

## SCC

Centralized traffic control system for lines and area junctions





- Genoa junction
- Venice junction
- Naples junction
- Palermo junction
- West Coast line (Tirrenica)
- East Coast line (Adriatica)
- Bologna-Brennero Line

**Main benefits:**

The SCC enables the achievement of the top capacity levels of lines consistent with the existing equipment, the concentration and best coordination of the fundamental activities of the control system, optimize the productivity level of the staff involved in managing the station regulation and reduce the costs of the infrastructure.

As far as the final customer, the SCC has the capacity to increase the quality of the service, improve real time information, supply a safeguarding service of the infrastructure and guarantee a high security level.

**General**

RFI, the Italian National Railways, with the support of Italferr, has set up a project for the technological development of the Italian railway network with new systems, called SCC, for the railway traffic control of the main lines and junctions.

SCC is composed of 3 hierarchical levels: a Control Centre, which represents the control room where all the Signallers operate, some Maintenance Posts and several Peripheral Posts located in stations and stops.

The Rear Projector panel presents the whole controlled area in a graphical way, and gives to the Signaller a real-time view on the traffic and infrastructures status.

Each operator desk of the Control Centre comprises several monitors which allow for various MMIs to be activated at the same time, updated in real time with graphs and windows for the controls, data acquisition and insertion.

The SCC' goal is to:

- introduce and expand the automation on the control and supervision activities on lines and junctions of the railway network,
- upgrade the infrastructure maintenance procedures in an innovative way, by using computer based systems and modern diagnostic systems,
- realize a new operational and prescriptive model of the organization and of the work procedures based on the model defined above,
- increase the quality of services offered to users according to the concepts of uniformity, efficiency and safety.

A key element is the close match between Traffic-Control activities and Diagnostic and Maintenance support, with particular respect to predictive diagnostic functions aimed at enhancing the realization of an on-condition maintenance.



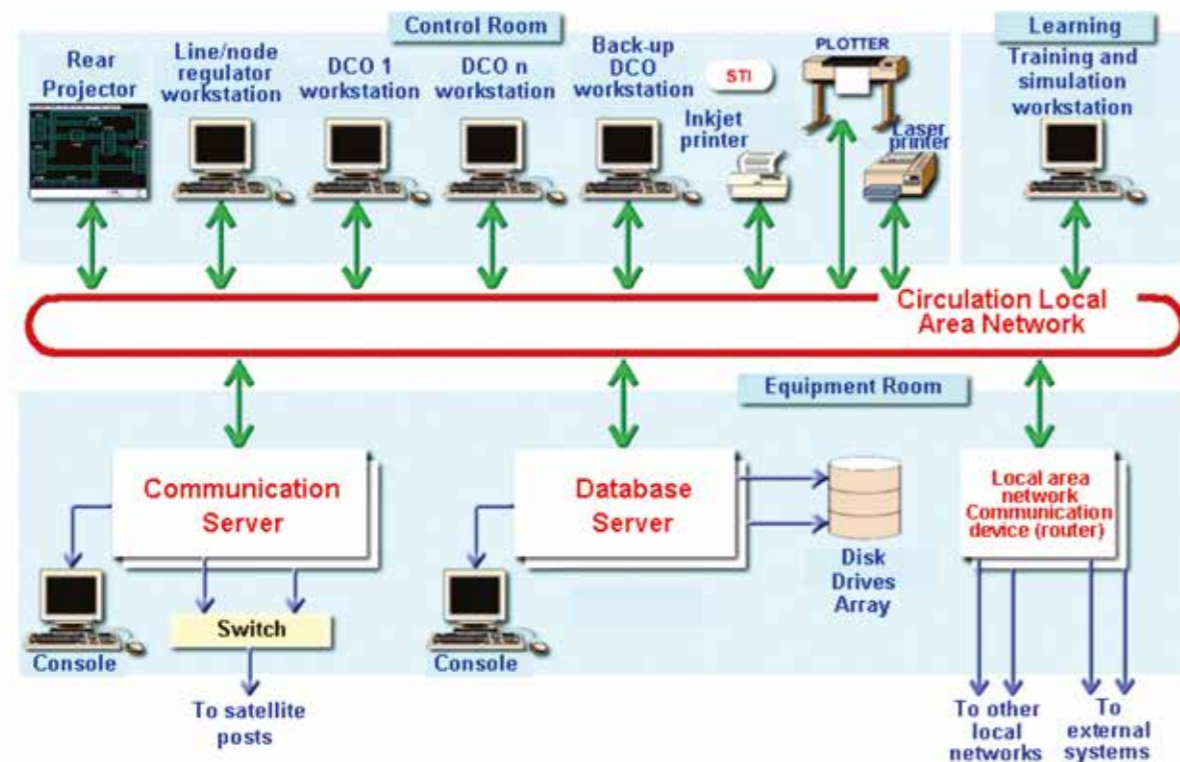
	Genoa junction	West Coast line (Tirrenica)	Venice junction	East Coast line (Adriatica)	Naples junction	Bologna-Brennero Line	Palermo junction
Control Centre	Genoa	Pisa	Mestre	Bari	Naples	Verona	Palermo
Trains/day	650	500	631	590	1150	400	490
Line length	205	500	387	649	137	287	232
ACEI Relay Interlockings	23	43	34	54	19	23	60
ACC CBI	4	18	3	15	7	22	11
Stops	8	29	30	8	11	3	47
Maintenance Sites	4	6	6	8	6	6	6
I/O digital channels for traffic	6288	17184	15744	23616	6352	9822	27000
I/O digital channels for diagnostic and maintenance	7856	21936	16080	24416	9088	11374	18000
I/O analogic channels for diagnostic and maintenance	2848	7520	5616	8640	2720	3488	13000
Control Centre Operators	16	20	20	20	19	20	26
Mimic Panel (screens/visual area)	16 16x3 m	26 26x3 m	32 32X3 m	26 26X3 m	22 22x3 m	-	-

