Zeitschrift: Swiss express : the Swiss Railways Society journal
Herausgeber: Swiss Railways Society
Band: 4 (1994-1996)
Heft: 1

Artikel: The Simplon Tunnel. Part 3, Electrification and operation
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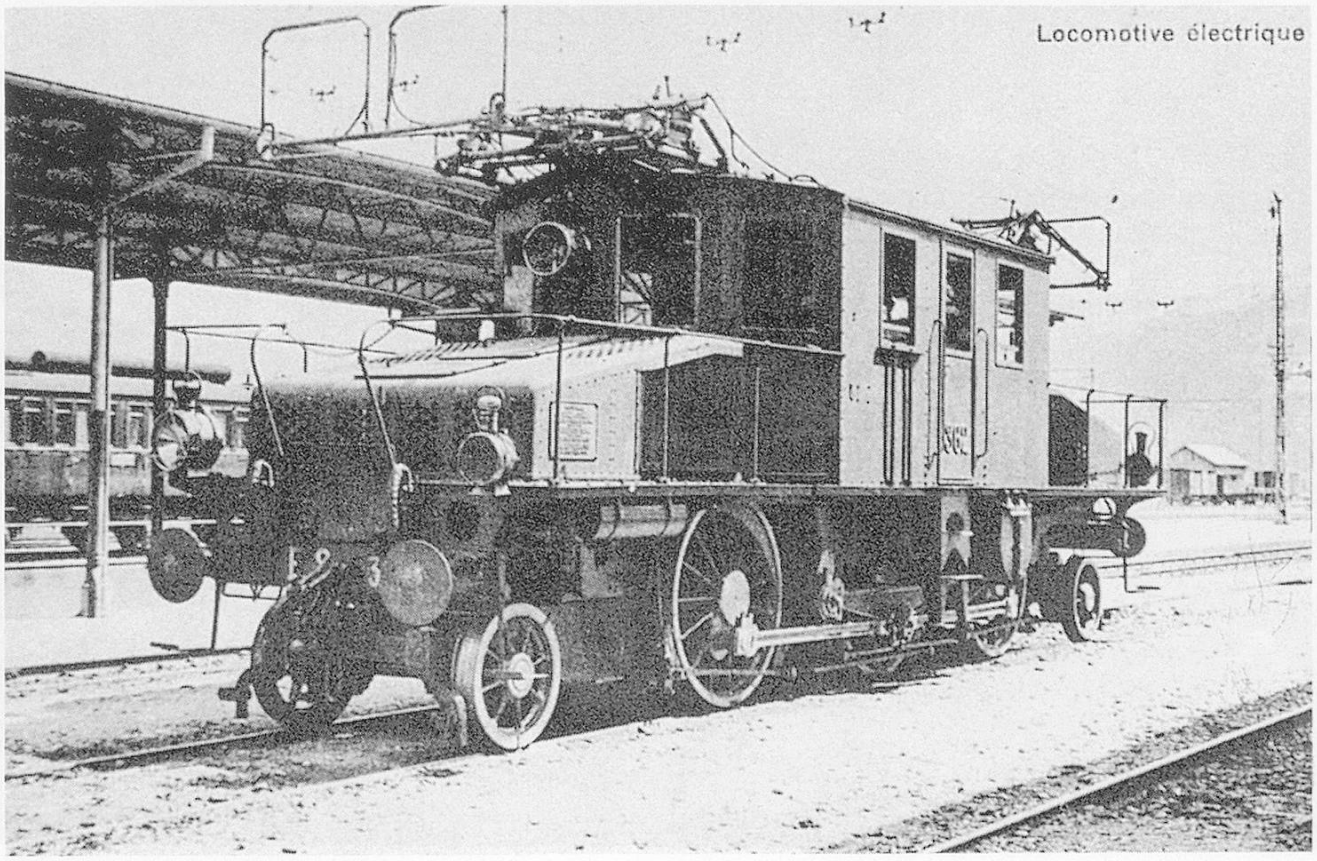
DOI: https://doi.org/10.5169/seals-854993



Fb3/5 No.362, one of the locomotives built by Ganz, Budapest, which were hired to the SBB by the FS for a short time. It is fitted with BBC current collectors.

