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Arts on Fire 2019, an industrial arts festival and iron pour held annually at the Scranton Iron Furnaces, part of the Anthracite Heritage Museum Pennsylvania, USA. The annual free festival offers a variety of industrial processes including iron casting, blacksmithing, glass blowing, jewelry-making, stained glass, and welding. Inside, the director of the Anthracite Heritage Museum, Bode Morin, presents the response of managers of three distinct historic industrial sites to the coronavirus pandemic.

EDITOR'S NOTE

This issue of the TICCIH Bulletin is dedicated to friends and colleagues struggling with the pandemic.

James Douet, TICCIH Bulletin Editor

SWITZERLAND

THE HISTORIC GORNERGRAT RACK-AND-PINION RAILWAY - AN INVENTORY

Toni Häfliger, conservation specialist of railway heritage, Marion Zahnd and Marc Wiese

The Gornergrat railway (Gornergratbahn, or GGB, in German) is a spectacular mountain railway in the Swiss canton of Valais. It circulates between the village of Zermatt (1604m above sea level) and the Gornergrat (3089m). In the light of a federal approval process for the replacement of a historic railway bridge at Zermatt, a railway line inventory was required. In this context, the historic Gornergrat railway line was for the first time systematically recorded and an appraisal of its cultural and historic merits undertaken.

When Nikolaus Riggenbach (1817-1899) patented his rack-and-pinion (r-a-p) system in 1863, the newly won ability to climb steep slopes provided touristic access to remote sites. Alongside the Riggenbach system, others developed their own types, such as 'Strub' and 'Locher', using gauges from 800mm to standard gauge. The most prevalent system worldwide however is the system developed by Riggenbach's former employee Carl Roman Abt.

In the last quarter of the 19th century, Switzerland was taken by a general enthusiasm for mountain railways. Engineers and speculators surpassed one another with new proposals, projects and applications for ever more spectacular railway projects in the Alps. Every project spurred new entrepreneurs to follow suit and incited jealousy in other regions. There are three high altitude railway projects in particular that arrest worldwide attention. First the Gornergratbahn (1896-1898) and the Jungfraubahn (1896-1912). In addition to these two formidable projects, the Matterhornbahn was to bring the triumph of modern technology over nature with its terminus at 4500 m, but was never executed.

Track and tunnel near Findelbach at 1900 (historic photograph)

The Gornergratbahn was constructed in merely two years, despite the high altitude and the short intervals between spring run-off and the onset of winter, and opened on 20 August 1898. The railway line was electrified from the very beginning. A three-phase system was used, operating with two parallel overhead conductors. A dedicated power-plant was constructed,

The rack rail is visible in this image of the Gornergrat line disappearing down the hillside, with magnificent panorama views of the surrounding mountain ranges. Photo: architecum 2018

complete with water supply management, pressure lines and turbines.

The line crosses different natural and geological landscapes. The lower, arboreous region alongside the valley with their craggy slopes is followed by a quite steep transitional zone within a thinning forest stand, and finally a high-altitude mountainous landscape, an open and heavily exposed terrain with permafrost.

What characterises the line are the precise retaining structures and hard shoulders, which were mainly carried out in a dry-wall construction method, as well as the numerous tunnels and snow sheds. The engineering structures are mostly well preserved in their original condition, unlike the train stations and their surroundings which have seen considerable change in the course of time. But equally contributing to the unique quality of the line are individual elements such as the large railway embankment leading up to the emblematic buildings of the summit station or the large girder bridge on its tall masonry pillars crossing the Findelbach stream.

By the end of the 19th to early 20th centuries, the new system incited a boom in r-a-p railways. In Switzerland, the earliest and still in use is the Vitznau-Rigi-Bahn (1871). There are around 280 in total worldwide, with close to 150 single systems and about 90 using both adhesion-drive and rack-and-pinion, approximately 40 are industrial railways. Only some 60 lines are still in use. Most such railways were constructed in Switzerland (28), Germany, Italy and France, to a lesser extent Austria and thereafter other European countries. But one can also find examples all over the world, though very few are still in use.

First and foremost, an inventory is a scientific expert opinion; as such it does not have any legal force which is only acquired by an act of endorsement by a competent authority. In practice, it will be necessary to balance the inventory's assessments with the intention of a proposed project (e.g. modernisation, investments, etc.).

The railway line as a whole consists of a variety of different elements, namely the infrastructure, which in its entirety as well as the sequence of all its individual parts defines the specific character

of the line. Typical for railway lines are a high degree of standardization and constructive repetition, specifically of bridges, retaining structures, tunnels, general buildings and railway infrastructure. It is therefore indispensable that an inventory for a historic railway line covers the line as a whole, its defining sections and its ensembles, and finally all the individual elements. In order to obtain meaningful results, all the relevant buildings and structures are to be recorded in their entirety. The findings will provide a global image of the system as a whole and help to understand its specifics and characteristics.

A central point of the inventory was the idea of considering the Gornergratbahn as a largely independent railway system, technically and operationally detached from the rest of the Swiss railway infrastructure. Therefore, its elements in terms of their cultural, technical and historic values were graded in the context of the line itself. Report and individual inventory sheets cover the history of construction and use, location, particular qualities, defects and sources of information as well as photographs and plans, both current and historic. In addition, a typology of all the objects has been compiled.

The rating of all the objects against the above criteria took place within the context of the line, always grading in four categories: very important, important, conditionally important, and not important. This detailed evaluation allowed the development of individual, nuanced objectives for protection, which were recorded on the objects' inventory sheets. An objective can be the conservation of the entire object unchanged, its restoration, the conservation of its material integrity or its appearance, the best possible integration of an intervention or the improvement of evidently disruptive qualities.

The GGB is also of considerable importance on the international level. The GGB was only the second originally electrified line ever constructed worldwide, the first having been the French Chemin de fer du Salève (1892) which was dismantled in 1936. From a technical perspective we should note for their total length the Bavarian Zugspitzbahn (GER, 1930, 2588m a.s.l.) or the Fayet-Nidd'Aigle-Bahn at the Mont Blanc (F, 1909, 2372m a.s.l.); the Achenseebahn (AT, 1889, 970m a.s.l.) which is still operated with steam locomotives, and from a typological point of view the Ribes de Freser-Vall de Núria in Catalonia (E, 1059m a.s.l.). Also of interest are the steam and diesel driven Snowdon Mountain Railway (GB, 1896, 1086m a.s.l.), the 112 km long line between Cosenza and Catanzaro (I, 1933, 829m a.s.l.), the Mount Washington Cog Railway in New Hampshire (US, 1093m a.s.l.), the 46 km long Nilgiri Mountain Railway (IND, 1899, 2371m a.s.l.) which is a World Heritage site, and the line which links Arcia (Chili) and La Paz (Bolivia) which however is only driven partially by rack-and-pinion (1913, 4235m a.s.l.).

Findelbach-Bridge (historic-photograph ca. 1900)

Findelbachbrücke 2018 (Photo architecum 2018)

The Gornergratbahn's high historical value has been clearly identified and the line's unique technical character and its pioneering achievements can be regarded as being of national and international significance - for its preservation the inventory can be a key tool.

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