

## THE WHOLE-LIFE TRAIN CAF

The delivery of 98 Civity DMUs and EMUs for the UK's Northern franchise will bring welcome relief for overcrowded routes in the north of England, boosting capacity and allowing older trains to be withdrawn. **Tony Miles** reports from Zaragoza.

Photo: Vladimír Fišák

# Civity multiple-units are ready to roll

The first of 98 Civity multiple-units being built by CAF for the Northern franchise was scheduled to arrive in the UK at the end of June. With final testing and commissioning to be undertaken over the coming months, the trains are on course to enter service with the December timetable change.

Under a £490m contract awarded by rolling stock leasing company Eversholt Rail, CAF is supplying 30 two-car and 25 three-car DMUs of Class 195 and 12 four-car and 31 three-car EMUs designated Class 331, plus a range of spare parts. The trains are currently being assembled in Spain, along with EMUs for Transpennine Express and loco-hauled stock for both TPE and Caledonian Sleeper.

Ordered as part of a wide-ranging investment programme under the new franchise which started on April 1 2016, the units 'will significantly improve journeys and the travel experience for our customers across the region', according to Arriva Rail North Managing Director David Brown. He sees the

introduction of brand-new trains as 'a landmark moment for rail travel in the north of England'. Their arrival will facilitate a cascade of older rolling stock types across the franchise, leading to the complete removal of the unloved Class 142 and 144 Pacer DMUs from Northern services by the end of 2019.

### Manufacturing

The Civity UK is based on a common modular vehicle concept, which has been derived from the Civity family launched by CAF in 2010. The European design has garnered a handful of orders from operators in Spain, Italy, Montenegro and the Netherlands (RG 4.15 p54), but to date the concept has been most successful in the UK. As well as the Northern and TPE contracts, CAF has recently won further orders to supply Civity DMUs for West Midlands Trains and the Wales & Borders franchise (p60).

Northern says its requirement was for a train that could be as large and spacious as possible while still capable of operating on Network Rail infrastructure

Testing of Northern's first four-car Class 331 EMU at Velim began in May.

without major clearance modification work. As the plans developed, some aspects of the 24 m long vehicles had to be modified. Despite the desire to use standard equipment wherever possible, the dimensions of some items had to be modified to fit within the UK's restrictive loading gauge, which 'presented its own range of challenges'.

Much of the design revision was undertaken using computer modelling; Northern was able to work with the other UK customers and NR to try and ensure that any physical infrastructure changes could be closely co-ordinated.

Construction of the Northern fleets has been split across three of CAF's facilities in northern Spain. The Zaragoza

**490**  
£m

VALUE OF ROLLING STOCK CONTRACT AWARDED TO CAF BY EVERSOLT RAIL

### Class 195 and 331 in numbers

Car length mm	
Driving cars	24026
Intermediate cars	23350
Width mm	2712
Height mm	3870
Maximum speed km/h	160
Axleload tonnes	11.3

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## Northern Class 195/331 suppliers

Bodyshells	CAF
Bogies	CAF
Wheelsets	CAF
Bearings	FAG
Pantograph (331)	Brecknell Willis
Traction controls (331)	CAF Power & Automation
Traction motors (331)	TSA
Gearboxes (331)	CAF
Diesel powerpack (195)	MTU
Transmission / final drive (195)	ZF
Pneumatics and airbrakes	Knorr-Bremse
HVAC	Merak
Exterior doors	IFE
Seats	Fainsa
PRM toilet	ALTE
AWS/TPWS onboard	Unipart Rail
ERTMS	CAF Signalling
OTMR	Hasler
ASDO	EKE
CCTV	R2P
Wi-fi	Icomera
Seat reservation system	Dilax
Passenger counting	Dilax

plant is responsible for fabrication of the aluminium bodyshells for both classes, along with assembly and painting of the EMU vehicles followed by testing and commissioning. DMU assembly, painting and commissioning is being undertaken at Irun, whilst the bogies for both fleets are being manufactured at Beasain.

Initially, a single production line at Zaragoza was producing a vehicle every eight days, but as the programme got into its stride a general speed-up of construction reduced this to six days. With the addition of a second production line, the factory was able to turn out a new car every three days.

