

Mobile maintenance solves new tasks in track construction

Modular vehicle combinations speed up procurement and work processes and increase safety and economic efficiency.

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Demographic change in the railway has been happening for some time. Skilled workers in track construction are scarce throughout Europe, issues such as occupational health and safety are becoming increasingly important. At the same time the demands on infrastructure availability are rising with the growth of conurbations. These developments require a new approach to the subject of maintenance: Work on the track has to become faster and safer, rising costs must be compensated for by increased productivity. One approach is the modular design of vehicle systems. Mobile maintenance systems are operational straight away, cover all essential activities with optimum work processes and create a safe and user-friendly work environment.

Requirements for maintenance vehicles

European rail operators are working intensively on the simplification of processes for the development and procurement of rail vehicles [1]. Lead times are to be shortened, process efforts and expenditure reduced and operating costs cut. The aim is to buy vehicles as a product and not as a project. The main obstacles in current procurement processes include long delivery times, insufficient product maturity upon delivery and a huge variety of different vehicle types. The Mobile Maintenance System by ROBEL (ROMIS System) already meets these changing requirements to a large extent. Depending on the type of activity and the conditions of use for the system, field-tested modules will be configured, no matter whether it is for a tender process or a customer-specific solution. The high degree of maturity when a contract is awarded results in faster procurement processes and excellent quality when the vehicle is handed over.

From the case study to the maintenance system

Each ROMIS System is based on a customer-specific concept, the modules are configured according to the given specifications. These less and less follow the traditional requirements specifications, but focus on the tasks to be carried out in the respective environment. The track infrastructure operator know their work processes better than anyone else. ROBEL analyse these and from a modular system configure the appropriate vehicle formation with the required work modules. Experience from European projects of the last few years feed into this process. In addition, the system is designed such that it is scalable, i.e. can grow with future requirements. The resulting train combinations range from the ROMIS Compact with a vehicle length of 23 metres through to the ROMIS System with track vehicle and transport trailers reaching a vehicle length of over 100 metres (Fig. 1).



