Abstract: In order to fulfil the requirements of European Standard EN 473, in particular for NDT applied to the safety components of railway rolling stock (axles, wheelsets and bogies), the CFCM (railway maintenance certification committee) was created in France in 1997. Founded by the SNCF, the RATP and the AFWP (French association of freight wagon owners), CFCM is one of five industrial sector committees of COFREND (French confederation for non-destructive testing). CFCM certification covers levels 1, 2 and 3 for magnetic particle testing (MT), ultrasonic testing (UT) and, more recently, for penetrant testing (PT). Over ten years, the CFCM has delivered more than 900 certifications, mostly from France but also from Belgium, Luxemburg and the UK. To date, 650 operators have a valid certification.

In 2005, the certification of UT operators for rails was added to the scope of the CFCM's activities. At a time of intense development for rolling stock interoperability and the opening up of the markets for railway operators, CFCM has become a major player in the management of NDT for maintenance of safety components.

1 Introduction

For a little over half a century, SNCF has been employing non-destructive testing in the maintenance of safety components for rolling stock (axles, wheels, bogies). It quickly became apparent that special training was required for the operators. This training was introduced around 1970 at SNCF's rolling stock laboratory, then located at Levallois, and covered the three methods: ultrasound, penetrant testing and magnetic particle testing. The training courses, lasting several weeks, included general theoretical training in the methods and components, and also practical training on components withdrawn from service with real defects.

On completion of the training cycles comprising an introductory phase and an in-depth phase, the skills of the agents were monitored by their local managers. This naturally gave rise to an "internal" qualification based on a frame of reference devised by the maintenance activity of the railway companies.

The value of this organisation was immediately recognised from the significant improvements it produced in the reliability of safety components. However, at the time, there was no formal validation of skills outside of the employer.

The emergence of new international regulations (EN 473, UIC Leaflet 960) in the 1990s made it necessary to revise the arrangements. The new rules on railway interoperability meant that the railway companies of one country had to provide the infrastructure manager of another
country with evidence of their capacity to maintain their rolling stock using recognised frames of reference, and also to open up their maintenance contracts to European tendering. A special railway certification structure, independent of the employer, was therefore set up for third party NDT personnel. This structure, the CFCM (railway maintenance certification committee), was set up at the start of 1997 by SNCF, RATP, and AFWP (French association of wagon owners). The CFCM is a sectorial committee of COFREND, the French confederation for non-destructive testing.

2 The CFCM

2.1 The reasons for a railway maintenance sectorial committee

Non-Destructive Testing (NDT) is used in railway maintenance to detect fatigue cracks in areas identified as susceptible from the experience feedback and calculations. On rolling stock, NDT is used mainly on:

- solid or hollow axles (magnetic particle testing on the "visible" parts, ultrasound testing in non-accessible areas, wheel seats, etc.),
- wheel rims (ultrasound testing for the absence of internal cracks)
- bogie frame (magnetic particle, penetrant or ultrasound testing of certain welded zones),
- the various bogie components and body structures that have been shown by the experience feedback to require monitoring during maintenance: magnetic particle, penetrant or ultrasound testing on gears (Fig 1), bearing races, linkages, wagon tanks, etc.).

![Figure 1: Automatic MPI bench for gear wheels](image)

Rails are special products that can develop different types of damage, including internal cracking modes that must be detected by preventative and non-destructive methods in order to ensure the safety and reliability of the tracks. Since the 1950s, rails have been subjected to ultrasound inspection using both manual and train-borne systems in order to detect and then measure faults as part of preventive maintenance. Given the large number and relatively slow development of these faults, once detected on the track they are left and monitored regularly. Once they reach a certain size and the probability of rupture is too great, defective rails are removed more or less quickly depending on the type and size of the defect. The safety and reliability of train movements are therefore directly linked to the quality of the operators who assess the size of the cracks.
The particular geometrical characteristics of railway components, the specific nature of the maintenance examinations (on site for rails, in workshop or under the vehicle for rolling stock) and procedures and the wish to combine railway with NDT competence have led to the creation and recognition of a special certification sectorial committee (CFCM), alongside the other four committees currently existing within COFREND (figure 4).
2.2 Organisation

The CFCM has two areas of activity: RAIL and ROLLING STOCK. Three NDT methods are covered: ultrasound testing (UT), magnetic particle testing (MT) and penetrant testing (PT). For UT and MT methods and agents of levels 1 and 2, the ROLLING STOCK sector is further divided into two sub-sectors: wheelsets and bogies. Figure 5 presents the overall structure.

Although widely used in under-vehicle maintenance, visual examination is not yet covered by certification. It should also be noted that ultrasonic and magnetic particle testing are hardly ever carried out under the vehicle, but only in maintenance workshops on dismantled components, where the operating conditions are much more favourable.

![Figure 5: Structure of the CFCM](image)

The frame of reference used by the CFCM is European Standard EN 473. The requirements of this standard are divided into four consecutive stages:

- Training,
- Qualification (Exam)
- Certification
- Authorisation to operate.

2.3 Certification levels

The three levels of the EN standard are covered:

- Level 1: for operators who carry out testing using qualified operating procedures.
- Level 2: for personnel who prepare and write the procedures and operating methods to be applied by the level 1 operators.
- Level 3: corresponds to engineer level. These persons qualify the procedures prepared by the level 2 personnel prior to their application. They act as examiners for the practical and theoretical exams taken by the candidates at levels 1 and 2.

2.4 Prerequisites and training of operators

Before enrolling for an exam, candidates must be in possession of the prerequisite personal skills and training.
In France, a ministerial decree that came into effect on 1st January 2004 sets out the "conditions of fitness and professional skills that are required of personnel if they are to be authorised, even on an occasional basis, to carry out duties related to the safety of users, personnel and third parties on the national rail network".