As far as possible, the diesel and electric units are identical, with common bodyshells and bogies, seating layouts and interior fittings. Only the traction package is different. There are three basic vehicle types: two driving cars with and without an accessible toilet and an intermediate car, which can be powered or unpowered.

A three-car Class 331 is formed from two driving motor vehicles, equipped with traction converters and

asynchronous traction motors from TSA, and an unpowered intermediate car which carries the 2570 kVA transformer and pantograph. The four-car variant includes an additional trailer vehicle.

On the Class 195 DMUs, all vehicles are equipped with MTU underfloor powerpacks incorporating 390 kW Daimler engines and ZF hydro-mechanical transmissions.

The vehicles ride on inside-framed bogies and will be able to operate at up to 160 km/h, whereas the five-car Class 397 EMUs for TransPennine Express are intended to run at 200 km/h. Northern says that its EMUs and DMUs could be extended to a five-car formation if required, although in the case of the EMUs the additional trailer car would have a small impact on performance.

Both the 195s and 331s are fitted with Dellner couplers at the outer ends and bar couplers within the units. While the two classes are able to couple with each other, they can only be coupled to other Northern stock using adapters, which will be held at strategic locations around the network.

### Passenger facilities

Each vehicle has a pair of double doors at the 1/3 and 2/3 positions, which open into a large vestibule area. The floor height is designed to allow near level boarding. This is intended to improve passenger flow. Additional fold-down seats are provided in each vestibule, and in one bay of the DMS vehicle

to provide a cycle storage area. Two door control panels are fitted in each vehicle.

Northern says the interior layouts of the air-conditioned DMUs and EMUs will be identical, with standard class seating throughout and one universal access toilet per unit, located in the DMSL driving car.

The Fainsa seating is laid out in a mix of face-to-face bays around tables and airline-style face-to-back with seatback tables. The seats are all arranged in a 2+2 layout with armrests between each pair, and covered with a bespoke pattern fabric. The transverse seats are cantilevered from the vehicle sidewall to simplify cleaning. This also provides space for storing luggage between back-to-back seats, augmenting the overhead racks, which are big enough to take small suitcases.

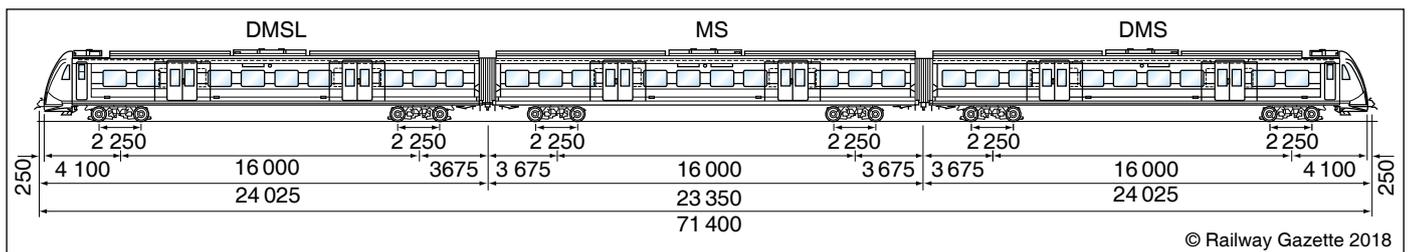
Electronic seat reservation indicators are provided underneath the luggage racks; this is a new development for Northern, as it is introducing the functionality for passengers to reserve seats up to 10 min before departure. As well as providing details of the train's actual journey, the onboard passenger information system will be able to provide real time travel information about connecting services, using a data feed from the UK rail industry's common Darwin train running system.

All trains will be equipped with Icomera wi-fi, and a power socket is provided between each pair of seats for charging laptops or mobile phones. The PRM TSI compliant trainsets have two wheelchair spaces with adjacent seating

**Three-car DMU 195 101 was hauled by rail from Bremen to Velim, having been dispatched from Spain by sea.**



Photo: Flickr/VectonX4E



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for a travelling companion.

