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The Simplon Tunnel

John Jesson

Part 3 – Electrification and Operation



Fb 3/5 No. 364, with lowered bow collectors, on a freight at Iselle.

Photo: Franco Dell' Amico

Although operations through the first tunnel started with steam locomotives, concern had been expressed during construction as to the use of this form of traction. Studies of the Burgdorf - Thun railway, and the Valtellina line, between Lecco and Sondrio in Italy, led to the decision to electrify the tunnel at 3,300V 15 cycles ac 3-phase. The power supply for the electrification came from the two hydraulic power plants, at each end of the tunnel, which had been used during construction. Suitably altered and enlarged, they were capable of generating the traction current without the necessity of importing power from elsewhere.

This decision was influenced by an offer by Brown, Boveri & Cie of Baden (BBC) to electrify the line between Brig and Iselle, an offer that was made in order to make comparisons between steam and electric traction on a large scale. At the time BBC were building two 3-phase locomotives for the "Società delle Strade Ferrate Meridionali", an Italian private railway, which became part of the FS in 1905. It was hoped that the Italian railways would agree to the transfer of these two locos to the Simplon line, as it would not have been possible to build completely new locomotives in time. This was what occurred, so in April 1906 trial running began with the two 1-C-1 locomotives. These, Nos.364 and 365, were classified Fb3/5 by Swiss railways. After 3 months of trials, electric working of trains through the tunnel

between Brig and Iselle di Trasquera was introduced on 1st July 1906.

BBC delivered two more locomotives in 1907/8, which became Nos.366 and 367. These were of the D wheel arrangement and classified Fb4/4. In the period between the opening of the tunnel and the delivery of these, the FS hired the SBB three more Fb3/5s Nos.361, 362 and 363 that had been built by Ganz of Budapest for two Italian railways. Nos.361 and 362 were in regular use with No.363 (of the Rete Adriatica) as a reserve. During the year they ran on the SBB, the Ganz bow-collectors were replaced with the BBC design, a curiosity that this should have been done for such a short period of operation. A 1906 postcard shows one of the locos in green livery. The three locos were not taken into SBB stock.

In 1914, a further locomotive was delivered, in anticipation of a much-needed extension of the electrification to Domodossola. This was Fb4/6 No.371 (1-D-1 wheel arrangement) and was the most powerful electric locomotive in the world at that time. The southward extension did not materialise, but in 1919 the 3-phase was extended from Brig to Sion, necessitating construction of a further two locomotives Fb4/4 Nos.368 and 369. The three classes were re-classified for a time into the standard Swiss system as Ae5/5e, Ae4/4 and Ae4/6, the last becoming Ce4/6 in 1921, when the maximum speed was reduced. With their published maximum speeds of some



Fb 4/4 No.366 has arrived at Iselle with a freight in 1929 – photo Franco Dell' Amico.

70kph, a Be classification would have been more appropriate. The locomotives were not renumbered. These seven locomotives comprised the total fleet until the SBB's standard single-phase electrification system ousted the 3-phase on 15th May 1930. Six of them were scrapped, but No.365 was bought back by BBC with rebuilding in mind and was stored in BBC premises at Münchenstein until 1940 when it, too, was scrapped. One traction motor from the fleet was preserved, and is now at the Swiss Transport Museum at Luzern.

Although the tunnel was electrified from its earliest days, steam locomotives also did work through. Initially, the electric locos worked only freight trains and one stopping passenger train each way. Other trains were steam worked, and photographs exist showing C4/5 (27xx Class) and A3/5 (7xx Class) on such trains. From 1st August 1906 all trains were planned to be electrically hauled, although there is written evidence that the "*Simplon Orient Express*" continued to be steam-worked by an A3/5 throughout, to avoid the two locomotive changes. The C5/6 (29xx Class) was also in use until the electrification of the Iselle - Domodossola section rendered them redundant. The shortest normal running time was made by electrically-hauled trains running south, which took about 18min. from Brig to Iselle. The longest time was taken by steam-hauled freights running north that, because of the adverse gradient, took

between 25 and 28min.