## Structure

The architecture of each SCC is a pyramid like and is based on a Control Centre and on a series of Maintenance Sites (Pman), each of them is linked to a varying number of Peripheral Posts, which belong to the line managed by the Pman; the data transmission network implements the connection among Control Centre, Pman and Peripheral Post.



Control Centre - Circulation Subsystem



### Control Centre Architecture

The Control Centre structure is based on a distributed processing architecture (client-server architecture), with COTS Hw and "open" OS according to the POSIX stand.

All the equipment (computers, work stations, network equipment, printers etc.) is duplicated in such a way that no individual failure (and in some cases a double failure) may cause the loss of the system.

The Control Centre has four independent processing systems for:

- Traffic Control and Mimic Panel,
- Diagnostic and Maintenance,
- Public Address
- Security / CCTV.

Each and every processing system comprises:

- Data Base Server in Cluster configuration with shared Disk Array.
- Communication Server in a duplicated configuration
- A series of operator desks with high resolution color monitors.
- Various equipment such as printers, plotters, etc.

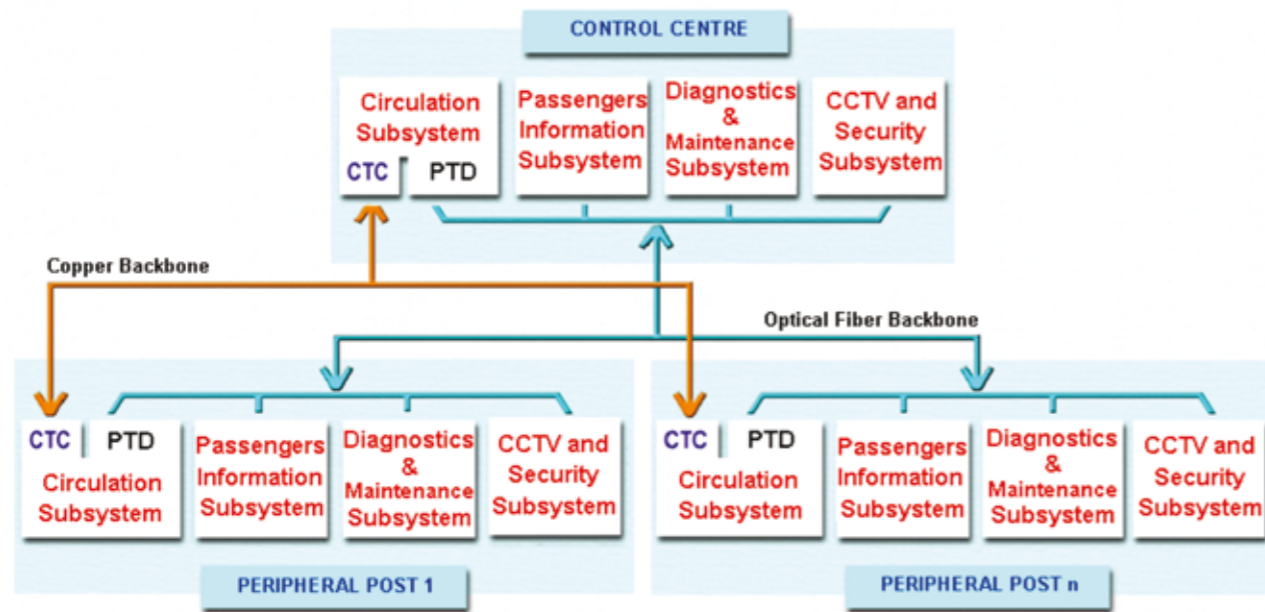
The mimic panel is composed of video projectors with direct projection on a 100" screen.

Alternatively, the client may choose to represent the same line on a series of mimic panels as it has already been done on the SCC of the Bologna - Brennero line or the Palermo junction. In this case, the panels used are 46" TFT/LCD panels or bigger.

All the equipment in the Control Centre is connected with a high speed ethernet duplicated system, based on the HUB Switch Fast Ethernet and divided into virtual sections (Virtual LAN VLAN), one for each subsystem.

A router in a duplicated configuration enables the communication among different virtual sections, with the peripheral locations (by the WAN) and with the external systems.

Operators desks are equipped with various high resolution monitors, with graphical MMI's based on a windows style with the possibility of dimensioning (resizing and pan/zoom) and with an advanced support (selection menu / pop-up or pull-down menu, cut & paste, help utilities).



## Telecom Network Architecture

The Telecom network links the Control Centre to the Peripheral Locations (Peripheral Posts and Maintenance Sites). The transmission of data for each system is carried out by logically subdividing the line in sections, one for each jurisdiction. For the Traffic Control Subsystem (command and control of traffic) the transmission of data is based on duplicated copper lines (telephone duplex cables) with ring closure at the section. For the CCTV subsystem, specific PCM channels are used and these are different for the link between the Peripheral Post and the Control Centre and the link between the Peripheral Post and the Maintenance Sites.

Apart from the above mentioned links used for remote control and remote checking, the Control Centre is

linked to the Peripheral Post and the Maintenance Sites by a router based WAN network and 64Kbps point to point channels on the PCM system; traffic on this network "gives information" and involves the electronic mail between the Maintenance operators, the configuration updating files, the documentation of the system and the manuals for the documental system, as well as the timetable for the use of Public Address.

The client may choose among different telecommunications network architecture options, but depending on the transmission support already available. For instance, at the Palermo junction, the whole Data Transmission uses a double 2 Mbi WAN.



## Peripheral Post Architecture

The Peripheral Post mission is to interface with the local interlocking and management of the operator interface for the local station operators.

Each Peripheral Post is made up of one or more Satellite Posts, depending on the activities required by the Peripheral Post itself: Traffic Satellite Post, Diagnostic & Maintenance Satellite Post, Public Address Satellite Post, TV Surveillance and Security Satellite Post, all with different equipment as for the Control Centre.

