

## **Rolling-stock change risk management: an innovative approach**

J. P. Bert & F. Jubert

*Department of Safety Control, RATP, Paris, France*

### **Abstract**

The objective of this paper is to provide an empirical analysis of the difficulties encountered by drivers from a metro line in adopting a new type of rolling stock and to present the innovative process set up to accelerate this adoption. The introduction of a new type of train on a Paris metro line was met by some drivers with a sense of nervousness. Initial difficulties, in terms of training and braking, added to various technical problems, hindered the adoption, causing a genuine concern about driving the new trains. A rather superficial knowledge of the rolling stock made switching over to the new trains more difficult, leading to a fear of rejection of the new rolling stock by drivers and a prolonged delay of the processing of faults. Having identified those risks, the management of the metro line commissioned a report on human and organisational factors, with a view to identifying several management levers to facilitate switching to the new rolling stock. The initiative presented in this paper was started in this context. This innovative perspective, which aims at reducing the risks related to changing rolling stocks, derived from a meeting between a sociologist who graduated recently and a seasoned executive with a strong background in people management. This blend between theory and practical experience enabled one to build an innovative process, combining knowledge-management and operational marketing.

*Keywords: rolling-stock change, risk management, qualitative approach, knowledge-management, operational marketing.*



1 Introduction

The study proposes an empirical analysis of the problems drivers from the Paris metro line 2 faced whilst switching over to a new type of rolling stock and describes in detail the innovative process set up to speed up this adoption.

1.1 Focus of the study

Line 2 is one of 14 lines of the Paris metro. It follows a semicircular route in the northern part of Paris, by and large following the former outskirts boulevards. It was the second line to be opened in the capital: its first section was commissioned in December 1900 and it was completed in April 1903 in its current configuration between "Porte Dauphine" and "Nation" (fig.1). The line has remained unchanged ever since. It ranks #7 in terms of traffic and is 12.4 kilometres long.

Up until 2006 the line consisted only of type MF67 trains. On the 17<sup>th</sup> of January 2007, a preproduction MF01 was introduced on the line in manual driving mode. MF01 units (fig.2) gradually replace the old MF67. Nevertheless, the introduction of this new type of train on the line gave rise to a kind of apprehension on behalf of drivers. A more superficial knowledge of the train hindered the adoption process, generating a fear of rejection of the new rolling stock by drivers and a prolonged delay of the processing of faults.

Faced with these risks, the management of the line commissioned a report on human and organisational factors with a view to identifying several management levers to help with the adoption of the new train type. It was in this context that the work presented here was carried out.



Figure 1: Plan of line 2.



Figure 2: Exterior of the MF01.



Table 1: Interviewed staff.

Position \ Assignment station	Nation	Porte Dauphine	Total
Drivers' supervisors	1	2	3
Drivers	11	4	15
Total	12	6	<u>18</u>

## 1.2 Survey methodology

About 15 informal interviews were carried out with drivers in their cabin in standard operation conditions. These interviews lasted between 30 and 40 minutes. Drivers were chosen randomly as trains arrived. More than 70% of the driver population present at the time on the line (tab.1) was interviewed.

Several topics related to MF01 were addressed during those interviews: training, the strong and weak points of the train, and braking issues. Short notes summarising these points were then written shortly after each interview.

Additional interviews are also conducted with drivers' supervisors, in order to collect their opinion on the various types of training on the new train.

## 1.3 Presentation

Taking over a new type of rolling stock always follows a learning curve that starts with training and ends when driving is fully mastered. In order to follow this evolution over time, the proposed analysis follows a chronological sequence. Initially it focuses on the problems encountered by train drivers when the first MF01 arrived on the line. It then describes the innovative process set up to speed up the adoption of this new type of train. Finally it addresses the results obtained using this approach.

# 2 A difficult start

The early days of MF01 on line 2 were met with a kind of reluctance by drivers. Initial difficulties in terms of training and braking, added to various technical problems hindered the adoption of the train, causing a genuine fear about driving the new type of train.

