RailKonsult

Office of Rail Regulation

Further Assessment of Approaches to Improve Efficiency

Technical Appendix Number 8

Enclosed Barriers

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Executive Summary

This paper is one of a series commissioned by the Office of Rail Regulation in order to gain an improved understanding of the maintenance and renewal techniques used outside Great Britain. These reports have been produced as part of the PR08 process.

Over the last decade there has been an increase in demand for rail travel at both weekends and off peak hours that has led to increased pressure to supply regular train services over a seven day period. Network Rail have recognised this need and are proposing a move towards a seven day railway concept on a number of prime routes that would meet the increased customer demand and bring in additional revenue to the industry.

In order to achieve this strategy, the track access regime and methods of undertaking maintenance and renewal of the infrastructure will have to change significantly. This change must not take place at the expense of safety. Therefore the need to investigate safe systems of working is paramount for its success.

To facilitate a seven day railway operation, not only will track access hours be reduced but a move towards single line working operations will also be required. There are safety systems currently being used in Britain that allow for train movements to take place on running lines adjacent to engineering works. However, these systems require;

- Time to set up;
- Temporary speed restrictions on adjacent lines; and
- Down time on the engineering work as certain work has to be stopped whilst the trains pass the site.

Therefore safe systems of working that remove the need for additional set up costs and temporary speed restrictions would be of value in today's operational railway system.

There are a number of systems currently being used across Europe to protect staff undertaking maintenance operations in single line working conditions that would benefit the British railway industry if they were to be implemented today.

It is estimated that in excess of £3 million could be saved by utilising alternative safety protection systems. Further benefits on intangible savings such as operating costs with the ability to run trains at line speed and higher productivity efficiencies through quicker set up and better working conditions would also result.

This short report looks at a number of these systems, the countries where they are being used and the railway applications to which they are being applied as well as the potential to take these systems further.

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- Geismar
- Plasser / Robel

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1.0 SAFE SYSTEMS OF WORK

1.1 Enclosed Barrier Systems

With the proposed move towards a seven day operated railway, particularly on prime routes, and the costly set up costs associated with current safety systems, there is a need to look at innovative ways of safely undertaking the maintenance and renewal activities that will be required to keep the railway infrastructure in a safe and reliable condition

There have been a number of mobile enclosed barrier systems developed in Europe over recent years. These enable railway infrastructure activities to be undertaken in a safe and efficient manner, whilst still allowing the safe passage of trains on the adjacent line to the work being undertaken.

This short report describes a number of these systems together with the activities that are undertaken inside the protected area and the benefits that have been realised.

1.2 Extent of Methodology

The systems described in this report are currently being used for undertaking a wide range of activities in countries such as Switzerland, Austria, Netherlands and France.

1.3 Applicability

The systems available have been used on both maintenance and renewal operations, but have particular benefit to maintenance as this is often carried out on shorter sites. This work scope includes activities such as:

- Replacement of defective rails;
- IBJ replacement;
- Arc weld repairs of rails or crossings;
- Wet bed removal;
- Component replacement (pads, clips, etc.); and
- Detailed inspections of rails or switches.

Note that, whilst references are made to specific products and systems that are in use in particular countries, there may be other products available that provide a similar functionality. The report does not review all available alternatives, or consider their comparative merits. The case studies are included as being indicative of alternative approaches in asset management.

2.0 EUROPEAN APPROACH

2.1 Method Deployed

The basis of the method employed is to provide a “barrier” between the line being maintained and the adjacent line open to traffic. This “barrier” is formed from the side of a rail vehicle, thus enabling easy transport and implementation on site. The following sections detail some examples of this approach, ranging from the sophisticated through to the simple in approach.

2.1.1 Robel Mobile Maintenance Unit 69.50

This item of purpose built plant was developed by Robel Bahnbaumaschinen GmbH in association with Austrian Railways (OBB) as a protection system for staff working in a confined area. There was a need to develop a system that would also protect staff from the weather elements as productivity was being lost, with complete cancellation of shifts occurring when inclement weather conditions prevailed.