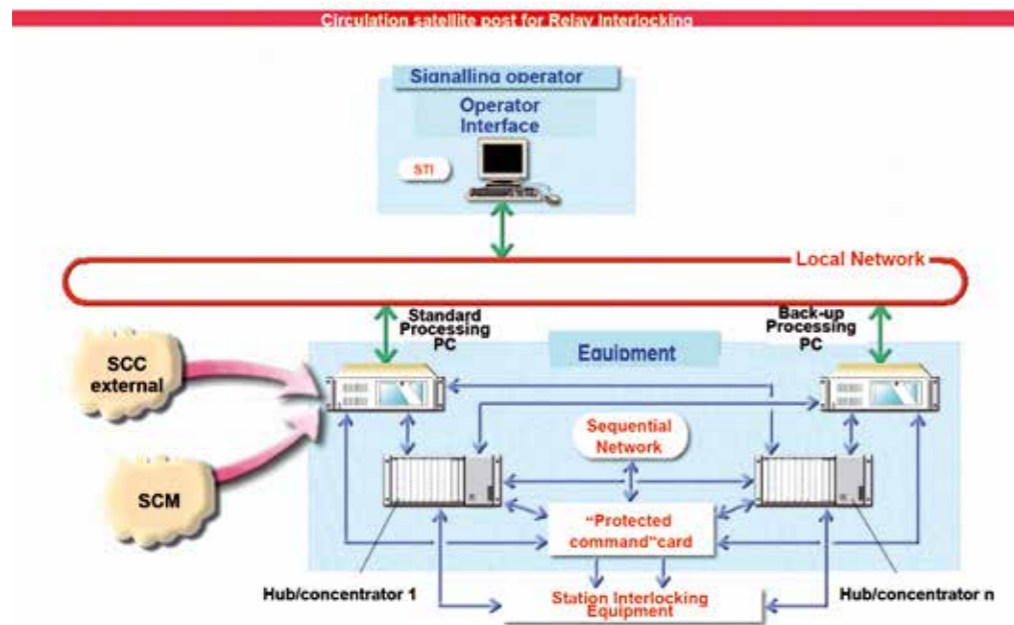
### The Traffic Satellite Post implements the following:

- acquisition of indications and implementation of controls to the equipment on the field: the interface is relay-based with the ACEI equipment, serial with the ACS
- management of the interface of the local operators for the Peripheral Train Describer (TDP) activities and the tele-messages.
- Management of the interface with the external systems
- Management of the interface with the Diagnostic & Maintenance Satellite Post

The Traffic Satellite Post, as the other Posts is made up of industrial personal computers in a duplicated configuration, equipment that gathers I/O from the field, equipment for the protected commands, operator interface desks and the local ethernet network. Interface with the Telecommunication network is achieved via serial ports on the Industrial Personal Computers (for controls and indications) and via HUB-Router of the Peripheral Post (for the WAN network),

### The Diagnostic & Maintenance Satellite Post implements the following:

- acquisition of the diagnostic state of the Signalling Objects via dedicated acquisition equipment
- acquisition of the state and execution of controls to auxiliary objects via I/O distributed equipment
- acquisition of the state of the other satellite posts in the station
- management of the operator interface for the local diagnostic activities and for the documental system



### The Public Address Satellite Post implements the following:

- management of voice announcements in stations and stops: these announcements are made with a voice card.
- management of monitors for passengers, ticket offices in stations and stops
- management of notice boards, signal boards and remote indicators