As well as the statutory OTMR event recorder, GSM-R and AWS/TPWS train warning systems, the trains are fitted with hot axle bearing detection. A fire detection system is fitted to all units, along with an automated fire extinguishing system for the DMUs. Selective door opening will be provided for use at stations with short platforms. The onboard CCTV includes both forward-facing and saloon cameras. The EMUs have pantograph-mounted cameras to monitor the overhead line equipment and to provide a visual record of any problems.

The full-width driving cabs have a central driving position giving a wide field of view; the design was finalised through extensive consultation with drivers and maintenance engineers, leading to a number of design iterations. The layout of the controls is almost identical between the diesel and electric sets; according to one engineer, 'the only real difference is that the engine start/stop buttons in one cab are replaced by pantograph up/down in the other'.

### Testing and delivery

The first completed units were tested at their respective factories in Spain during February, before moving to the test track at Velim in the Czech Republic for dynamic testing. Test running with both types began in May.

The first two-car DMU was due to be delivered to the UK at the end of June, with the first EMU expected in August. Sets coming from Velim are scheduled to arrive by rail through the Channel Tunnel, while deliveries from Spain will come directly by sea.

Northern says the intention is to carry out as much testing as possible in Velim before the sets are delivered to the UK, so that the units can go straight onto Network Rail tracks for the next phase of certification and approval. Nevertheless, the EMUs will initially take power under a total possession as a precaution against any unexpected electrical issues.

Testing in the UK is due to run from August to November, so that the first sets will be ready to enter passenger service in December. The EMUs are due to be trialled on the West Coast Main Line, where they can experience a wide

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variety of overhead line equipment.

The first trainsets for each of the four variants will be required to achieve 2400 km of fault-free running before acceptance by Northern, with the target falling to 800 km per unit for the remaining sets. The DMUs are expected to enter service slightly faster than EMUs as these require a greater degree of testing and clearance work.

In order to minimise maintenance costs, the extensive use of modular components and subsystems means that items such as the power packs can be removed and replaced quickly, reducing down time. Whilst the trains will be maintained by Northern staff, technical support will be provided by CAF, especially through the initial warranty period.

The DMUs are to be based at Newton Heath depot east of Manchester and will mainly be deployed on the new network of 'Northern Connect' services. They are due to be introduced first on the route between Chester, Bradford and Leeds via Manchester Victoria, as well as on services from Manchester Airport to Windermere. The EMUs will be based at Allerton depot near Liverpool and are intended to work services from Manchester Airport to Preston and Blackpool North — providing that the much-delayed 25 kV 50 Hz electrification of the route through Bolton has been completed.

### Driving growth

As well as replacing older trains through the fleet cascade, the entry into service of the Civity fleets will enable Northern to increase capacity to accommodate rising demand, particularly around Manchester and Leeds. The target is to deliver a 40% increase in peak capacity across the franchise by the end of the decade with the number of services operated increasing from 13000 to 16000 per week.

This is expected to contribute to a further uplift in ridership, continuing the growth trend which has seen passenger journeys on the Northern



Assembly and fitting out of the Class 331 EMUs is being undertaken at CAF's Zaragoza plant.



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network increase from 60 million to 100 million over the past decade. The view locally is that overcrowding and the general quality of the older trains has suppressed growth rates; Arriva Rail North says the previous franchise saw passenger numbers between Liverpool and Manchester jump by 12% in the first six months following electrification in 2015.

This growth was used as evidence to inform the specification for the new franchise, countering the view held by some parts of the Department for Transport that reducing service and

**The cab layout (above) and seating configuration (right) are virtually identical for the Class 331 EMUs and the Class 195 DMUs.**

sweating the existing assets was the only way to reduce the level of subsidy. Although the government was persuaded to accept the premise that additional services would grow ridership and lead to a reducing subsidy requirement, Northern insiders are already becoming concerned about what to do when passenger numbers increase to fill the additional capacity. This might trigger the need for further investment by the mid-2020s, and the current franchise is due to end in 2025.

In the short term, the contract includes options for add-on orders, but

these would need to be exercised before the jigs are dismantled. Whilst the initial order for 98 sets will be completed in Spain, CAF says that it should be possible to produce further vehicles at its Newport facility where the other UK sets are to be assembled. ■