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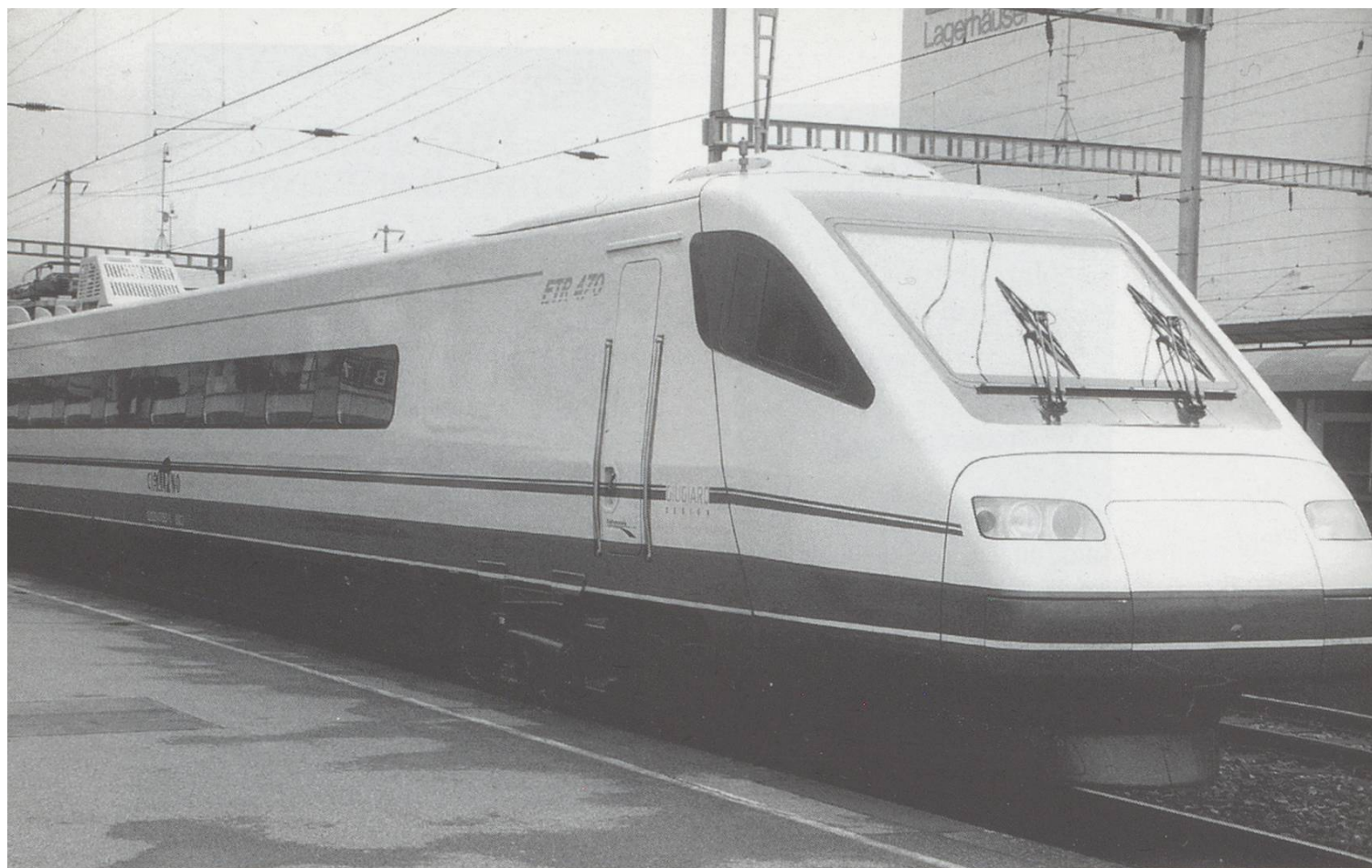
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## High Speed Trains to Switzerland; part 4 - *Cisalpino*

**Peter Marriott** continues our series looking at Europe's high speed trains which serve Switzerland

As with the TGV and ICE trains already considered in this series the Pendolino ETR 470 Cisalpino is a multiple unit which reduces turn-round time at such major Swiss terminus stations such as Zurich. The units are sometimes known as the "Pendolino of the Alps".

### Fiat Ferroviaria Pendolino

To begin with a few words about the Pendolino family of trains produced by the Italian company Fiat Ferroviaria. *Pendolino* is the registered name identifying their growing range of tilting trains.

Tilting trains work on the principle of making the train body lean inwards into bends. This compensates for centrifugal acceleration up to  $1.35 \text{ m/sec}^2$  using an active tilting system reaching a maximum of  $8^\circ$ . This enables travelling speeds to increase up to 35% without the need to modify infrastructure.