The Simplon Tunnel Part 3

Electrification and Operation

by John Jesson *Photographs courtesy AGG Baden*

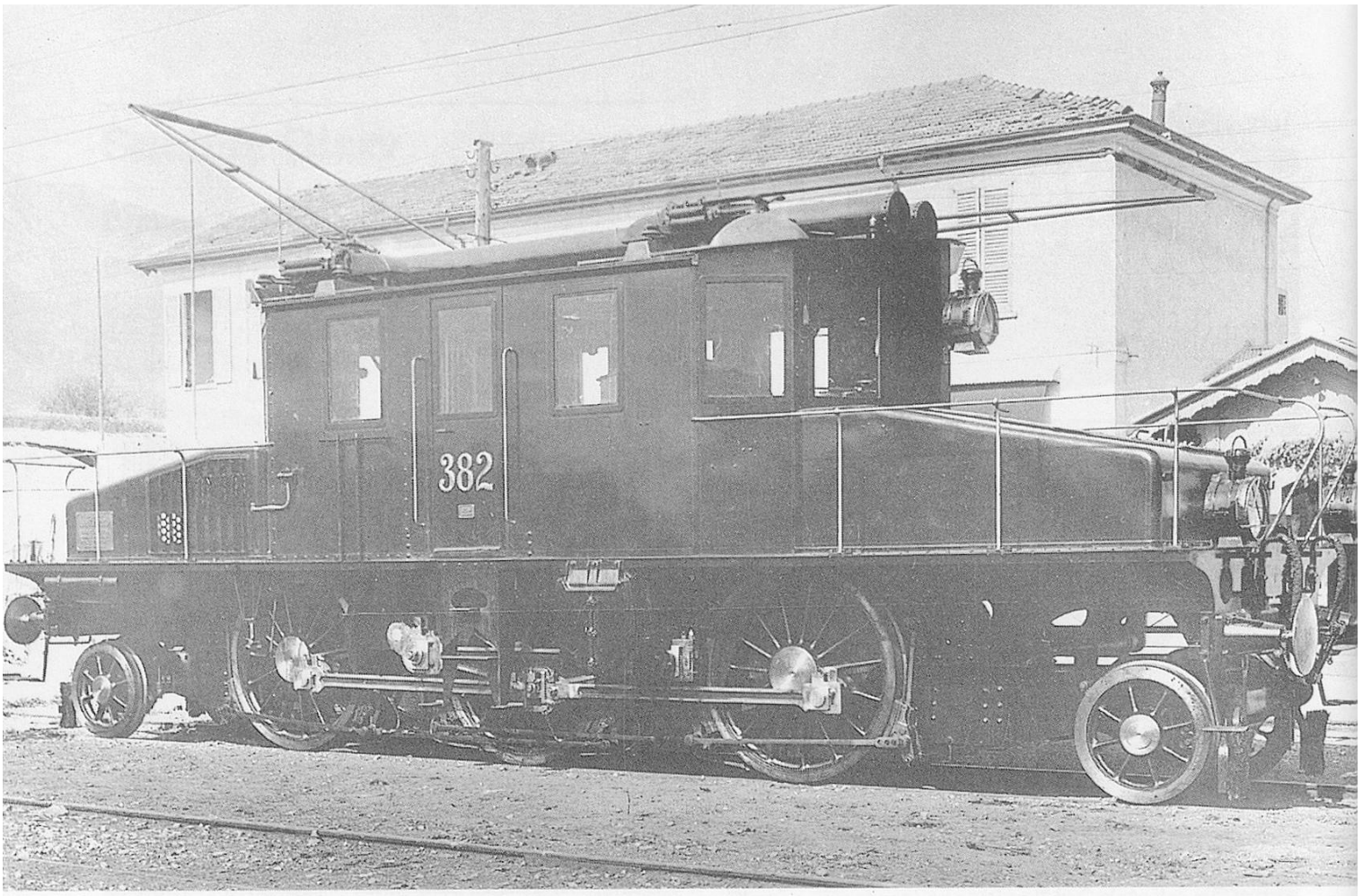
Continued from page 24, December 1993 Swiss Express

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 3,300 volts AC, 3-phase.

This decision was influenced by an offer by Brown, Boveri & Cie of Baden 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, in fact, what occurred and, in April 1906, trial running began with the two 1-C-1 locomotives, working on 3,300 volts, 15 cycles. These locomotives, nos. 364 and 365, were classified Fb3/5 by the 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.

