160	
160	170	
170	180	
180	190	
190	200	
200	210	
210	220	
220	230	
230	240	
240	250	
250	260	
260	270	
270	280	
280	290	
290	300	

Dispositivo in uso

20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200

- Se il treno è in F2R, mantenere solo un treno in F2R.
- Procedere al cambiamento di treno o al cambio di linea con l'attivazione del pulsante di comando di comando in F2R.
- Quando viene richiesto l'arrivo di un treno, fare sapere quello con il numero di comando in F2R e indicare quello precedente ad indicare immediatamente il successivo.
- Utilizzare questo sistema a meno di 2 ore per fare il piano (18 ore).
- Quando le macchine sono in uso, fare sapere il tempo con il quale sono state utilizzate a meno di 2 ore.

tool x maintenance management



The screenshot displays the 'Planning Alz' web application. At the top, there are navigation tabs: ANNOTAZIONI, PDC, ALZ, PLANNING, and TRENI. The main content area is titled 'DETTAGLIO ZONA' and shows a calendar for October 2015. A table below the calendar lists the days of the month. To the right, there is a 'NOTE DISPONIBILITA'' section with a 'Bozza' button. The main part of the interface is a Gantt chart showing maintenance activities for zones RGA, Z11, Z12, Z13, and Z14. Each zone has a 'Stato' bar and a time grid from 20:00 to 12:00. Activities are represented by colored bars: green for '008 - GTT', yellow for '04:00', and blue for '217 - GTT' and '033 - GTT'. The interface also shows a sidebar with options like 'Mensile' and 'Esci'.

Maintenance : subsystems

	UTO/ATO/ATP	Safety	Usability	Quality
Rolling stocks	★			
Signalling	★			
Way	★			
Power	★			
Platform doors	★			
OCC	★			
Lifts			★	★
Elevators				★
Ticketing				★
Fire protection		★		
Videosurveillance		★		
Tel networks	★	★		★
Lighting		★		★
HVAC		★		★

Maintenance

Make

Or

Buy ?

1. There are enough resources (workers, warehouse, time shifts,..)
2. Special qualifications are not required (lift maint, welder...) or they are present
3. The production amount justifies the process to be implemented
4. The company skill is compatible with the activities to be performed (“railway men” vs plumbers)

1. The above conditions are not verified !!
2. It is making or provision of parts
 1. Equipments or tools or skills (the manufacturer) are requested
3. It is cheaper (at the end of supply chain)

- 0
 - Inspection, identification of problems, ON / OFF
- 1
 - Interventions on redundancy, reset, procedures, degraded modes
- 2
 - Diagnostics and replacement of elements in failure or breakdowns or malfunctions, preventive maintenance
- 3
 - Repair / Revision / Spare parts

Rolling stock maintenance

- **0: Tests before operations – 12.500km maint**
- **1: On board interventions in case of failure, to allow the vehicle to come back**
- **2: Diagnostics and replacement in workshop**
Maint 25 / 50x / 100x / 400.000km
- **3: Repair / Revision / Spare parts**