The conversion of the Simplon route to single-phase ac current, and its extension to Domodossola, allowed the use of the standard Swiss electric types, notably the Ae4/7, which were fitted with regenerative brakes. The exception to this were the Ce6/8, the "Crocodiles". Because of the unsatisfactory electrical insulation of the traction motors and the unusually high humidity to be encountered in the Simplon tunnels, their use south of Brig was prohibited. A single class Ae4/7 was permitted to haul 335t up the 2.5% (1:40) gradient of the south ramp. Heavy international trains and freights were frequently double-headed. During the early 1960s several of the new Ae6/6s were allocated to Lausanne with duties that took them through the tunnel. These were Nos.11460/61/62 and Nos.11471 to 76, although both the total allocation and the individual numbers have changed over the years. However it was not until 1967, and the introduction of the Re4/4IIs, that the use of the Ae4/7s through the tunnel came to an end. In the mid-60s, nine of the Ae3/5 locos were rebuilt for push-pull car carrying trains through the Simplon and Gotthard tunnels. Nos.10218/19/20 were allocated to Brig for the Simplon traffic between Brig and Iselle di Trasquera. The rebuilding included the fitting of multiple-unit control, for operation with a control vehicle, and a radio. The main circuit breaker was replaced and positioned on the

roof, and one pantograph was removed.

All of the more recent SBB classes have seen duty through the tunnel, including the RAe/RABe multi-voltage units in both their TEE and EC roles, and the RBe4/4 railcars, which from 1967 to 1977 worked local trains between Domodossola and Brig, with only the Re4/4I locos being little used. Many loco-hauled services have been in the hands of Re4/4II and Re6/6 locos, with the emphasis very much on the former. One of each class, coupled in multiple, can haul the maximum permitted load of 1170t, worked by a single driver. During the

1950s this weight of train would have required four Ae4/7s, with four drivers. Not only SBB locomotives work through the Simplon tunnel - the BLS also provides motive power. The number of through workings has increased in recent years, as more SBB locos work over the Lötschberg, so various types of BLS locos can be seen in Domodossola on through trains to Bern or Basel, thus avoiding a change of locomotives at Brig. At one time the BLS "Blue Arrow" railcars worked through to Stresa, hauled from Domodossola by an Italian electric locomotive. Now, in the 21st C, many through services are being worked by long-distance, high speed, EMUs.

One of the most intriguing features of the Simplon tunnel is the centrally located crossing station. This is officially located at 9.148km from the northern end of the original (now the south-bound) bore. Originally staffed by two men, this continued until 1956 when it became remotely controlled from Brig. With modern signalling, 5 - 6 trains can be in the tunnel in each direction simultaneously. Both tunnels are signalled for running in either direction. However, the central station still sees railway staff regularly, as it is the meeting point of the daily examination of the tunnels. Each day pairs of both SBB and FS personnel enter the tunnels to carry out a visual inspection. After walking to the crossing station and meeting their colleagues, each pair returns along the other tunnel back to their respective entrances, a round trip of 6 - 8 hours. When a train approaches, sanctuary can be sought in one of the cross-tunnels, of which there are forty, or in one of the refuges located every 50m. Every kilometre there are larger refuges equipped with telephones, and every 5km is a materials store. The international border is at 9.06 km from the northern end, not far from the highest point of the tunnel. To mark the border a plaque carrying the Swiss and Italian coats of arms and the words "Suisse" and "Italia" is fixed to the wall.

This is the last of three articles by John Jesson that first appeared in Swiss Express over 20-years ago. With many new members having joined the SRS since then we have decided to re-run them with appropriate revisions.