ROMIS Compact, Länge 23 m



Einheiten ROMIS, Länge Europa 49,8 m, Länge UK 45,7 m



Einheiten ROMIS, Länge Europa 70,5 m, Länge UK 69,5 m



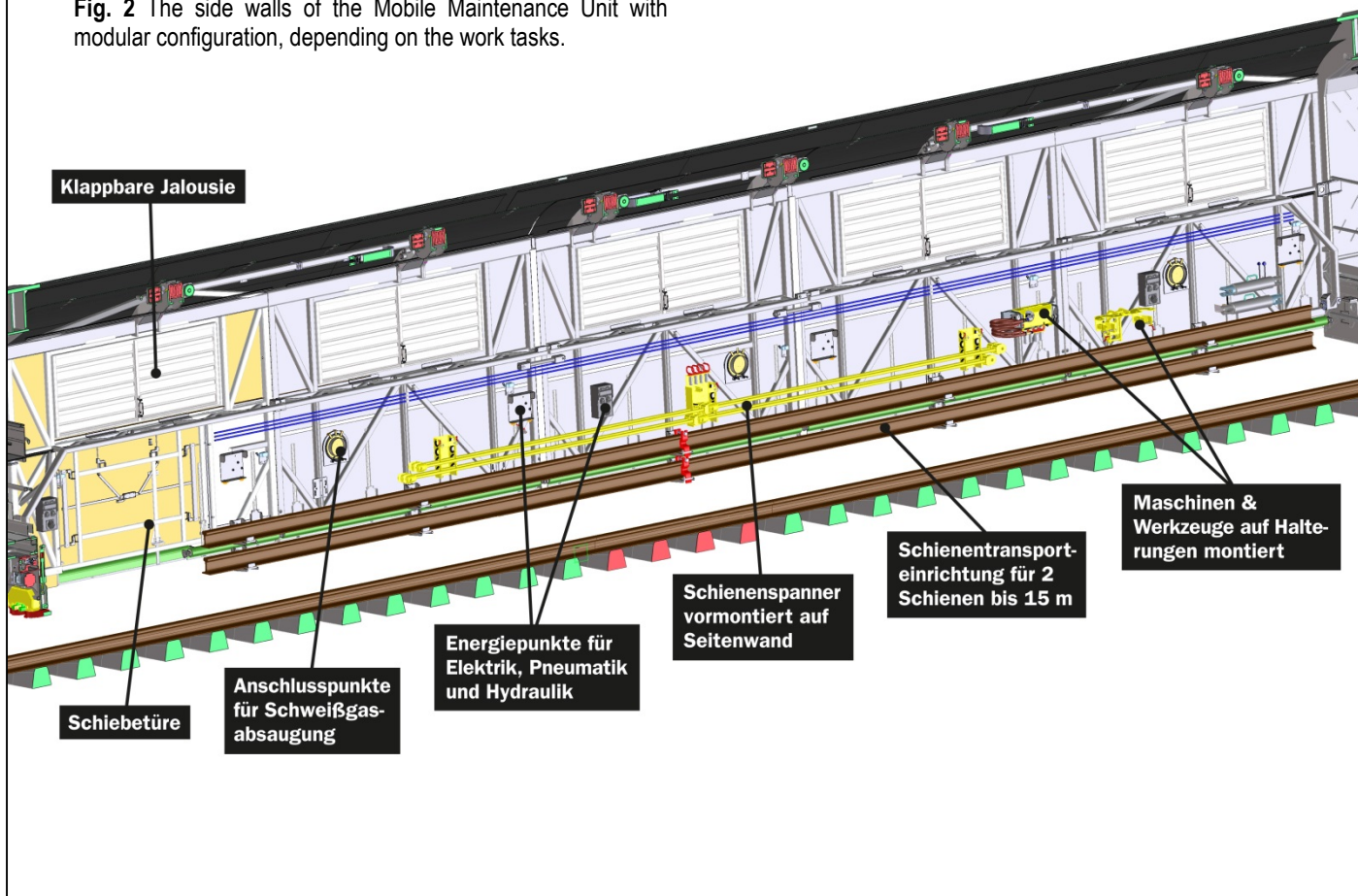
ROMIS Flexi, Länge ca. 92 m



ROMIS Flexi, Länge ca. 112 m

Fig. 1 Examples for train formations of ROMIS Mobile Maintenance System

Fig. 2 The side walls of the Mobile Maintenance Unit with modular configuration, depending on the work tasks.



The system equipment varies, depending on the areas of activity and use (mainline railway, tunnel, etc.):

- train formation with and without traction,
- variable equipment of side walls in Mobile Maintenance Unit (MMU): rail transport, support brackets for hand-guided machines, etc. (Fig. 2),
- side walls of Intermediate Car (IC) folding up fully or partially (Fig. 3),
- with one, two or no ceiling cranes,
- with or without servo wrenches,
- standard-compliant and at the same time flexible transport securing concept in the IC: pallet cages, transport racks, floor securing, etc. as well as
- maintenance on demand

This approach not only generates benefits for the purchaser but also added value for the operators: Track construction work will always be ergonomic, comfortable and carried out in a safe environment - once the operators are trained to operate the system the only thing that changes are the work tasks.

How the ROMIS System changes track maintenance

The Mobile Maintenance System has been proven to increase efficiency and safety in spot repair, e.g.:

- rail replacement including tensioning and welding,
- renewal of insulated rail joints and maintenance of rail joints,
- repair and build-up welding,
- replacement of rail fastenings, such as

- ribbed plates, rail pads and fasteners,
- correction of track geometry,
- replacement of individual sleepers and ballast renewal,
- work on switches and diamond crossings with slips, including their replacement,
- inspection and replacement of balises and other signalling equipment



Fig. 3 Fully or partially folding side walls for comfortable loading and unloading on Intermediate Car.

Process	Work time in ROMIS (hh:mm)	Work time conventional (hh:mm)	Time saving in ROMIS	ROBEL Equipment
Transit to worksite, setup worksite	02:28	03:30	01:02	MIS hoist, MIS Light, Supply
rail offload	00:02	00:32	00:30	MIS hoist
Old rail removal	00:28	00:53	00:25	MIS hoist, wrench or clipping machine, band saw or rail cutter
New rail installation	00:28	00:43	00:15	MIS hoist, band saw, wrench or clipping machine, rail stressor
Welding 1 and 2	01:17	01:40	00:23	MIS extraction system, weld trimmer, band saw, rail stressor
Grinding	00:50	01:00	00:10	grinding machine, rail stressor
Clear worksite, transit to depot	02:30	03:05	00:35	MIS hoist
Total Working Time	08:03	11:23	03:20	

Table 1 Time taken for rail replacement in British ROMIS compared to conventional methods (average values)

Using the replacement of closure rails as an example, Table 1 shows the clear increase in working speed, work safety and comfort when using ROMIS compared to conventional maintenance methods.

