

New COPP System: safety critical SIL3 control for platform screen doors

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Public transport making the right mobility choices





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- SME specialized in the development of safety critical systems
- Located in Aix en Provence and Paris
- 50 people (engineer, Phd)
- Partnership with a factory to provide industrial equipments
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Clearsy's trademark associated to Clearsy railway products

Fersil – Clearsy – many references



- **DOF1**: Device to Open and Close Platform Screen Doors ; safety critical SIL3 system, put in service on the line 1 of Parisian subway
- **COPP**: Device to Open and Close Platform Screen Doors ; safety critical SIL3 system, actually in service on the line 13 of Parisian subway (Châtillon station equipped by an automatic turn back)
- **COPPILOT**: Device to Open and Close Platform Screen Doors : to equip one or many stations ; without any rolling stock equipment ; 3 platforms equipped 3 years ago in Paris
- **DPAS**: SIL4 safety critical system, Train Passage Detection
- **KFS**: System to detect and stop a train when it goes across a red signal ; installed in Corsica France
- **KPVA**: train over speed detection independent system; installed in several lines in Paris
- Safety critical software : Val de Roissy (for Siemens TS), Urbalis Evolution, new CBTC available in Beijing Subway (for Alstom)

COPP system – Paris Line 13

- Device to Open and Close Platform Screen Doors
- Safety critical SIL3 system
- Complies with EN50129, IEC61508, EN50126, and EN50128 standards, and uses the B Formal method.







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General context



- The Line 13 (Parisian subway), a line carrying heavy traffic
- RATP (Parisian subway operator) proposed a driverless automatic turn back in Chatillon end of line station, to increase train frequency
- For safety reasons, Platform screen doors must be installed in this station to protect the railway during the turn back maneuver
- KABA provides the PSD
- Clearsy provides COPP control system
- Beginning of the project : August 2007
- First operational system in service: May 2008
- Clearsy provided specification, prototypes and serial material
- 3 platforms and all trains equipped



COPP Functions



- COPP sensors observe a portion of the track area and analyze the behaviour of trains travelling through stations. When appropriate conditions are present, it then orders the platform doors to open or close.
- More specifically, the COPP system:
 - Detects the absence of the train on the track under observation
 - Detects a moving train on the track under observation
 - Detects that the train, in the area where it stops at the platform, is moving at a speed lower than 0.5 km/h (which speed is considered null).
 - Detects that a train is present at the platform and located in the nominal loading area, i.e. Loading Point +/- 1.10 meters.
 - Acquires and provides information supplied by the train on the opening and closing of the doors, provides this information to the train by the ground and processes this information.

Why the PSD create new hazards?

- The PSD make people on the platform calmer, but in return they pay less attention as they feel protected
- This creates new patterns of behaviour, such as people on the edge of the platform leaning against the entrance doors as they wait for the train
- What would happen if, due to some kind of fault, the doors were to open whilst the train was absent or only just approaching?

How do you avoid the new hazards?

- RATP (Paris underground) has made a study of the hazards linked to the PSD installation and defined several new ones.
- RATP has thus assigned safety levels which must respect certain functions of the whole PSD system:
 - SIL3 for the opening function of the entrance doors, on the control system which manages all the entrance doors on a platform (system linked to the train).
 - SIL2 for the control and command function of a single entrance door.
 - SIL4 for the control loop for locking the entrance doors, which gives the train driver permission for the train to leave by means of a specific signal.



- The development of the COPP system complies with EN50129, IEC61508, EN50126, and EN50128 standards, and uses <u>the Formal B method</u>
- The development process involves a Clearsy safety team that is independent from the development team
- The RATP has had the system verified by an independent body (EOQA)
- The safety SIL3 guarantee relates to the presence and correct positioning of the train in a stopped position at the platform





- A similar system (DOF1) is being installed on the line 1 of the Parisian Subway
- A new version of COPP system, without sensor, is being developed to be installed on the line 13 in 2010

Why an autonomous system like COPP



- COPP is managed independently from the train's automatic driving mechanisms.
- it enables safety levels to be maintained, without modifying what are already complicated existing systems
- COPP/DOF1 systems provide significantly shorter response times because of direct link board/wayside to control PSD (time to deliver the opening command: 500 ms max)
- It also continues to enable the automatic door opening function to be maintained should the CBTC fail
- It can be available on the existing lines without changing the automatism and the signalling

With this safety system, it's now possible to install Platform Screen Doors on existing lines and trains without changing the existing system