Relations between Railways and Universities in Switzerland

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1. Definition of Theme

The request for this article went first to the Swiss Federal Railways (SBB), who redirected it to me. This is an honor and a good example of the cooperation between railways and universities in Switzerland.

In addition, probably every large railway company and each country has specific forms of cooperation, so an introduction about the basic situation in Switzerland must precede the following statements.

2. Background

Switzerland

Switzerland is a small central-European state without powerful political ambitions. It is a proven democracy with strong protection of minorities and pronounced federalism providing extensive competence on lower political levels. Consequently, this increases the number of problems encountered in solving important questions at the national level.

Switzerland has an area of approximately 41,000 km^2 - 25% of which is non-productive - and only 7 million inhabitants. It is divided into 26 cantons and 3000 communities, each with comparatively-high political independence.

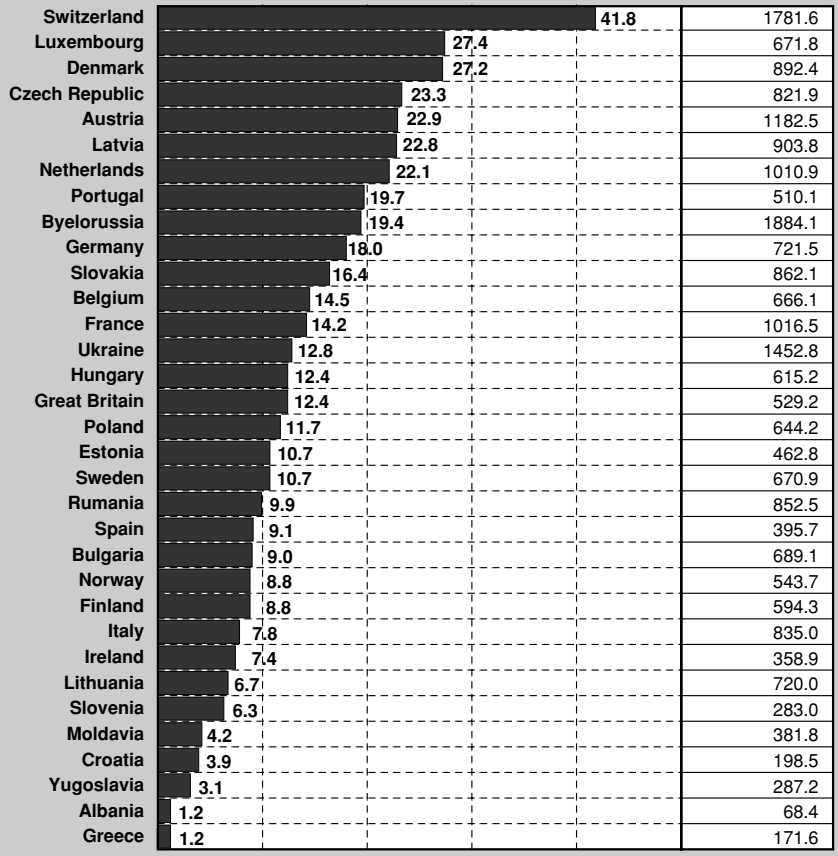
It is a highly-developed, wealthy nation with no mineral resources nor heavy industry. Transport claims 8.6% of the expenses of private households and 33% of the final energy consumption (road: 77%, air: 20%, rail: 3%).

On average, each inhabitant used the railways 41.8 times in 1993 (Fig.1).

All Swiss railways alone, with 965 million travellers (1994), account for 12.9% of the passenger transport market and public transport as a whole, takes a 24.2% share of the passenger market and public transport as a whole, takes a 24.2% share of the passenger market.

Fig. 1 Railway trips per inhabitant in 1993

source: LITRA



Not all the markets in Western Europe can be compared to those in Central and Eastern Europe. The eastern countries have notably fewer cars. Thus, there is little freedom of choice in transport. Despite Switzerland's very high degree of motorization, it is at the top of railway use. The reason is due to the attractive and efficient public transport, as well as better underlying economic conditions, permitting higher overall mobility.

