Switzerland's deep heritage in rail

Switzerland is undoubtedly the world's number one railway country! What started in 1874 with the so-called 'Spanisch-Brötli-Bahn' from Baden to Zurich finds its current climax in the Gotthard Base Tunnel that will be opened on time in 2016. At 57km-long, this tunnel will be the longest railway tunnel in the world – and this in the heart of the small country of Switzerland that has already excelled in the past, not just with size but with innovative strength, explains Michaela Stöckli, Director of the SWISSRAIL Industry Association.

Let us make a small excursion into the past of the Swiss railway world

At the start of construction of the Gotthard Bahn in 1872, Switzerland's neighbouring countries were already in possession of transalpine railway lines: Austria with the Semmering railway since 1854 and the Brenner railway since 1867, as well as France with the Lyon-Turin line through the Mont Cenis tunnel since 1871. Nevertheless the technical knowledge gained through the construction and operation of these railways could be integrated into the Gotthard Bahn project.

The construction work for the Gotthard tunnel began on 13 September 1872 in Airolo and on 24 October 1872 in Göschenen. The responsible engineer Louis Favre did not witness the breakthrough that took place on 28 February 1880. The Gotthard Bahn was officially assigned to operation from 22 – 25 May 1882. Although this meant a delay of 15 months, it proved to be a short construction time considering the extent of the work (this bears no relation to today's construction delays such as the airport in Berlin or the Elbphilharmonie in Hamburg).

Soon after the opening of the Gotthard Bahn, it was clear that the single-track operation was no match for the increasing demands in the transport of passengers and goods. Even a goods train pulled by two locomotives assisted by a third one pushing from behind could just about achieve a gross weight of 510 tonnes and, with 20km/h, blocked the line much too long. Actually, the necessary increase in traction power should have been achieved with the 87 tonnes Mallet tank locomotive (ed. 2x3/3) that was delivered by Maffei in 1890, particularly as the good curve compatibility of this model would have taken into account the tight radii of the hairpin bends and the spiral tunnels. However, the biggest steam locomotive in Europe at that time did not prove to be practical; the tank was too small and the engine required frequent maintenance. The machine remained a unique specimen up to its withdrawal from service in 1917.

In the absence of more efficient locomotives, an effective increase in the efficiency of the Gotthard Bahn could only be achieved lineside by the laying of a second track. While the summit tunnel was already double-tracked in 1883, the partially very complex double-track extension of the approaches began in 1890. After the successive commissioning of individual sections, it was completed by 28 May 1893 enabling uninterrupted use of the entire double-track, slow mountain section between Erstfeld and Biasca.

The long desired reduction in journey time for express train traffic became apparent in 1894 as two 90 km/h prototypes of class A 3/5 as

three cylinder (No. 201) and as four cylinder compound version No. 202) were delivered from the Schweizerischen Lokomotivfabrik Winterthur (SLM). After the decision in favour of the four cylinder system, a total of 28 further locomotives of the A 3/5 class that could transport 140 tonnes on the mountain at a speed of 40km/h were put into service between 1897 and 1905. In 1908, Maffei and the SLM each produced a further four locomotives of class A 3/5 with drive on the first axle and increased performance. Thanks to the maximum permissible speed of 90km/h, it was possible to do so without transforming between the valley and mountain sections. In addition, the higher train weight enabled the inclusion of a dining car so that provisions stops could be dispensed with and the journey time on the Gotthard route could be reduced by two whole hours. But even an A 3/5 double heading with 2x 140 tonnes (corresponds to 280 tonnes) was not capable of fully exploiting the coupling load by now increased to 320 tonnes. Therefore, the Gotthard Bahn decided on the procurement of a series of special locomotives consisting of eight pieces that, as C 4/5 achieved a maximum speed of only 65km/h but hauled 180 tonnes up the mountain at a speed of 40km/h. In this way, tow-trains with a weight of 320 tonnes could continuously be hitched with an A 3/5 and travel in flat country with 90km/h. On the approaches to the Gotthard tunnel, these trains received tows with a C 4/5 and travelled there at a speed of 40km/h. This type of operation for passenger transport was maintained up until the introduction of electric traction.