INTERNAL

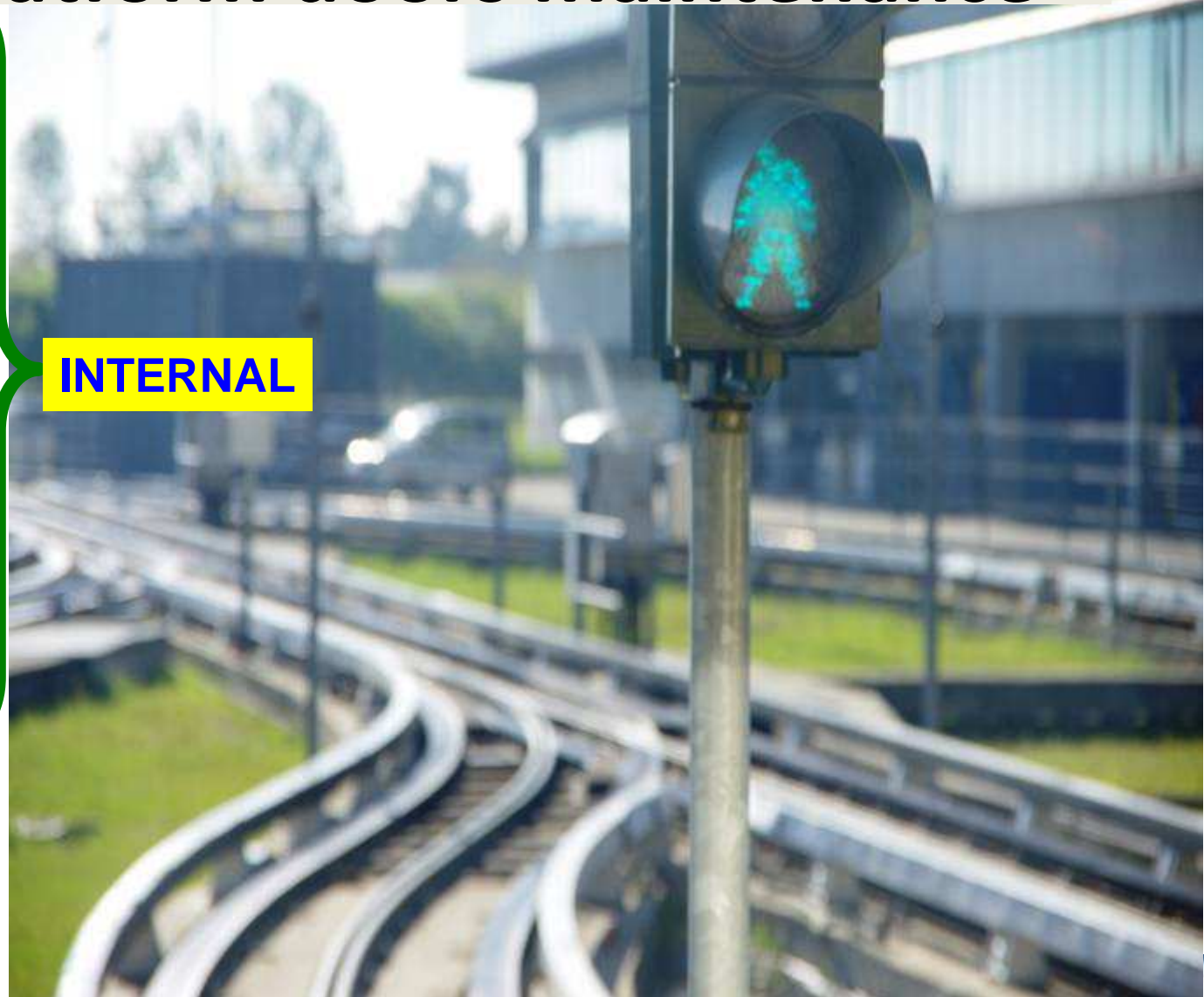


Power / way / signalling / platform doors maintenance



- **0: Tests before operations – visual inspections**
- **1: Interventions on cockpits (redundancy, reset, degraded mode operations)**
- **2: Diagnostics and replacement Configuration Periodic maint**
- **3: Repair / Revision / Spare parts**

INTERNAL



Escalators / Lifts

- 0
 - Tests before operations – visual inspections – ON/OFF
- 1
 - Periodic maint
- 2
 - Diagnostics and replacement
 - Instrumental tests
- 3
 - Repair / Revision / Spare parts



