

Unichanger prototypes start to take shape

INTEROPERABILITY With four different technologies for gauge-changing wheelsets in use or under development across Europe, an ADIF-led research project has started developing a universal gauge-changing station. Chris Jackson reports from Barcelona.

The first fruits of the ADIF-led Unichanger Project should become evident by the end of this year, according to the Spanish infrastructure manager's Director of Research & Development, Ignacio Jorge Iglesias Díaz.

Addressing a conference in Barcelona to mark the 40th anniversary of the *Catalan Talgo*, Iglesias explained that ADIF was 'obliged' to permit the operation of all existing rolling stock over its network, even though the subject of gauge-convertible stock is not explicitly addressed in the European TSIs. As a result, ADIF is 'strongly committed' to the development of universal changeover facilities, which can accommodate all of the current technologies. He hopes that this work will feed into the UIC project on Automatic Gauge Changeover Systems, helping to open up more of the world's railways for the operation of variable-gauge stock.



Break of gauge

Breaks of gauge have proved a significant barrier to traffic between incompatible networks since the earliest days of railway operation, and continue to pose problems on almost every continent. Whilst 1435 mm gauge is dominant across Europe, there are many borders with the broad gauge networks in Spain and Portugal (1668/1676 mm), and the former Soviet Union and Finland (1520/1524 mm). Such breaks of gauge can be overcome by transshipment, mixed-gauge trackwork or gauge-changing trainsets.

The drive to increase rail traffic via the Eurasian landbridge corridors has spurred considerable interest in gauge-changing technologies, as well as RZD's high-profile project to extend a broad-gauge route to Wien. UIC commissioned a study into the opportunities for through running between the 1435 mm and 1520 mm networks, but Iglesias says this focused mainly on the

gauge-changing technologies developed in Germany and Poland, which have so far seen limited use in revenue service, and largely overlooked the Spanish experience.

Spain's effective isolation from the rest of Europe ended in July 1969 with the launch of the first gauge-changing Talgo trains between Barcelona and Genève. Over the past 40 years, almost 300000 movements have taken place through an increasing number of installations, according to Alberto García Álvarez of the Spanish Railway Foundation.

García pointed out that whereas the break of gauge originally applied only to international services, the expansion of Spain's 1435 mm gauge high speed network since 1992 had made it a domestic problem. The number of through trains operating between the two gauges has continued to increase, and today around 50 gauge-changing movements take place each day at 11 locations.

Proprietary technologies

With expansion of the market, various manufacturers have developed their own gauge-changing technologies, and Iglesias reports that there are now five different (and incompatible) systems in operation or under development. The pioneering Talgo RD single-wheelset technology has been in use since 1969, initially for hauled stock, but more recently for self-propelled trainsets with powered bogies. Talgo has also been working on a variant for use on freight trains. CAF's Brava system has been in operation on selected Spanish domestic routes since 2003. The Polish SUW2000 technology has been used for through services to Lithuania and Ukraine since 2000, while DB has been developing the Rafil Type V system which García believes has not yet found a commercial application.

The Spanish gauge-changing installations require the weight of the

Delegates to the Barcelona gauge-changing conference watch ADIF's Talgo XXI inspection train pass through the TCRS-1 changer at Roda de Barà near Tarragona.



TCRS-1 uses vertically-mounted changers. With the Talgo platform folded away, the CAF platform is lowered into position (left), so that a CAF-built Series 120 EMU equipped with Brava variable-gauge wheelsets can pass through the changer at Roda de Barà (right).

vehicle to be supported externally while the wheelsets are unlocked and repositioned. Whereas Talgo RD uses a locking pin that must be pulled down by a guide rail to release the wheels, CAF's Brava relies on the weight of the vehicle to lock the wheelsets in position from above, and a similar approach is used for the prototype gauge-changing trains under development in Japan. SUW2000 and Rafil use a transverse locking mechanism.

Spain's first gauge-changing stations were all designed for Talgo trains, so the advent of CAF's Brava technology initially posed problems for RENFE Operadora and ADIF. Each type of train had to be used on dedicated routes, with the correct changers. In Sevilla, two separate installations were built adjacent to one another.

The early changers for hauled stock were designed so that the vehicles could be run through by gravity,

leaving the single-gauge locomotives on either side. The advent of self-propelled trainsets brought the added complication of voltage changeover between the 25 kV 50 Hz used on Spain's high speed network and 3 kV DC on the broad-gauge routes.

Evolution of the gauge changer

In 2000 ADIF began development of a combined changer for both Talgo and CAF trainsets, and the prototype TCRS-1 went into operation at Plasencia de Jalón near Zaragoza in 2003. This has two separate platforms carrying the changing tracks, which are stored vertically and hinged down into position as required. But around 15 min is needed to change from one system to the other, limiting the throughput.

ADIF subsequently patented the TCRS-2 variant in which the two

platforms traverse horizontally, permitting a faster changeover at the cost of greater land take. The first of these went into operation at Valdestillas and Madrid Chamartín with the opening of the Madrid – Valladolid line in December 2007.

The TCRS-1 and 2 changers are working satisfactorily, and some have been relocated as the Spanish high speed network expands, but they are complex to build and operate. There is also the risk of the wrong trains passing through; ADIF insiders admit that a CAF train has inadvertently been run through a Talgo changer without derailling, but the reverse would not apply.

ADIF therefore began to investigate the possibility of designing a changer in which only the guide and support rails move, rather than the entire track platform. A patent for TCRS-3 (Fig 1) was granted in February 2008, and a



The TCRS-2 gauge-changers at Madrid Chamartín (above) and Valdestillas use horizontally-traversing platforms to speed the switch between systems.