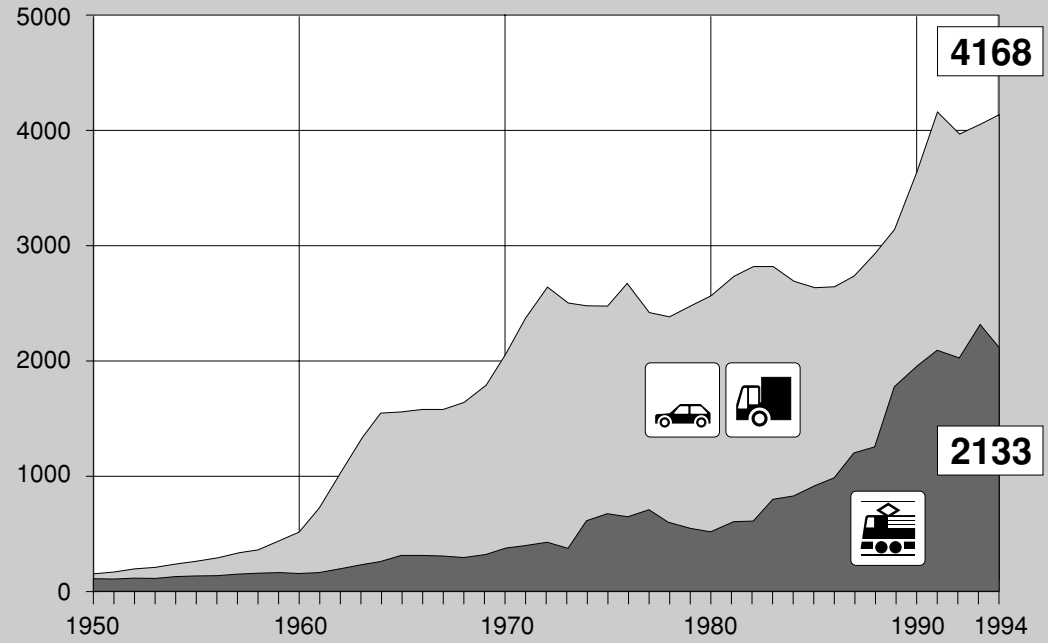
Public transport/railways in Switzerland

In Switzerland, 554 companies offer public transport services on a 24,700-km long public-transport network (road and rail); a large number are joint stock companies. Two federal enterprises, Swiss Railways (SBB) and Postal Bus Service (PTT), account for 14% (SBB) and 9.5% (PTT), respectively, of travellers and 12% (SBB) and 35% (PTT), respectively, of the network length.

Railways (without cable railways and rack-railways) include the SBB and 56 private railways, most of the latter being owned by cantons and communities. Of these 57 companies, the SBB account for 56% of the total

Fig. 2 Infrastructure investments source: LITRA

Investments in railways and roads in Switzerland (Sfr million)



5029 track km, 68% of travellers (398 million in 1993), and 43% of the 1879 stations. The narrow-gauge net covers approximately 1400 track km.

Except for SBB and PTT, the public transport enterprises belong to the Association of Public Transport Enterprises (VÖV), which play a very important role in cooperation with universities.

In comparison to roads, the railway infrastructure has been neglected for decades, which is disadvantageous for competition (Fig. 2).

This backlog shall be recovered with large projects like Rail 2000 (junction principle with basic interval timetable (BIT) and fast interchanges, including new and upgraded lines), and "Alp transit" (high capacity railways through the Alps, max gradient 10%, including a 57-km long tunnel at the Gotthard).

Universities in Switzerland

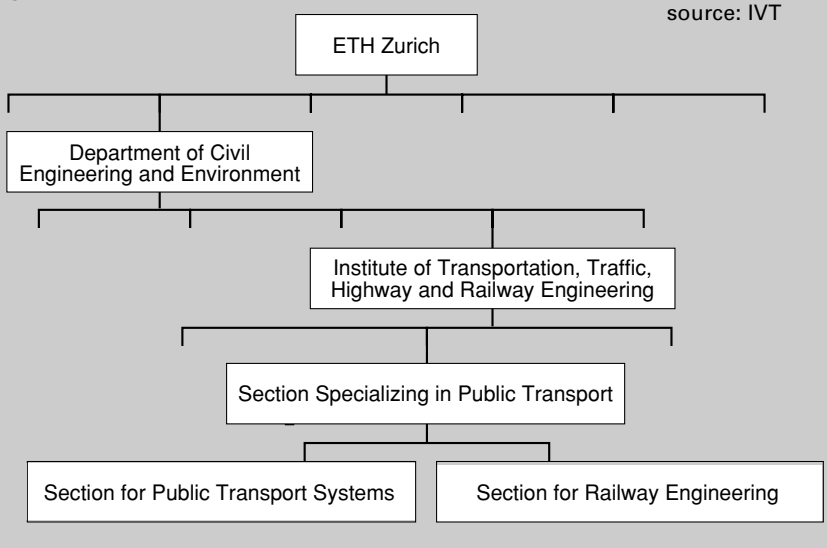
The only university owned by the state is the Eidgenössische Technische Hochschule (ETH) with locations in Zurich (ETHZ) and Lausanne (EPFL). Seven universities and one college for economics, law, and social sciences are owned by the cantons in which they are located, but are partly financed by the state.