Robel Mobile Maintenance Unit 69.50

The first prototype was built in 2004 and trialled successfully with OBB to the extent that 14 of these mobile maintenance units are now in use in Austria alone. One unit is owned and operated by BLS Lotschbergbahn AG in Switzerland and has been in use since 2006, with another unit in use in the Netherlands operated by BAM Rail.

Unit Operated by BAM Rail

Unit operated by BLS Lotschbergbahn AG

The Swiss and Austrian systems are accompanied by a purpose built traction and supply unit (Robel 69.40) that is used to transport the maintenance unit to and from site. This traction and supply unit consists of a cabin that spans it entire length and includes:

- An operator's compartment;
- A staff room; and
- A workshop and a storage room.

The Robel 69.40 supplies the power to the maintenance unit and transports the staff safely to the worksite. The safety of the track workers is guaranteed by a riskless crossing from the supply unit into the working area that ensures that the protected area is never left.

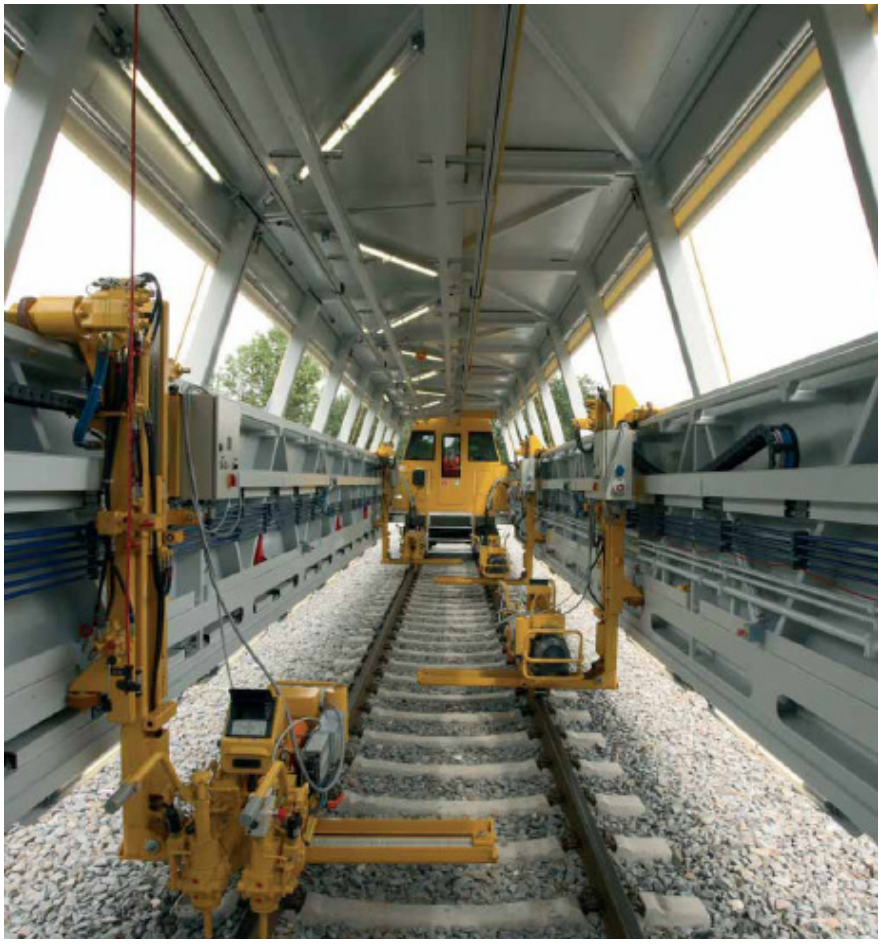
As well as protecting staff from passing trains, the barrier also forms a protective shield from the weather. For example, thermic welding can be undertaken without any fear of rain affecting the process, thus eliminating the risk of shifts being cancelled through inclement weather conditions.

The unit can be driven from either the traction supply unit or from a driving cab at the other end of the mobile maintenance unit up to a speed of 80 kph. Once on site, the unit is switched to work drive and travels at speeds between 0 and 10 kph. It is controlled using a mobile control panel, which is situated on both platforms of the mobile maintenance unit. The unit is quick to set up and break down, thus reducing costs on set up time and improving productivity through increased working time.