The duties of "rolling stock maintainer", and more specifically the operators in charge of non-destructive testing, are covered by this decree, commonly known as the "skills decree". The decree covers the training, verification of psychological skills (psychomotricity, behavioural and cognitive abilities) and physical fitness (visual acuity). It is based on the third party certification from EN 473.

Training includes a module at a specialist school: for the Rolling Stock sector at the Quatre Mares maintenance centre near Rouen, and for the Rail sector at the national infrastructure training centre (CNFI) at Saint OUEN near Paris. To complete the training there is an industrial training phase under the responsibility of a "tutor"; an agent holding level 1 or 2 certification in the same method, who is responsible for confirming the diagnostic results obtained by the trainee.

### 2.5 Qualification /exam

A candidate who fulfils the prerequisites meets the visual acuity requirements and has the necessary training and industrial experience can then take the qualification exam (figure 5). There are two examination centres: one at the premises of the Agence d’Essai Ferroviaire (AEF) at VITRY sur Seine (figures 6 and 7) for Rolling Stock, and the other at the CNFI at Nanterre for Rail (figure 8).

![Figure 6: Practical exam for magnetic particle inspection on wheelsets](image)

![Figure 8: Ultrasound practical exam on rails](image)

### 2.6 Award of certification

On completion of the exams, marks are awarded by the level 3 examiners. Failure to detect certain defects results in the disqualification of the candidate who must then re-sit the exams. All of the marks awarded by the Qualification Centre are examined at the meetings of the CFCM board.

Under the terms of EN 473, if the marks are satisfactory, qualification is recognised and certification is proposed to COFREND. Recognition of qualification leads to the issuing of a
COFREND-CFCM certification card giving the NDT method and level and date of certification.

It should be noted that since the end of 2006, the processing of candidates' files and the transfer of results between the CFCM and COFREND examination centres takes place via the Internet using the GERICCO database, a new computerised system for certification set up by COFREND.

![Figure 7: NDT qualification centre for rolling stock at Vitry sur Seine](image)

2.7 Authorisation to operate

Certification is a means of recognising a person's competence. There must also be an arrangement to show that the person concerned has the authorisation of the head of the company to operate within a defined environment according to his qualification.

This notion of authorisation is a useful one as it is withdrawn when the person changes establishment or company. Certification, however, remains and must be maintained. The new employer alone is responsible for the new authorisation.

Here too, rigorous monitoring is essential; authorisations can be renewed for periods of one year.

2.8 Conditions for maintaining certification

Authorisation and maintaining certification are subject to the application of effective controls. This involves rigorous monitoring within the maintenance company in order to control the activity of all the agents. Thus, level 3 agents monitor the skills of the level 2 agents, and level 2 agents monitor the skills of the level 1 agents. If there has been insufficient practice, authorisation is not renewed and, in accordance with standard EN 473, certification is withdrawn.

These arrangements rely on the sharing of tasks and responsibilities between,

- The employer,
- The certification committee,

as illustrated in figure 9.
2.9 Control of all CFCM procedures

The principle adopted is the conventional one for quality assurance. Audits of CFCM are carried out by:

- COFREND, to check the proper organisation of the whole system set up by the members of CFCM,
- CFCM, with respect to the qualification centres, to assess the efficiency of the arrangements for conducting exams, respect for confidentiality of questionnaires and professional standards.

3 Ten years in existence

Figure 10 illustrates the situation as regards certifications, with to date approximately 900 railway maintenance certifications currently valid, held by 650 operators.

Of this total, 90% are level 1 operators. These figures show the difference between the railway sector and other industrial sectors (figure 11), which have a much higher number of
level 2 agents. This is due to the much smaller range of components inspected, the repetitiveness of the examinations and the fact that these examinations are made using very precise procedures, previously validated by level 3 agents, well suited to level 1 agents and allowing no room for interpretation. This setup only requires level 2 agents for providing supervision and producing these procedures.

Around 30 exam sessions covering all methods take place each year at the two centres, involving around 150 candidates.

The pass rate for the exams, that was initially rather low has now stabilised at between 60% and 80% (Figure 12).

Over these ten years, the range of methods and sectors covered has changed considerably. It was originally limited to ultrasound on wheelsets and magnetic particle testing of wheelsets and bogies. In 2004, certification for ultrasound on bogies was introduced. This was followed in 2005 by the creation of penetrant testing certification and the incorporation of the RAIL sector, with the first rail ultrasound sessions. After eighteen months’ operation, half of
the 130 ultrasound operators in the Rail sector were awarded level 1 COFREND / CFCM certification. By the end of 2010, all personnel will be validated by this body.

It should be pointed out that this CFCM certification is not limited to the member companies of the sectorial committee (RATP, SNCF, AFWP), but is open to certain NDT operators of other European railway maintenance companies who recognise CFCM as a certification body.

4 Conclusion

Today, the European railway landscape is undergoing radical change with the arrival, for freight and also for passenger transport, of new railway operators alongside the major historic operators, and with the emergence of new maintenance companies for both rail and rolling stock.

Major changes are also underway in the area of regulations and reference standards with the introduction of the Technical Interoperability Specifications (TSI) issued by the European Railway Agency and European standards on railways. One of these standards currently at draft stage (pr EN 15313) will define the requirements and mandatory operations to be applied in maintenance and in operation for railway wheelsets. Non-destructive testing is, of course, a part of this and compliance with EN 473 for operators is an essential requirement for all new wheelset maintainers applying NDT.

After ten years of operation, the CFCM is now a well-established committee that seeks to achieve recognition within Europe as a certifier of NDT personnel in the field of railway maintenance.