### The TV Surveillance and Security Satellite Post implements the following:

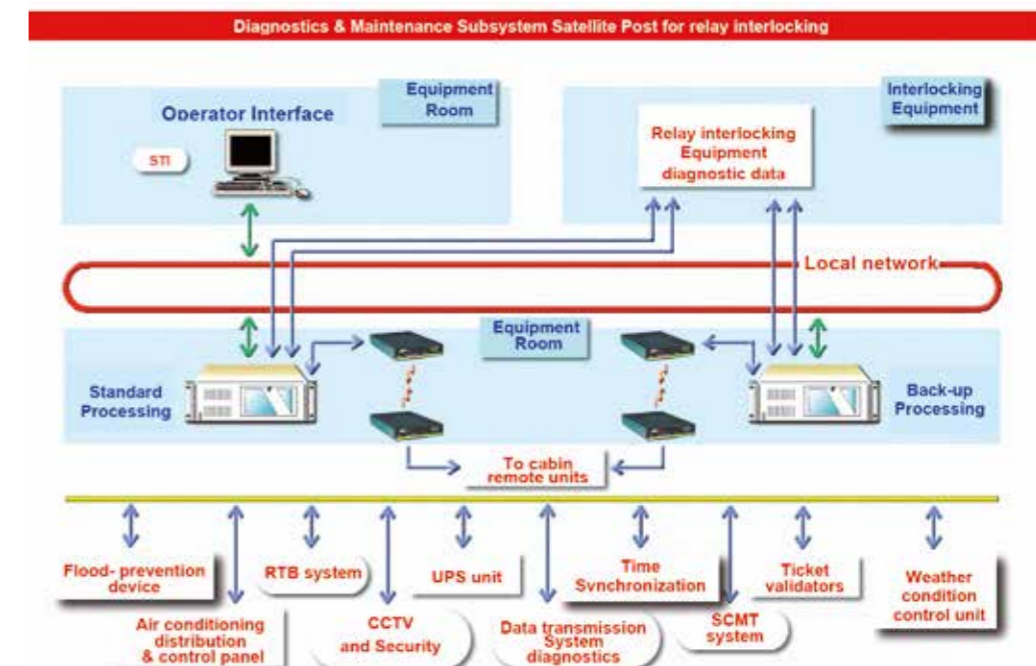
- management of the CCTV system: acquisition of the camera images, digitising and sending off to the Control Centre and Maintenance Sites
- recording of the camera images on a digital backup: motion detection alarm trigger activities