Brown Boveri delivered two locomotives in 1907/8, which became Nos. 366 & 367. These were of the -D- wheel arrangement and had the classification Fb4/4. In the period between the opening of the tunnel and the delivery of 366 & 367, the FS hired to the SBB three more Fb3/5 locos, no's 361, 362 & 363. These had been built by Ganz of Budapest for two Italian



Corresponding to the Simplon N0.362, FS No.382 is of the same type, and shows the simple type of current collector fitted to the Ganz locomotives.

railways. 361 & 362 were in regular use, with 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. It is a curiosity that this should have been done for such a short period of operation. A postcard of 1906 shows one of the locos in green livery. The three locos were not taken into SBB stock.

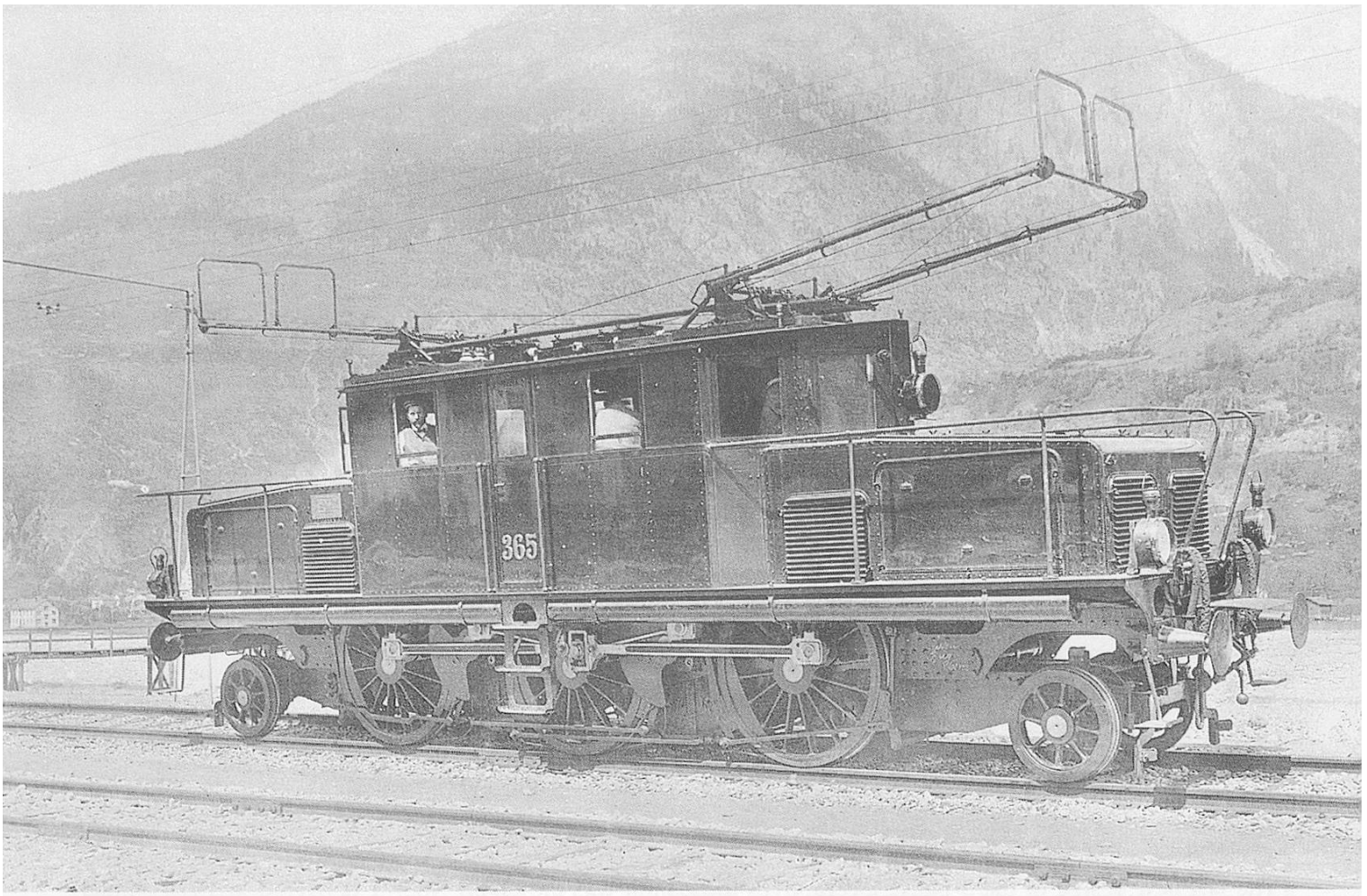
In 1914, a further locomotive was delivered, in anticipation of a much-needed extension of the electrification to Domodossola. This was no. 371, of class Fb4/6 and 1-D-1 wheel arrangement, and was the most powerful electric locomotive in the world at that time. The southward extension did not materialise, but in 1919 the 3-phase was extended from Brig to Sion, necessitating construction of a further two Fb4/4 locomotives, 368 & 369.