The power supply for tools and lighting is electric, thus removing the problems of fumes and noise generated from diesel or petrol driven machines. The ergonomic lighting provides ample light in the work area without long set up times and noise.

Productivity within these barriers has been significantly improved as a result of the better working conditions. As well as the reduction in thermic welding shift cancellations mentioned above, OBB have found that re-padding operations has increased by approximately 70%.

Further developments have continued since the unit's first introduction, with a view to improving the tooling inside the unit. This has resulted in the development of an electric disc cutter that works in a vertical direction to produce a perfect cut through the rail in less than two minutes.

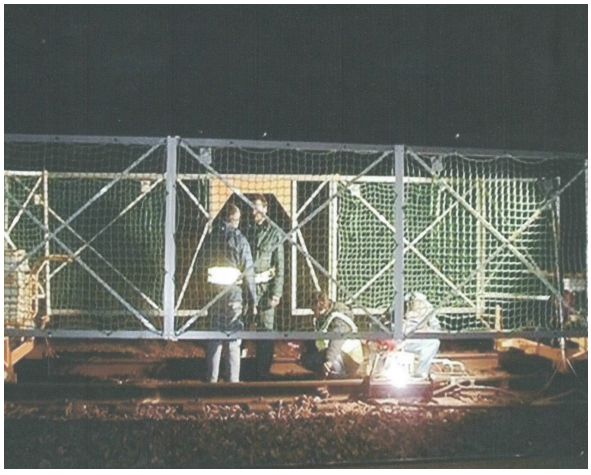


Enclosed working area of the Robel Mobile Maintenance Unit

The Mobile Maintenance Unit in use in Switzerland was purchased to enable maintenance work to be carried out safely in the 30 kilometre long Lotschberg tunnel, which has a line speed of 160 km/hr. Prior to its introduction, any maintenance work undertaken in the tunnel required a complete blockage of both lines and extensive travelling time to and from the workplace from the tunnel access. Now, using the Mobile Maintenance Unit, single line working can be utilised with trains running at line speed past the worksite. The unit not only acts as a safe working environment for the staff, it also protects the passing trains from any materials or tools that are being used.

2.1.2 Geismar Enclosed Barrier Systems

Geismar have developed several barrier protection working systems that are regularly used in France for undertaking various maintenance activities whilst still running trains at line speed on the adjacent line. These systems are based on a netting type barrier built around a standard permanent way trolley to create an enclosed moveable working area. The logistics of using this barrier system are far less complex as it can be delivered to site in the back of a vehicle and assembled in a matter of minutes by two people. They are a lot cheaper than the Robel system to purchase, but do not have the benefit of being completely self contained, nor do they provide complete cover from the weather elements. They also require additional equipment for power, lighting and tools.



Weld repairing inside a Geismar barrier system

Trains passing on adjacent line

Geismar are currently developing a British variant of this enclosed barrier system called a “Rolling Green Zone” (RGZ). This system is similar in concept to that used in France, but will have a firmer barrier than the netting system used in France that will keep staff within the safe envelope of the barriers even in the event of accidentally falling against the outer walls. The length of the enclosed working area is 10 metres and is of a modular design which makes it possible to add further sections by introducing another trolley and fence sections to suit the length of worksite required. This system remains lightweight and can be transported to site in the back of a vehicle and erected by two staff in a matter of minutes.

2.1.3 EDS Barrier Systems

Geismar / Fassetta have further developed their barrier system in France by attaching the barrier to a road rail vehicle. This is called the EDS barrier system and it is currently on trial in France for undertaking arc weld repairs in single line working conditions.

EDS Barrier System off track

The vehicle is driven onto the track using rubber tyred wheels and lowered onto rail wheels before being driven to site. Once on site the trolley on the rear of the vehicle is lowered and pulled along the track which allows the folded barrier to concertina into position. The barrier is then fixed in place and lighting attached. The whole operation taking approximately 15 minutes.