- local and remote reproduction of the recorded images
- management of fire fighting and break in switchboards: The computers acquire the state of the working keys, smoke detectors, magnetic and volumetric presence detectors.

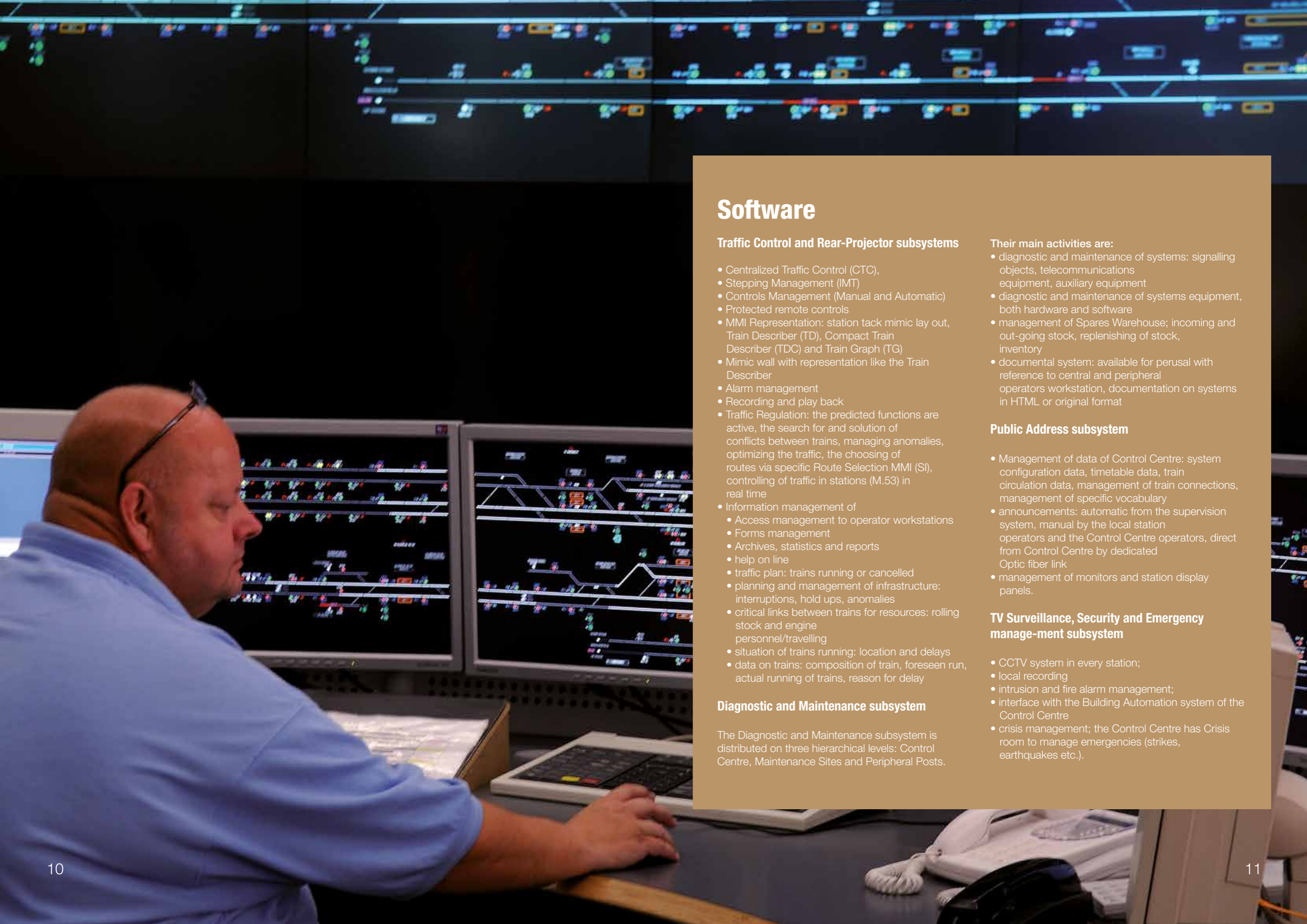
## Maintenance Sites (Pman) Architecture