These seven locomotives comprised the total fleet until the SBB standard single-phase system ousted the 3-phase on 15th May 1930. All of them were scrapped, although 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. The technical details of the locomotives are appended at the end of the article.

The three classes were re-classified for a time into the standard Swiss system as Ae3/5, Ae4/4 and Ae4/6, this last becoming Ce4/6 in 1921, when the maximum speed was reduced. With the published maximum speeds of 70/71 km/h, a Be classification would have been more appropriate. The locomotives were not renumbered.

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.

Although the tunnel was electrified from its earliest days, steam locomotives did work through. Initially, the electric locos worked only freight trains and one stopping passenger train each way. Other trains were steam worked,



Fb3/5 No.365, one of the two original locomotives built by Brown, Boverie & Cie. for the Simplon tunnel.

and photographs exist showing C4/5 (27xx) and A3/5 (7xx) classes 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.

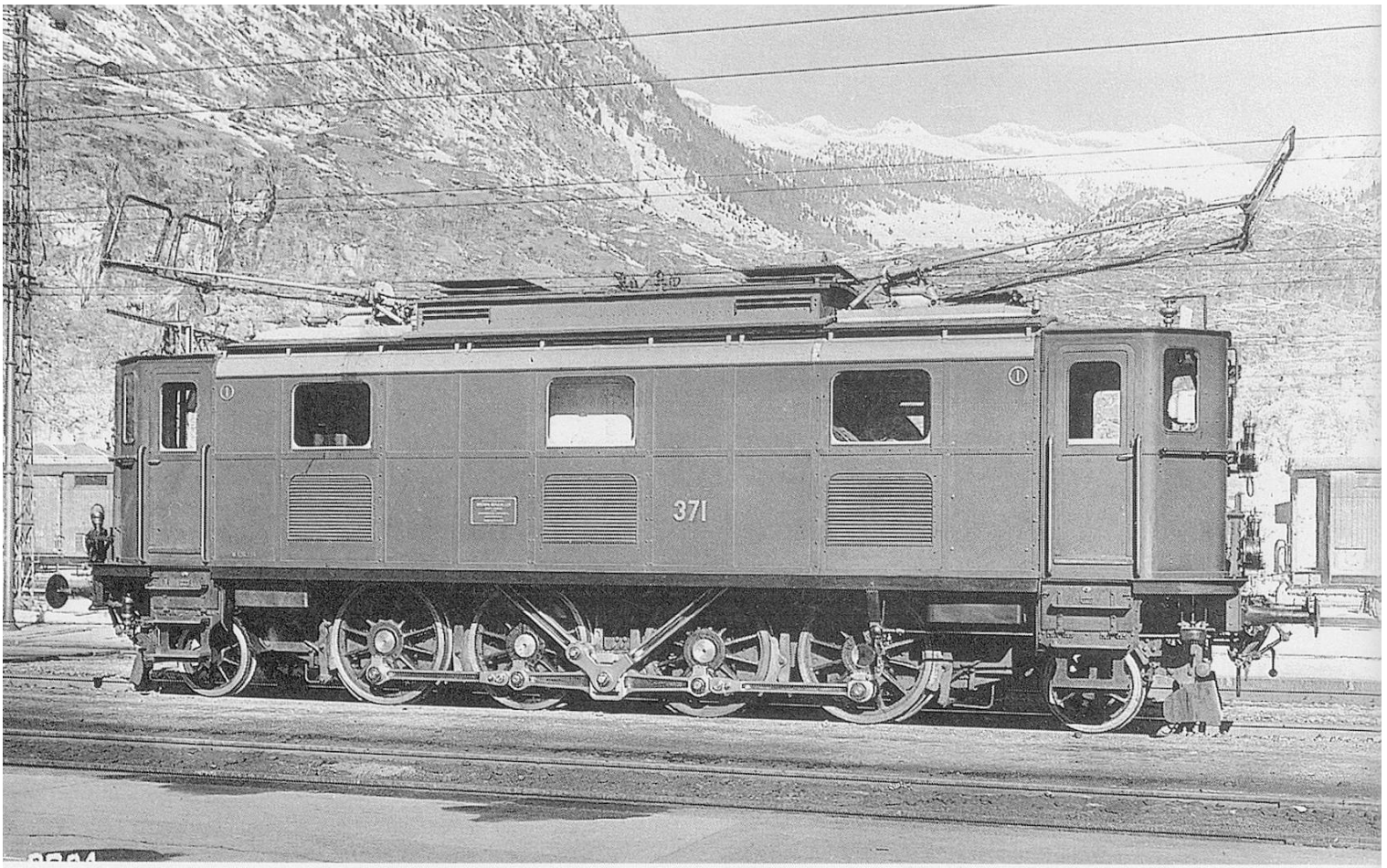
The shortest normal running time was made by electrically - hauled trains running south, which took about 18 mins from Brig to Iselle. The longest time was taken by steam - hauled freights running north which, because of the prevailing 1:143 gradient, took between 25 and 28 mins.