EDS Barrier system deployed on track

Power for tooling and lighting is supplied from a generator located on the back of the road rail vehicle. The vehicle also carries tools and materials and is fitted with a small hi-ab crane for lifting equipment on and off the back of the vehicle.

The system operates with two people when in use in France. One acts as the safety controller (French equivalent of a PICOP). The other is a trackman who drives the road rail machine, sets up the barrier and undertakes the arc weld repairs on his own.

Performance details of the EDS System are as follows:

- Maximum travelling speed on rail wheels is 25 km/hr;
- Maximum travelling speed when protection barrier deployed is 3 km/hr;
- Machine weight is 5 tonnes;
- Machine dimensions (without barrier extended) are 5.30m x 2.50m x 2.80m;
- Enclosed barrier working area is 7.00m x 3.00m; and
- Hi-ab lifting capacity is 430kg at 5.8m.

2.1.4 Geismar VT4141 System

Another enclosed barrier system similar to the EDS is the Geismar VT4141. This vehicle is used for inspection and consists of a road rail unit with small sections of barrier that extend to the front of the vehicle to allow for closer inspection by foot whilst still being within the enclosed barrier protection area. This illustrated in the photograph below.

Geismar VT4141 being used for inspection

2.2 Management Approach

Just as in the British rail industry, safety of staff working on railways in Europe is number one priority. However, trains still have to run and work to maintain and renew the infrastructure still has to take place. These barrier systems were developed to encompass all of these elements with the added bonus of higher productivity levels being achieved through eliminating interruption of work and improved working conditions.

2.3 Technology Involved

The Geismar barrier systems are simple, whereas the Robel Mobile Maintenance Unit is much more customised to reflect a better working environment as well as a safe system of work.

3.0 CURRENT BRITISH APPROACH

3.1 Method Deployed

There are a number of methods utilised today for protecting staff working on the rail infrastructure in Britain. These are governed by the Rimini hierarchy system. The current provision of barriers for safe working ranges from the rigid Vortok protective fencing through to blue plastic netting or black and yellow tape connected to stakes or poles.

It is common, particularly on the West Coast Main Line, to set up automatic track warning systems (ATWS) where work is taking place on lines adjacent to open running lines. Whilst this has improved safety it requires:

- Additional resources;
- Time to set up and remove; and
- A temporary speed restriction in place over the length of the worksite.

3.2 Management Approach

The preferred method of protected staff working in Britain is to set up a safeguarded green zone whereby movement of trains on all lines are stopped with the exception of engineers train movements made at extreme caution within an Engineering Supervisor's worksite. However, with the move towards seven day railway operations on certain routes and the introduction of more single line working, the safeguarded green zone will become more difficult to implement.

3.3 Technology Involved

There are barrier systems available that can be set up to protect staff working next to adjacent lines that are open to traffic such as the Vortok safety barrier. As noted above, these systems take time to set up. They also require protection in the form of a possession or lookouts to set up and take down. If the work is a moving or rolling site such as re-padding operations, enough fencing needs to be erected to cover the whole site.

Vortok safety barrier

Although not a physical barrier, ATWS is commonly used on open lines adjacent to worksites to allow work to take place. There are a number of systems available such as the Schweizer system. These use treadles to set off visual and audible warning devices provided throughout the worksite to warn of approaching trains.

4.0 BENEFITS

4.1 Asset Management

The moving protective barrier systems described in section two would enable work to be undertaken on the railway infrastructure in a safe environment, whilst retaining the capability to run trains on adjacent lines. There are certain locations where safe guarded green zones are currently the only way to undertake any type of maintenance work.

This leads to work being restricted to those times of the year when disruptive possessions have been planned. This means that assets can suffer from lack of attention at the appropriate time and may deteriorate beyond preventative maintenance levels.

4.2 Efficiency Savings

It is not the intent of this paper to provide a detailed, bottom-up, financial analysis. The following section is a simple analysis that provides an indication of the financial advantages if best European practice over current British practice.

The ability to rapidly set up either the mobile maintenance unit or the Geismar barrier system will ensure that maximum opportunity is gained from track access time made available.