## 2.1 Training issues

Whilst the actual contents or the training was reasonably positively perceived by drivers, it failed to remove the last remaining worries about the new type of train. This residual fear was twofold: training was considered too short and some important technical points had not been addressed during the course.

### **2.1.1 Training perceived as being too short**

Training sessions lasted four days. Then two rotations of driving under supervision on the new trains took place before drivers could drive on their own. These training sessions were considered too short by a majority of drivers who were interviewed. In fact, they found it too short to ensure that they were comfortable enough driving the train. Many mentioned in the interviews that they were uneasy during the initial months driving the new trains. One driver actually admitted he always took his training booklet in the cabin with him when he had to drive an MF01.

### **2.1.2 Technical points left unaddressed**

In the course of the interviews, it appeared surreptitiously that the operation of sandboxes used to restore the grip on MF01 was not known by all, including a driver's supervisor who had himself trained drivers. Actually, some drivers thought that the sanding process on MF01 was identical to that of MF67, which it is not.

Besides, it seemed that the change in the lubrication system had not been addressed either. Actually, in the case of MF67, lubrication is carried out by a track lubrication system performed by just a few units whereas, in the case of MF01, it is performed by a wheel flange greaser which features on every single MF01 train.

Both issues on the track-wheel interface had apparently not been addressed in training, yet they are essential in ensuring safety.

## **2.2 Different reactions on braking**

Many drivers acknowledged having encountered difficulties on grasping the braking behaviour of MF01 in operational use. They all mentioned the difference in perception between the old and new trains while slowing down with breaks.

### **2.2.1 Braking with MF67**

One first behavioural difference between both types of trains was that operational braking on MF67 was performed by all five cars. Thus the driver had a feeling the train gripped the track. This reaction was distinctly noticeable while braking.

When a loss in grip occurred while braking in standard operation conditions, MF67 would jam (wheels would jam, there would be a feeling of sliding) a phenomenon that could be identifiable instantly and trigger an immediate reaction from the driver.

### **2.2.2 Braking with MF01**

As braking with MF01 in standard operational conditions applied only to three power cars, for a given breakage intensity, the train would rely more on grip than MF67. It is therefore more sensitive to deterioration of the grip in standard braking conditions.

When faced with the same loss of grip than MF67, MF01, which is fitted with a jam-prevention system, optimises the intensity of braking in standard operation

conditions with respect to the available grip, thus giving the driver the feeling of limp braking, which does not call for reaction to recover the grip.

In fact, the technical performance specific to each train accounted for the difference in sensation, the MF67 jerk being greater than that of MF01. It was this difference that initially led to the lack of confidence in the MF01's braking behaviour.

### **2.3 Various technical issues**

Various technical issues also hindered the early days of MF01.

#### **2.3.1 Issues connected to door operations**

Issues of door closures on MF01 occurred first. These anomalies occurred in the event of heavy traffic. The pressure exerted by passengers on door wings prevented the doors from closing. As far as drivers were concerned, the pressure was too low, hence the need to perform several closing cycles before triggering the departure sound signal, causing a subsequent delay before the train could start again.

#### **2.3.2 "Sliding" issues**

Besides, several sliding problems faced MF01 in controlled manual-driving mode caused long delays in stations however not causing a safety threat. Now these incidents, together with a discrepancy in perceived braking, contributed to a kind of apprehension regarding the behaviour of the new rolling stock.

### **2.4 Risks related to changing rolling stock**

Several difficulties upset the early days of MF01 on line 2, leading to a fear of extended delays in dealing with faults and worse still, the outright rejection of the new train by drivers.

#### **2.4.1 An increased delay in the time dealing with faults**

The most experienced drivers, who often had the longest driving experience on the line, knew the "nooks and crannies of the MF67 by heart". Now, this "nook and cranny knowledge" could not be transposed to the MF01 owing to technological changes, from a wired technology to embedded computers, and also because technical training was considered less in-depth compared with that on MF67.

This more superficial knowledge on MF01 accounted partly for the reluctance felt by drivers fearing faults and also difficulties they came across, to deal with them rapidly.