Work steps in conventional maintenance

Staff load a maintenance road vehicle in the depot and drive on the road to the track access point. Depending on local conditions, the workers carry machines and tools to transport wagons and push these to the work site. There may be considerable waiting times until the track possession and the work site safety are set up. Diesel generators are connected up, work site lighting is installed, machines and materials are unloaded by hand. Insufficient lighting, adverse weather and the dangers of the adjacent traffic may aggravate the work even more. The noise generated by the work site and the work site

safety at nighttime will often result in resentment and strong protests from local residents. During the break the crew walks along the track back to the vehicle, which has only limited recreational facilities. The sanitary facilities are rudimentary at best. Depending on working speed and time required for disassembly and return journey, even the best crew will often not manage to complete the maintenance task in one shift.

ROMIS newly defines old processes

Working on the track with maximum work safety

The crew is transported directly to the work site on the closed working track by train, thereby avoiding any contact with the open adjacent track and its train traffic. With the arrival of the maintenance unit the work site is secured straight away, continuously and optimally - without the requirement for any lookouts or visual or acoustic warning devices to protect from train traffic on the adjacent track and without the need for trains to reduce their travelling speeds on the adjacent track for reasons of health and safety. This alone constitutes an enormous cost and operating benefit compared to conventional maintenance methods. The section of track where the work takes place is occupied by ROMIS and therefore closed for operation of other vehicles. All work is carried out in the protected environment inside the system, at no time are the workers at risk from traffic on the adjacent track or from overhead lines. Comfortable messrooms with kitchen, toilet, wash room and lockers allow true recreation for the staff during transit and in breaks and can be used for health and safety and other briefings and completing documentation. A fully equipped workshop in the system

provides additional efficiency in the tightly scheduled work processes.

Operator comfort in an optimum environment

All maintenance work is carried out inside the Mobile Maintenance Unit (MMU) in a generously laid out area of 4.4 x 17 m maximum (depending on kinematic envelope). The whole of the inside area is lit glare-free, dry and ventilated, at the same time less noise and light get through to the outside. Integrated work stations supply electric, pneumatic and hydraulic power for custom-designed machines and tools. This results in short distances, better ergonomics and considerably reduced emissions. In addition, an integrated high-performance extraction system is available for any welding, cutting and grinding work (Fig. 4).

Clever transport and storage for increased productivity

Chain hoist modules with a total carrying capacity of 5 t transport equipment and materials over the whole length and width of the work and storage unit (Fig. 5). This makes the transport of material in the ROMIS much faster than with conventional methods, hard manual labour is now a thing of the past.

All the equipment on the train is secured in line with standards on an area of 60 m² max. and stored readily available for an ergonomic workflow.

The storage and transport of rails is just as flexible:

- a maximum of 6 rails up to 15 m length in the underfloor transport device of the IC,

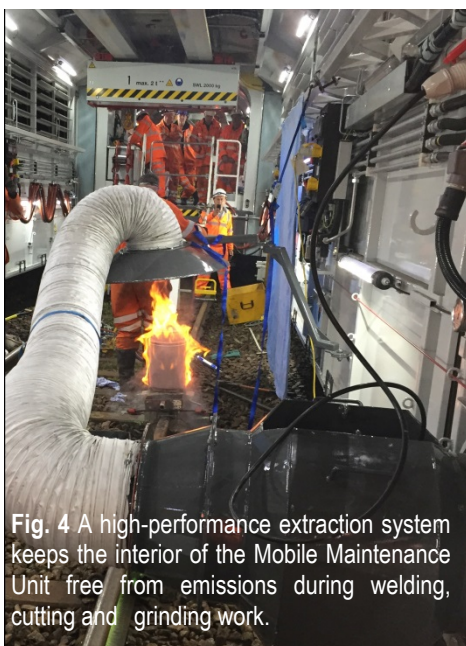


Fig. 4 A high-performance extraction system keeps the interior of the Mobile Maintenance Unit free from emissions during welding, cutting and grinding work.