At the turn of the century, apart from the local trains, six express train pairs, including the famous 'Gotthard Express', were already crossing the Gotthard in the summer months. In 1908, one year before nationalisation, the Gotthard Bahn even decided to introduce a deluxe train from Hamburg to Genoa in the style of the Simplon-Orient-Express, which, apart from a luxurious dining car, also included particularly comfortable passenger carriages and was marketed under the name of the Lloyd Express. Normally, the train was pulled by one of the four A 3/5 engines of the latest generation delivered in 1908; on the mountain assistance was given by a C 4/5.

In 1909, the Swiss Federal Railways (SBB) took over the Gotthard Bahn. Under their aegis, the acquisition of locomotives for the North-South axis progressed; in doing so, the advance in locomotive construction was initially advantageous for freight traffic. Between 1913 and 1917, SLM delivered a total of 30 units of the largest and strongest of the SBB steam engine class C 5/6. Under the nickname 'Elephant', with 1.192kW power it pulled 320-tonne freight trains up the North-South ramp of the Gotthard at 20km/h and helped express trains with a weight of 200 tonnes over the mountain with at least 35km/h. Steam locomotive operation however had its problems. The capacity of the engines was limited, coal for the steam locomotives had to be imported and transport to the depots was costly. In addition, the smoke gasses in the tunnels endangered the locomotive personnel.

In 1913, the increasing performance requirements tipped the scales towards an important decision: The SBB decided to electrify the section between Erstfeld and Biasca. The remaining sections were to follow so that one could travel from Lucerne to Chiasso under contact wire. The selection of the power system was not difficult, as the alternating current system tensioned to 15 kilovolt at 16 2/3 Hertz had already proved itself with the Lötschberg-Simplon-Bahn that had just been put into operation.

In 1914, the work that had been immediately started had to be stopped with the outbreak of the First World War. As coal became scarcer and more expensive after the end of the war, the electrification was continued with vigour. On 12 December 1920, the contact wire on the mountain section was energised and from 6 February 1922, the whole section from Lucerne to Chiasso could be traversed continuously by electric locomotives. With the start of electric operation, the coupling load on the mountain section was increased from 400-500 tonnes. At this point it would be extremely enticing to further highlight the technical development of the Swiss railway industry based on the Gotthard line. On the other hand, this would go beyond the boundaries of this article and, at some stage, would bore the sympathetic reader.

Just this: Under the direction of the companies SLM, BBC and MFO innumerable classics of railway construction were born. On the sidelines only the following are mentioned: 'Grossmutter', 'Zuger Berta' or even the legendary 'Crocodile'.

Together with the Swiss railway network, the Swiss rail industry has developed in an almost symbiotic way. Over the years, the avant-garde of Swiss engineers has grappled with the construction and maintenance of the Swiss railway network. Despite the turning point at the end of the eighties as the fate of the Swiss rail industry was hanging by a thread, the know-how and tradition in this area was able to assert itself.

Today, almost 100 Swiss companies in the field of the rail industry are organised within the 'SWISSRAIL Industry Association'. Many of them can look back on a turbulent but largely successful past. The majority of these industrial protagonists are hardly known to the general public, as they are 'only' suppliers for our rail world. However, what would be a modern, safe and efficient railway today without intelligent air conditioning systems, doorways, tachographs and fire protection equipment?

Switzerland not only market-leading components in the area of rolling stock are produced today but also locomotives are developed and vehicles produced that are in use throughout the world.

Thanks to the exceptional achievements of the rail industry, in general public transport in Switzerland has developed commendably: In no country in the world is the utilisation of the rail network higher than in Switzerland! Public transport customers in Switzerland benefit from a provision: No matter how many different transport companies are utilised, only one ticket is necessary – correspondingly the public transport package is used very intensively.

Switzerland's example demonstrates convincingly how the cooperation between industry, transport and politics can lead to public transport being enjoyable every day and does not become a pest!

The SWISSRAIL Industry Association and its members contribute daily towards public transport in Switzerland continuing to lead the way in the future and also to Swiss innovations being utilised and appreciated beyond the tight frontiers of the country.

Michaela Stöckli has been Director of the SWISSRAIL Industry Association since November 2009. Made up of approximately 100 members, the Association's main focus is to represent the Swiss railway industry abroad and contribute to a positive industry environment in Switzerland. Before this, Michaela worked in a number of managerial and executive roles in the fields of IT and software, and particularly traffic security within the rail industry.