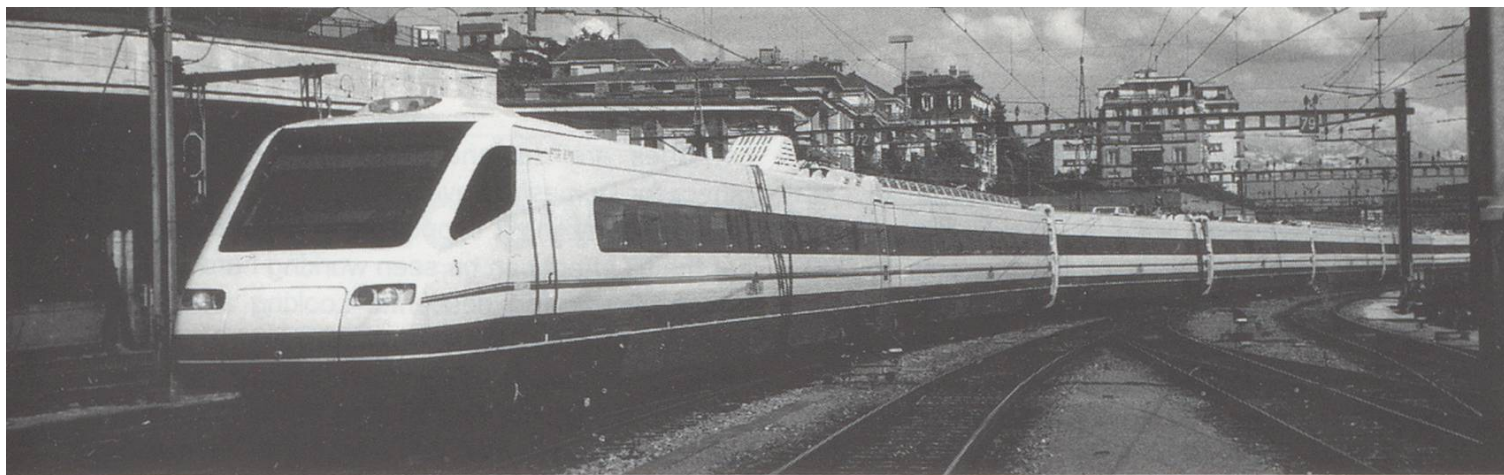
The Pendolino story began in 1967 with the arrival of the Y0160 tilting single unit prototype railcar. Following extensive testing FS (Italian State Railways) ordered the first full tilting train

prototype known as the ETR 401. This was a four vehicle set delivered in 1976. Following various modifications and improvements during testing service tilting train sets were ordered in 1985. These were designated ETR 450 and 15 sets began service in 1988 between Rome and Milan. These trains are still operating today over an extended network.

German Railways were the next to benefit from Pendolino with the introduction of 20 two-car VT610 diesel multiple units based on ETR 450 technology. These were introduced on regional services on winding lines around Nuremberg. Travelling times on these routes reduced by 25% compared with conventional rolling stock - passengers increased by 40%.

The third generation Pendolino is known as the ETR 460 and was introduced on FS in 1993. This order was for ten nine car sets styled by Giugiaro and although based on ETR 450 technology they incorporated further improvements and technical advances. These trains, like the ETR 450's, are capable of 250





km/h. ETR 460's have already been tested in Poland and are now used for services linking France with Italy in addition to the domestic FS services.

Derivatives of the ETR 460 are already in use in Finland as Sm3 tilting units. These larger gauges units have improved cold weather protection compared with the units used in Italy. Other forthcoming projects include the ATR 410 diesel multiple units for FS and tilting EMUs for Portugal and Spain.

In late 1998 it is anticipated that the prototype SBB tilting train will commence tests. The new ICN tilting train will use new bogies, the latest on-board electrics, revised current collection and other innovations being produced by FIAT SIG Schienenfahrzeuge AG which is a company within the FIAT Ferroviaria Group. Twenty four of these sets will be built.

Milan has become one of the centres for European high speed train operation. It is the terminus of a variety of Fiat Ferroviaria products; the Cisalpino ETR 470 services from Geneva and Bern/Basle/Zurich, stablemate ETR 460s on the Rome and Lyon routes and the latest ETR 500 trains operating on the domestic FS Milan to Rome services.

### Cisalpino

Because of the winding nature of the routes, the frequency of stops and the gradients the start to stop times of Swiss rail services are rather slow. Despite these obstacles as readers will know Swiss railway timekeeping is generally some of the best in the world. To reduce journey times on the International services Cisalpino tilting trains are now in use on the Swiss and Italian networks.

Cisalpino SA is a Swiss based joint venture company formed by Swiss Federal Railways (SBB), the Bern Lötschberg Simplon railway (BLS) and Italian Railways (FS). The nine

Cisalpino sets were built by Fiat Ferroviaria. They are designated the ETR 470 and have been based on the ETR 460 Pendolino sets as referred to above.