- a maximum of 18 rails up to 18 m length mounted on the loading platform of the IC,
- a maximum of 2 rails up to 15 m length per side wall in the MMU.

Figures from practical experience: The British network operator Network Rail with its eight ROMIS systems records a threefold increase of productivity and 50% more availability compared to previous maintenance methods.

Fast processes reduce costs

The biggest cost driver in track construction is time. ROMIS with its short set-up and disassembly times can be used for ad hoc maintenance work on any work site and in any environment. No additional measures or costs are incurred for securing the work site, smaller crews achieve a higher work output. Added benefits are the reduced possession times, no need for the closure of or speed restrictions on the adjacent track or switching off overhead lines - short maintenance measures can even be carried out between scheduled trains. Furthermore, semi-mechanised processes, e.g. servo wrenching in three-dimensionally guided movements, speed up and improve work processes in the system.

Figures from practical experience: With ROMIS, Network Rail increases the available working time by 50%. For rail replacement alone, the company records a cost reduction of 30 per cent.

New quality of the work performed

Precise processes inspired by production lines deliver work results at reproducible and controlled quality: For each maintenance task the appropriate equipment as well as materials and supply are available in the system. Furthermore, complete safety monitoring with CCTV, laser systems and light beams allows for concentrated and uninterrupted work.

Maintenance and protection of the environment

With the Mobile Maintenance System, no additional road vehicles or fuel-operated small machinery is used. A latest generation central power supply considerably reduces exhaust gas emissions. Old and waste material is taken away in the same shift, the track is left behind in a clean condition. In addition, local residents also benefit from the "clean" maintenance with ROMIS. Working in the enclosed MMU reduces the exposure of light and noise noticeably, especially for high-emission work, such as thermit welding.

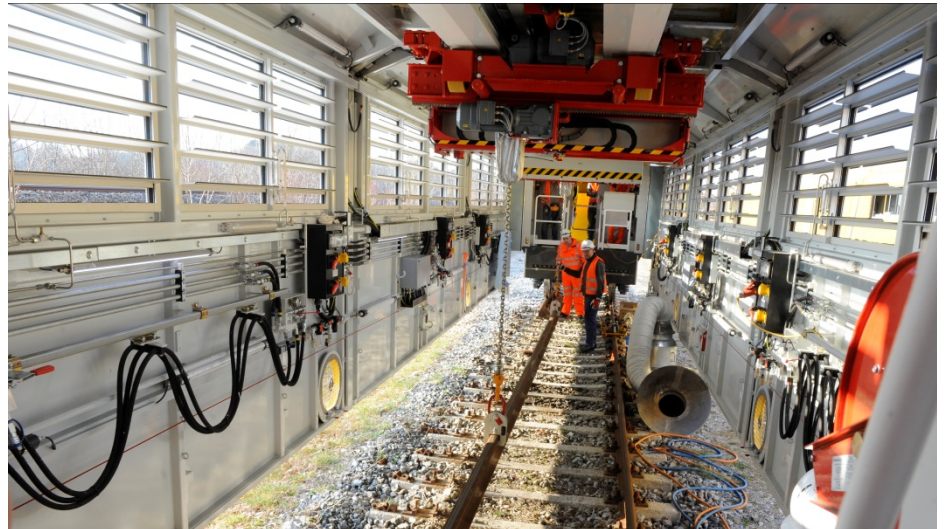


Fig. 5 Two chain hoists transport equipment and materials over the whole length and width of the work and storage unit.



Fig. 6 The whole equipment in the system is secured according to standards and readily available.



Fig. 7 The two-floor ROMIS Compact is particularly suitable for use in constricted spaces.



Fig. 8 The open side wall of the ROMIS Compact enables protected access for cleaning drains in tunnels.