**Special
Qualification Req**

Estate / Station facilities maintenance



SEGNALAZIONE

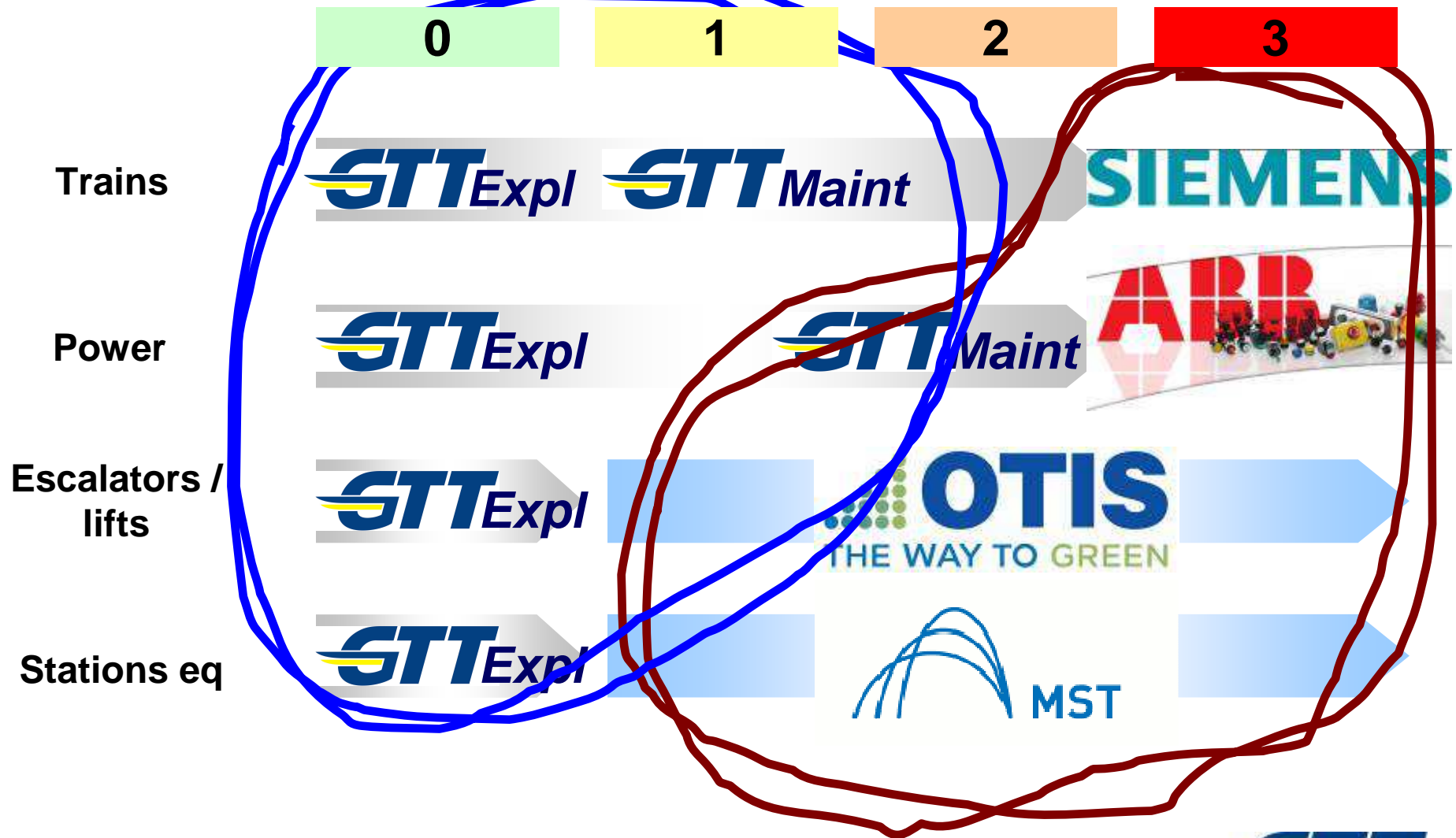
- 0
 - Tests before operations – visual inspections – ON/OFF
- 1
 - Periodic maint
- 2
 - Diagnostics and replacement
 - Instrumental tests
 - Test required by national regulations
- 3
 - Repair / Revision / Spare parts

Special and many skills required



Maintenance

Intervention levels (inspection repair)



- **MAINTENANCE**

- Preventive
- Predictive
- Corrective



- Upgrade / Update / Evolution
- Obsolescence



Obsolescence is the state of being which occurs when an object, service, or practice is no longer wanted even though it may still be in good working order. Obsolescence frequently occurs because a replacement has become available that has, in sum, more advantages compared to the disadvantages incurred by maintaining or repairing the original. Obsolete refers to something that is already disused or discarded, or antiquated.[1] Typically, obsolescence is preceded by a gradual decline in popularity.



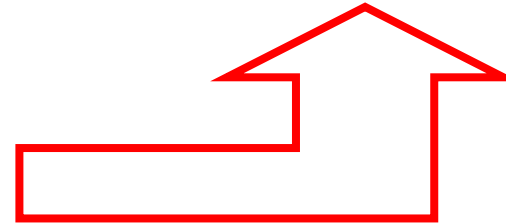
“Obsolescence”

- **Examples**

- Steam locomotive : 100 years
- Electric locomotive : 50 years
- Automatic driverless train : ~~35 years ?~~

5 - 10 anni

- PLC: 10 years
- PC/hardware 3-5 years
- Operating systems / sw: 10 years



“Obsolescence”

clear and present danger

- **To be disclosed and managed**

- 4 – Consultants
- 5 – Expertise
- 3 – User groups
- 2 – Maint engineering
- 1 – Obsolescence reports
 - Periodic e in advance
 - As contractual part of maintenance (repair) contracts





Managed Obsolescence

Required
or Done

- Network: switches AVAYA, NORTEL
- A/V: encoder/decoder, gateways, switchboard, digital voice recording
- Operation centre: phones, PCs, Servers, operating system, video monitors, Rear Projection Video Wall
- Video surveillance: On board PCs
- Station equipments: fireprotection embedded PCs, fire revelators

Not yet
required

- Rolling stocks
- Signaling and UTO
- Wayside



Grazie per la cortese attenzione

Piero La Scala

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