Each train comprises of nine vehicles of which six are motor cars and the remainder trailers. Power equipment is distributed along the train which is arranged as three independent traction units - each includes a transformer, traction converter and auxiliary converter. Four asynchronous motors supply a total of 6000 kW of power. Motors are suspended from the underside of the carriages with the drive to the bogies using cardan shafts. The tilting mechanics are situated below the carriage floors - micro-processors determine the angle of tilt which is provided by a hydraulic system beneath the carriages. The bogies incorporate the latest technology for winding routes and minimum radius curves. Coil springs form part of the primary and secondary suspension systems.

The bodyshells, which have been designed by Giugiaro, use aluminium double-skin extrusion technology keeping the maximum weight per axle down to 13.5 tonnes and the maximum running weight of a set to 491 tonnes. The aerodynamic driving end incorporates collision protection for the driver.

Passenger capacity is 475 of which 156 are first class - seating is a mixture of 2 + 2 in second class and 2 + 1 in first. All seats can be reclined (electrically in first class) with air conditioning being standard throughout the train. The armrests in first class carriages feature an audio system with four channels (earphones can be purchased from the bar at 3.50 Sfr). Window blind movement is electrically controlled from buttons just below the windows. The body width is 2.8 metres and overall length is 236.6 metres with the rakes comprising of three first class, five second class and one restaurant car. The latter has seats for 29. Two handicapped seats are



included within each train set and one handicapped equipped toilet compartment. All toilet compartments are closed circuit units.

The maximum speed of the trainsets is 200 kph. The total power delivery of 6000 MW assists rapid acceleration on Alpine passes. Regenerative and rheostatic braking systems are used - the former in Switzerland and the latter usually in Italy. The units use 15kV ac (for Switzerland) and 3kV dc (for Italy) current - two pantographs for each voltage are carried by the units. Each set cost approximately Sfr 27 million.

One of the great advantages of the tilting train technology is the increased travelling speed without the need to revise infrastructure. The usual maximum speed over the Lötschberg line is 80 kph but the Cisalpino trains are permitted to travel at 100 kph along this route. Signalling and track has not needed to be modified to facilitate this increase in speed. For information about the Cisalpino test trains please see the June 1996 issue of Swiss Express.

From 29 September 1996 two daily return Cisalpino services commenced between Milan and Geneva via Lausanne. Additionally one return service operated between Basel via Bern to Milan and another service from Bern to Milan. The reductions in time using the tilting trains is up to 30 minutes on the Geneva route and 47 minutes on the Basel line. The Cisalpino sets were used on the Milan to Zurich route via the St Gotthard from 15 December 1996.

The 1997/8 timetable which commenced on 1 June 1997 had two return trains each day between Milan Central and Zurich with a journey timing of 3 hours and 41 minutes. It is intended to extend one service to/from Stuttgart from the May 1998 timetable change which will add approximately three hours to the overall journey time. Three daily return services operate between Milan and Geneva taking 3 hours 40 minutes for the 362 km journey. Two further return trips take place each day between Basel and Milan - the distance of 387 km to be completed in 4 hours and 26 minutes.

### **Riding the Cisalpino**

For travel within Switzerland using the Cisalpino sets there is no supplementary charge. International passengers crossing to and from Italy need to pay an additional fee. Some

carriages are designated to International and others for Domestic travel.

When sampling a cappuccino in the restaurant car the tilt effect can be seen working hard on the Alpine climbs and descents. Looking along the train it appeared to be like an aircraft during banking manoeuvres. Whilst seated it was comfortable but moving around in the carriages was not quite as easy. It is best not to attempt to carry drinks on the most winding sections of the journey! One of the Cisalpino leaflets describes the experience as "tilting technology enabling it to lean into the curves like a motorcycle". The acceleration and deceleration of the unit was most impressive. The carriage interiors are rather subdued - grey and blue predominate in first class with green/blue in second class. The bar and restaurant car has blue fold up seats offering a range from cappuccino (Sfr 3.00) through minestrone soup (Sfr 6.50) to full meals from Sfr 18.50. First class ticket holders with seat reservations will be entitled to receive a free newspapers and welcome drink.

Unfortunately it has been my experience that to ride the Cisalpino is rather disappointing. Some passengers find the Cisalpino stock a little claustrophobic - the windows are certainly small compared to Swiss panoramic coaches. Luggage room is limited and invariably the toilets are not all in working order. Personally I have found the ride to be rather rough. Cisalpinos are certainly not as smooth as the new generation of SBB double deck carriages. Similarly the interior finish on the trains does not reach the standards set by the DB ICE carriages but nevertheless it is a most enjoyable way to travel along the Lötschberg, Gotthard and Rhone Valley routes.

### **Cisalpino facts and figures**

Maximum speed	200 km/h
Gauge	1435 mm
Supply voltage	15 kV ac (Switzerland) or 3 kV dc (Italy)
Continuous power	6000 kW
Max. weight per axle	13.5 t
Weight (running order)	491 t
Body width	2.8 metres
Overall length	236.6 metres
Seats	483
Operating temperature	-25° /+ 50°