When operating elsewhere in Europe, there is no requirement for temporary speed restrictions to be placed on the adjacent open line. This provides a resource saving together with a reduction in train delay.

Using these types of rolling / moving barrier systems will save on additional time and resources that are required to set up and break down the Vortok barrier type systems in use today. There will be no requirement for ATWS to be set up which will once again realise savings on resources and time.

For example, to set up and breakdown an ATWS site would cost in the region of £6k per worksite. To set up ten ATWS sites per week would cost £3.12 million per annum, thus by using the barrier systems these costs would be saved together with intangible benefits such as:

- Running trains at line speed on adjacent lines;
- Higher productivity due to quick set up / breakdown and fully protected working environment; and
- Reduction in shift cancellations for inclement weather.

OBB in Austria has already proved that productivity on maintenance activities such as re-padding has improved in the order of 70% by using the Mobile Maintenance Units.

The capacity to set the sites up quickly will remove the typical 1 – 2 hours required to mobilise and demobilise sites. This means that it becomes practicable to undertake maintenance work during the available midweek “white period” possessions rather than needing longer weekend possessions.

4.3 Life Cycle Costs

This initiative will have no direct impact on life cycle costs. However, the additional opportunities it offers may allow more timely intervention when maintaining the assets, thus extending the asset’s useable life.

5.0 SAFETY ISSUES

The systems described in this report are provide an improvement on existing safe systems of work with respect to creating a fully enclosed working area for work to take place. No safety issues are anticipated over their potential use in Britain.

The Robel unit in particular is completely self-contained with tools and power thus removing manual handling problems of heavy machinery and generators. The ample lighting provided

by electric rather than diesel engine together with full protection from any inclement weather makes for a much better and safer working environment for the staff

6.0 IMPLEMENTATION INTO GREAT BRITAIN

6.1 Estimated Implementation Duration

The Robel Mobile Maintenance Units would take nine months to manufacture but would then need to go through trials and safety approvals, thus giving an estimated implementation duration of around twelve months.

The British variant of the Geismar barrier system is well underway to being introduced into the rail industry market. It has already been developed and is now awaiting trials on the West Coast Main Line to prove its capabilities before it goes into full production. These are scheduled to occur in the near future.

6.2 Constraints and Dependencies

The standard approval processes for new items of plant will be applicable. Changes in working methodologies will also require review. Neither of these issues are seen as major obstacles as the mobile barriers have already been introduced in Europe and been fully demonstrated.

These barrier systems are an improvement in safety protection as they provide a physical barrier. It is not anticipated that there should be minimal or no constraints with their introduction. However, working adjacent to open traffic running at line speed may need a shift in the cultural practices used for carrying out railway infrastructure work.

Further detailed assessment would be required in those locations where narrow six foot clearances exist, such as on the West Coast Main Line. However, provided the type of barrier systems deployed remains within W6A gauge, then this should not constrain their effective use.

The logistics of operating the Mobile Maintenance Units will require managing with respect to stabling locations. If purchased as a separate unit from the Robel traction supply unit, transport to and from site with some form of traction unit will also have to be determined.

6.3 Investment Requirements

The initial investment for a new Mobile Maintenance Unit together with the power traction unit would fall in the range of between 1.5 and 2.5 million Euro. The price range is dependant on the specification of the traction supply unit. However, to purchase a single Mobile Maintenance Unit that could be transported to and from site by some other form of traction, such as a General Purpose Tramm, the cost would be around €900,000. This would include the certification process and power plant for running the various machines inside the unit but does not include the traction unit or any of the machines/tools that would be used inside the working area.

The Geismar enclosed barrier system the “rolling green zone” (RGZ) is expected to cost around £10k once it has been trialled and given approval by Network Rail.

7.0 RECOMMENDATIONS FOR FURTHER WORK

It is recommended that the following additional study is undertaken:

- Further study into efficiency improvements in Austria when using the Mobile Maintenance Units
- Further study into efficiency improvements in France when using the Geismar barrier protection systems

Balfour Beatty
Rail