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 was 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 25‰ 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 which took them through the tunnel. These were 11460 - 2, 11471 - 6, 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 Re4/4^{II} that the service of the Ae4/7s through the tunnel came to an end.

In the mid-60's, nine of the Ae3/5 class were rebuilt for push-pull car-carrying trains through the Simplon and Gotthard tunnels. 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 modern classes have seen duty



The last new design of the 3-phase locomotives to be built was the Fb4/6 No.371 delivered in 1914. Notice the body style, which is very similar to the SBB Ae3/5, Ae3/6^{II} and Ae3/6^{III} of the '20s, and also the RhB Ge4/6, built in 1913/14.

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. Only the class Re4/4^{I}s have been little-used. Services today are predominantly in the hands of the Re4/4^{II} and Re6/6 classes, 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 '50's, 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. Although the number of through workings has increased in recent years, as more SBB locos work over the Lötschberg, BLS Ae4/4, Re4/4 and Ae8/8 classes can be seen in Domodossola on through trains to Bern or Basel, thus avoiding a change of locomotives at Brig. At one time, BLS "Blue Arrow" railcars worked through to Stresa, hauled from Domodossola by an Italian electric locomotive.

One of the most intriguing features of the Simplon tunnel is the centrally-situated crossing station. This is (officially) located at 9.148 km from the northern end of the original (now the southbound) bore. As previously stated, it was originally staffed by two men, and continued to be staffed 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, a pair of SBB and a pair of FS personel enter the tunnels to carry out a visual inspection. After walking to the 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 40, or in one of the refuges, located every 50m. Every kilometer there are larger refuges equipped with telephones, and every 5 km 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. A plaque is fixed to the wall to mark the border, and carries the Swiss and Italian coats of arms and the words *Suisse* and *Italia*. The Simplon was the last of the major Alpine tunnels to be built. With the prospect of even more massive, low-level, tunnels under the Brenner, Gotthard and Lötschberg, it was felt to be a suitable time to recount the difficulties which faced the builders at the turn of the century.

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 Fb4/4 are alternatively shown as weighing in at 69 or 70 t. and the solitary Fb4/6 at 88.4 or 91 t. One source quotes the length of 364 & 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!

Bibliography

Railways of the World — *F.A.Talbot*
Railways through the Mountains of Europe — *A.Schneider*
The History of the Electric Locomotive — *F.J.G.Haut*
SBB Nachrichtenblatt

In particular, I would like to thank Herr Lang of ABB Transport Systems for the photographs of the 3-phase locomotives.

SBB Stock News

New locomotives up to the end of November 1993:

Re 4/4	450.059, 066, 067, 068, 069
Re 4/4	460.021-023, 053, 056-068, 070, 072
Am	842.000
XTms	88100

Withdrawn:

Re4/4^{I}	10047 (accident)
Ae4/7	10960
Ae3/6^{I}	10680
BDe4/4	1647
Ee3/3	16320
Tm^{II}	814