The Maintenance Sites manage on a Diagnostic and Maintenance level as well as on a CCTV image level, the Peripheral Post of the section in its jurisdiction.

Each Maintenance Site is made up of two processing units on reciprocal fallback, both have three colour monitors and the necessary CCTV system equipment (matrix video, monitor, etc.) to view the images; the equipment is all linked to each other in local Ethernet network.

In each Maintenance Site there is a spare warehouse for the maintenance of the equipment both of the Maintenance Sites and of the Peripheral Posts of the section.





## Software

### Traffic Control and Rear-Projector subsystems

- Centralized Traffic Control (CTC),
- Stepping Management (IMT)
- Controls Management (Manual and Automatic)
- Protected remote controls
- MMI Representation: station tack mimic lay out, Train Describer (TD), Compact Train Describer (TDC) and Train Graph (TG)
- Mimic wall with representation like the Train Describer
- Alarm management
- Recording and play back
- Traffic Regulation: the predicted functions are active, the search for and solution of conflicts between trains, managing anomalies, optimizing the traffic, the choosing of routes via specific Route Selection MMI (SI), controlling of traffic in stations (M.53) in real time
- Information management of
  - Access management to operator workstations
  - Forms management
  - Archives, statistics and reports
  - help on line
  - traffic plan: trains running or cancelled
  - planning and management of infrastructure: interruptions, hold ups, anomalies
  - critical links between trains for resources: rolling stock and engine personnel/travelling
  - situation of trains running: location and delays
  - data on trains: composition of train, foreseen run, actual running of trains, reason for delay

### Diagnostic and Maintenance subsystem

The Diagnostic and Maintenance subsystem is distributed on three hierarchical levels: Control Centre, Maintenance Sites and Peripheral Posts.

### Their main activities are:

- diagnostic and maintenance of systems: signalling objects, telecommunications equipment, auxiliary equipment
- diagnostic and maintenance of systems equipment, both hardware and software
- management of Spares Warehouse; incoming and out-going stock, replenishing of stock, inventory
- documental system: available for perusal with reference to central and peripheral operators workstation, documentation on systems in HTML or original format

### Public Address subsystem

- Management of data of Control Centre: system configuration data, timetable data, train circulation data, management of train connections, management of specific vocabulary
- announcements: automatic from the supervision system, manual by the local station operators and the Control Centre operators, direct from Control Centre by dedicated Optic fiber link
- management of monitors and station display panels.

### TV Surveillance, Security and Emergency management subsystem

- CCTV system in every station;
- local recording
- intrusion and fire alarm management;
- interface with the Building Automation system of the Control Centre
- crisis management; the Control Centre has Crisis room to manage emergencies (strikes, earthquakes etc.).

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