Drain cleaning in the tunnel with ROMIS Compact

1. The traction vehicle or locomotive pushes the train formation consisting of ROMIS Compact and low-floor wagon with lorry into the tunnel.
2. The traction vehicle is uncoupled and travels to another work site section since the system has its own working drive.
3. Feeding hoses from flushing truck into MMU through the openings provided.
4. Ceiling hoist lifts drain covers or other covers, no more manual moving of heavy loads.
5. Protected access to all drainage channels: at the side of the tunnel wall (side drainage) (Fig. 8), under the side walkway and under the centre of a track. All corners and cavities are fully lit by ROMIS.
6. Flushing: The hose is pushed up to 160 m into the drain pipe, the thrust of the jet head at over 100 bar water pressure generates the propulsion. Additional cleaning with high-pressure hose in the area of the drain cover: Extraction of the flushing water for environmentally responsible disposal via the hose with a diameter of approx. 100 mm into the lorry tank. Water in the tank sufficient for one shift.
7. In ideal conditions an eight-hour shift can clean drains over 3.5 tunnel kilometres.

How the ROMIS system changes tunnel maintenance

The tunnel environment poses much higher requirements on maintenance and on man and machine. Space in the tunnel is constricted, access for the transport of crews and material very limited. Insufficient ventilation, flying sparks, fire risks and operations on the adjacent track pose a health and safety risk for the track workers.

ROMIS Compact (Fig. 7) with a length of 23 m has been designed specifically for use in this environment. It creates a protected work and recreation area for up to 8 people over two floors, with messing facility, store and workshop.

Doors in the two side walls allow for systems equipment in the tunnel walls to be inspected if the adjacent track is open. If required and provided the appropriate safety measures are in place, it is possible for the adjacent track to be accessed. The current expansion stage requires the supervisor's permission via the machine control for opening the door to the adjacent track.

An important application of the system is the regular flushing of the tunnel drains using high-pressure carriages (see Box 1). As the walls of the maintenance unit not only protect the crew but also fully shield the tunnel environment, there is no longer the need for complete line closure and currentless overhead lines due to the high volume of spray water generated.

ROMIS Compact not only optimises the work processes but also the tunnel environment: Rescue recesses to provide shelter for the

maintenance staff are no longer required, resulting in huge cost savings for new tunnel constructions. In Austria, where currently five ROMIS systems are used for tunnel maintenance, this savings potential is already utilised: No recesses were provided for in the tunnels of the Unterinntalbahnhof railway.

Sustainable track maintenance

The development of conurbations in particular will point the way forward: Infrastructure will only remain effective if work and procurement processes in maintenance are accelerated and safety and environmental aspects taken into consideration at the same time. This requires new approaches by maintenance vehicle suppliers.

ROBEL uses the responses from European markets for further development of country-specific designs. Insights gained are incorporated in new modular systems. Modular vehicle concepts not only simplify the decision-making and tender process for the customer but also result in a wider range of work areas. New ROMIS systems already have additional options available, e.g. drain flushing units on container wagons, ballast suction units for sleeper replacement and local formation rehabilitation. Furthermore, ROBEL sees great potential in semi-automation and automation of work processes. At the ROBEL In-House Exhibition in September 2019 in Freilassing the company will present robot-assisted processes in maintenance systems for the first time.

Conclusion

Based on market and manufacturer experience and expertise, ROMIS undergoes continuous further development and modular expansion. This helps for the system to deliver answers to the increasing requirements on maintenance in urban environments, in tunnels and on plain lines - from the transport to and from the work site and crew comfort through to work site set-up and automation of work processes.

All maintenance work on the track is carried out inside the system in a safe working environment, cost-intensive safeguards against train traffic on the adjacent track can be dispensed with completely. The all-round protection in the track working area provides assurance for the operator to be able to carry out the work undisturbed and to the highest quality. ROMIS not only improves the working conditions but also minimises the logistical effort. The crew and materials are transported to the work site on the train. Set-up times are reduced considerably, the work site is secured straight away. Energy and light supply are ready. This allows more time for high-quality work on the rail infrastructure. This way, ROMIS solves two acute problems of track maintenance: availability of resources and occupational health and safety, especially from the dangers of train services.

Two railway operating companies, well-known pioneers in their fields, have also recognised these benefits: in 2020 one ROMIS System for Deutsche Bahn and one for the Japanese JR East will start operation.



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[1] Railway News Archive, Zurich, 29.08.2018 (BA/gm) Initiative Round Table Rail vereinfacht Beschaffung von Schienenfahrzeugen

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