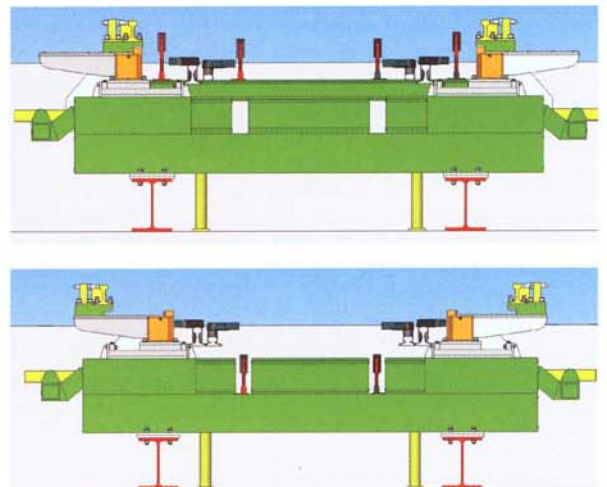


Fig 1. Using adjustable rails and guides, the TCRS-3 gauge-changer has been designed to accommodate Talgo (upper) and CAF (lower) trainsets on a single fixed platform.

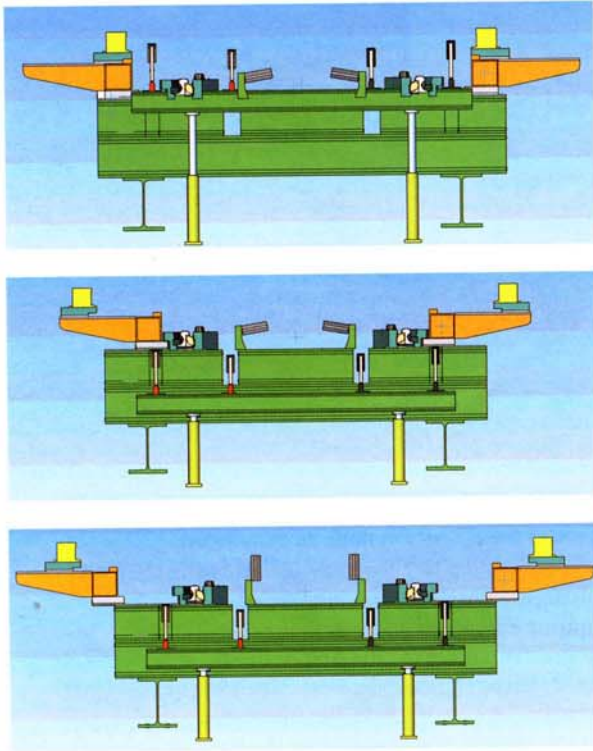


Fig 2. The TCRS-4 Unichanger will be able to accommodate the SUW2000 and Rafil technologies (bottom) as well as Talgo (top), and CAF (centre).

prototype is now under construction.

The former gauge-changing station at Roda de Barà, which was made redundant by the opening of the Camp de Tarragona – Barcelona line in February 2008, has now been taken over by ADIF's research department as a test facility. One of the former TCRS-1 units has been redeployed in Córdoba for the recently-launched Sevilla – Jaén service, and its building is being adapted to take the TCRS-3 prototype. The other TCRS-1 is to be dismantled next year and replaced by the TCRS-4 Unichanger.

Unichanger concept emerges

Last year saw the formal launch of the Unichanger Project, which is funded by the Spanish Ministry of Development. As well as ADIF, the project partners are CAF, Talgo, TRIA, CEIT (the Centre for Studies & Technical Research at the University of San Sebastián) and the Spanish Railway Foundation (FFE). These may also be joined by RENFE. The intention is to build on the TCRS-3 to develop a gauge changer that can accommodate any of the technologies currently available in Europe.

According to Iglesias, the Unichanger Project is 'one more step towards the elimination of railway barriers between different gauges'. ADIF also sees it as promoting an open market for suppliers of variable-

gauge rolling stock, 'allowing train operators to select the most appropriate technology without any preconditions imposed by the infrastructure manager'.

There are two main elements in the project. The first is a market analysis to identify opportunities where gauge-changing rolling stock could improve rail's competitiveness. The second is the functional definition and development of multi-system gauge-changing stations.

As a first step, the TCRS-3 has been designed to accommodate Talgo and CAF trainsets, using Talgo-style elastic guide rails to steer the displacement of the wheelsets. A change from straight to curved guide rails is also intended to achieve a smoother transition and reduce lateral accelerations. The unlocking guides will be made retractable, and the water now used to lubricate the Talgo support rails will be replaced by a biodegradable oil to reduce the risk of corrosion.

To accommodate the Rafil and SUW2000 technologies, the Unichanger TCRS-4 platform (Fig 2) will have to be lengthened slightly, with some additional retractable elements. ADIF also plans to incorporate an 'artificial vision' system to

identify the type of rolling stock on approaching trains and adapt the changer to the right system within a few seconds, avoiding the risk of incompatibility.

To make the unit suitable for use in winter conditions an improved heating system is to be installed to ensure that the wheelset locks are properly defrosted before a train passes through the changer. A derailment detection system will be provided, together with rapid intervention measures in the event of a blocked wheelset failing to adjust correctly.

García suggests that a further development of the TCRS-4 could see a longer changing platform split into two independently-adaptable sections, so that each half could be rapidly reconfigured in real time to accommodate multiple wheelset technologies within a single train.

With testing of the TCRS-3 due begin early in 2010, Iglesias hopes to have the basic four-system version ready before the end of next year, but it is not clear when this might be ready for revenue service. Based on the three-year development timescale for the earlier models, if all goes well a commercial Unichanger could be available by 2014. ☞



Now that one of the TCRS-1 changers has been removed from Roda de Barà, the building is being adapted ready for the installation of the TCRS-3 prototype.