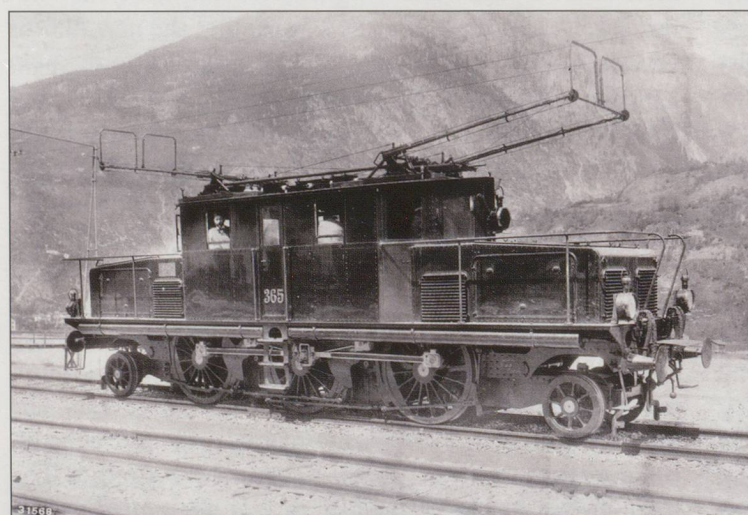
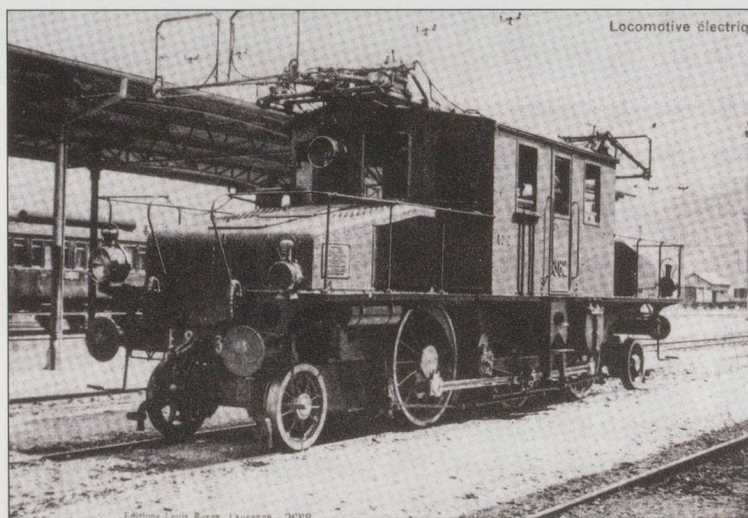
John's Postscript

In the 20-odd years since these articles were first published, there have been developments, not least in the motive power working through the tunnels. Passenger trains are now usually either multiple units or hauled by 460 class locos. The car

TOP: The unique Fb 4/6 No.371 on a freight bound for Switzerland at Iselle – photo Franco Dell' Amico.

MIDDLE: Fb 3/5 No.362, one of the locos built by Ganz, Budapest, which were hired to the SBB by the FS for a short time. It is fitted with BBC current collectors.

BOTTOM: Fb 3/5 No.365, one of the two original locos built by Brown, Boveri & Cie for the Simplon tunnel.



transporter shuttles to/from Iselle work push-pull with an Re 4/4II, with the loco at the Brig end. Freight can be hauled by SBB, BLS or any number of independent operator locos. Although a lot of the locos used are of the Bombardier TraxX type, there are others as well. Traffic has increased following the opening of the Lötschberg base tunnel. A few years ago, a lorry fire in the tunnel caused a lot of damage. As the tunnels were due to be

refurbished/repared shortly afterwards, this work was brought forward to combine the repairs and refurbishment in one closure, albeit a long closure. Starting with the section affected by the fire (I believe this was the southern end of the northbound tunnel), work is progressing to the other three sections, During 2012, the northern section of the northbound tunnel was being worked on.