#### **2.4.2 Rejecting the new train**

Beyond these difficulties related to dealing with faults, a more significant issue of the increasingly bad reputation of MF01 arose. The new train was increasingly perceived by drivers as being less safe than MF67, this being based on the

various incidents that occurred on the line. Many drivers actually threatened to stop driving new trains.

On top of this, some drivers used the MF01 shortcomings for their own strategic goals. As it were, the introduction of this new type of train reshuffled the expertise level on trains: expert MF67 drivers were not necessary expert at driving MF01. To put it differently, the most experienced MF67 drivers had a lot to lose, in particular their expert status, which could lead them to exaggerate issues, thus disrupting the introduction of MF01. For them, this new train meant starting from scratch, going back to square one, which meant a drop in self-esteem which was difficult to accept and could lead to an outright rejection of MF01.

### **3 The proposed approach**

To alleviate these risks related to the change of rolling stock, we proposed an original approach to the management of the line. This innovative prospective resulted from the meeting between a sociologist who had recently graduated and a seasoned executive with a strong background in managing people. This blend between theory and practical experience allowed one to build an innovative process combining knowledge-management [1] and operational marketing.

#### **3.1 A knowledge-management strategy**

The following proposals blend naturally in a global knowledge-management strategy, building on trained and technically competent supervisors/trainers.

##### **3.1.1 Progressing by encouraging the involvement of drivers' supervisors**

The various exchanges that took place between several departments within the company following the various issues of MF01, allowed to derive the first teachings. They seemed explicit enough to be conveyed directly to drivers' supervisors for them to convey them in turn to drivers in order to avoid various opinions that were often wrong as regards the occurrence of such and such an incident.

It was a matter of being part the spearhead of a knowledge-management strategy, with a view to widening the scope of knowledge [2] of drivers' supervisors on the technical points that could be responsible for incidents. To put it differently, supervisors had to be provided with a framework of knowledge-management to allow them to reassure drivers about the behaviour of MF01 through consistent and rigorous technical explanations. The ultimate objective was to spread the relevant up-to-date information to every level in the hierarchy of the line.

##### **3.1.2 Designing practical training**

The uneasiness about the processing of potential faults on MF01 that was identified in the course of interviews could be overcome thanks to enhanced practical training. Training, which had the unanimous backing of drivers, could in our opinion be used as a strong management tool allowing one to alleviate the



residual fear on driving the new type of train. This is why seeing their numbers increase was a genuine benefit for all parties.

As far as the content is concerned, it was beneficial to increase the training on the processing of faults that were most commonly met by drivers. Besides, we believed it necessary to provide a more in-depth technical insight on braking incidents, to delve into sanding and lubricating operations and finally to explain the difference in the braking perception in the light of the performance of both types of train used on the line.

Increasing these practical training sessions on line 2 also required increasing the number of trainers.

### 3.2 An operational-marketing initiative

Many drivers who had been interviewed felt they had not been heard when it came to the MF01 driving issues. They accused the management of the line of not being sensitive and not addressing the issue. However, tests were being carried out to solve the various braking and door closing issues.

Following an operational-marketing approach in this matter [3] by focusing more on communication and by better publicising the various tests could alleviate the perceived reluctance to change thus alleviating growing tensions. This involved energetically emphasising and promoting the attempts by the management of the line to solve the technical issues in order to show to drivers that management cared about their concerns [4].

## 4 Results

Once implemented, it did not take long for the first tangible results to appear and it could be said that today there are no adoption issues of MF01 as such.

Following the recommended technical and practical training, drivers adapted driving to the specificities of the new train and now master it fully. Based on what they say, drivers have adjusted braking to the new train.

Besides, the operational-marketing initiative carried out during the tests on braking and door closure allowed one to alleviate the budding tensions between drivers and the management of the line, thus preventing the risk of the new train being rejected.

Finally, whilst adopting the new rolling stock started as a struggle, it finally succeeded nevertheless. The fact that a wide majority of drivers who were interviewed now prefer driving MF01 despite having blamed it previously is clear sign of this success.

## References

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