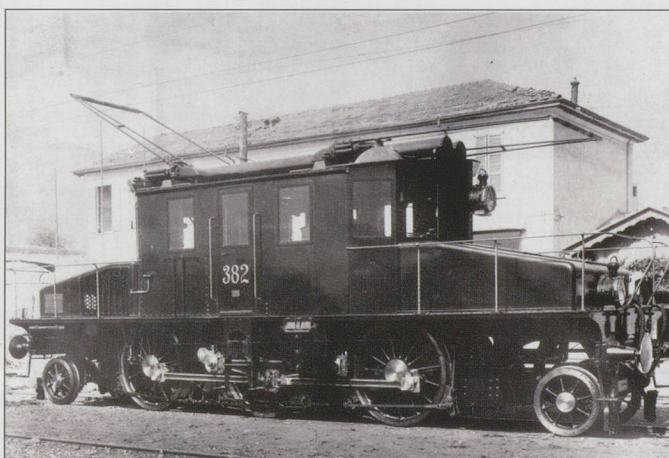
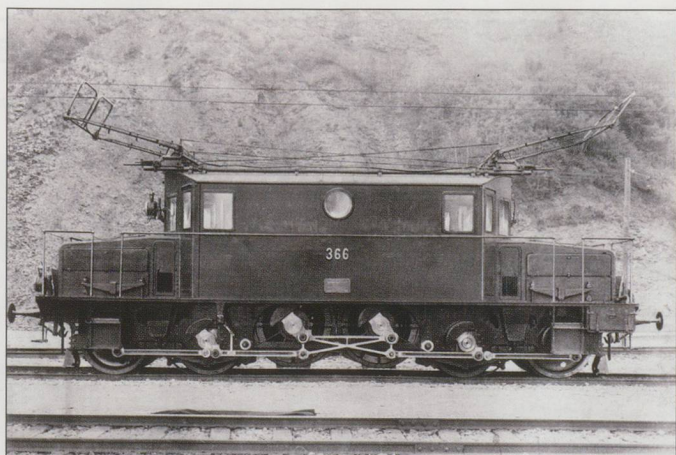
Appendix

Technical details of the 3-phase locomotives used through the Simplon tunnel:-

Class	Fb3/5 (361-3)	Fb3/5 (364-5)	Fb4/4 (366-9)	Fb4/6 (371)
Years built	1904	1906	1907/8/20	1914
Wheel arrangement	1-C-1	1-C-1	-D-	1-D-1
Total length (mm)	11,540	12,304	11,640	12,500
Total wheelbase (mm)	9,500	9,700	8,000	8,800
Coupled wheelbase (mm)	4,700	4,900	8,000	4,800
Driving wheel dia. (mm)	1,500	1,640	1,250	1,250
Pony wheel dia. (mm)	850	850	-	850
Total weight (tonnes)	62	62	68	90.3
1 hour rating (kW)	?	662	1,250	2,060
Tractive effort (kg)	?	9,000	13,000	17,000
Speeds (km/h)	35/70	35/70	26/35/ 53/71	26/35/ 53/71


Sources differ slightly regarding weights. The class Fb4/4s are alternatively shown as weighing in at 69 or 70 t. and the solitary Fb4/6 at 88.4 or 91t. One source quotes the length of 364 and 365 as 12,320 mm. Traction units working on the three-phase system do not have the variable speed range available to later systems. Instead, they have a limited range of maximum speeds. If the load of the train, or the gradient, causes the locomotive to be unable to maintain the speed set by the driver through the switching apparatus, the driver has to set a lower speed to avoid overheating. The once-extensive Italian 3-phase system was well known for the sight of boiling electric locos! My

Built in 1907, Fb 4/4 no.366 had disc wheels and a porthole window to the machinery room.



The last of the 3-phase locos to be built was Fb 4/6 no.371, delivered in 1914. Notice the body style, which is very similar to the SBB Ae 3/5, Ae 3/6 II and Be 4/7.



thanks go to Gus Basso of the Italian Railways Society, who has obtained three pictures of 3-phase locos working at Iselle from his friend in the Savona club, Franco Dell' Amico. 

PHOTOS: 'ABB AG, BADEN' except those by Franco Dell' Amico.

BELOW: Corresponding to the Simplon No.362, FS No.382 is of the same type, and shows the simple type of current collector fitted to the Ganz locos.