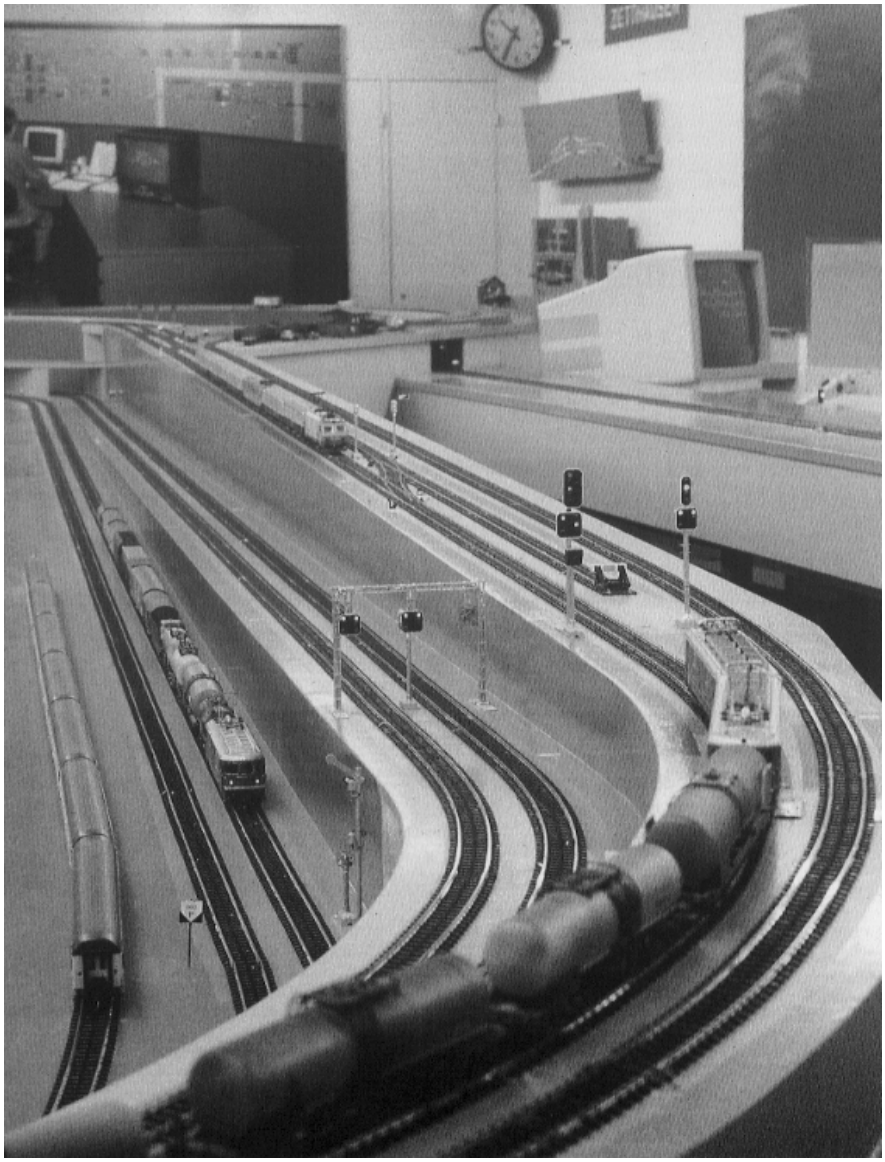
The Institute of Transportation, Traffic, Highway and Railway Engineering (IVT) is part of the ETHZ. The hierarchy is shown in Fig. 3.

The field specializing in public transport covers one professor (the author) and about 5 co-workers for teaching and research, financed by the ETH. Another six to eight co-workers are financed by third parties (consultant).

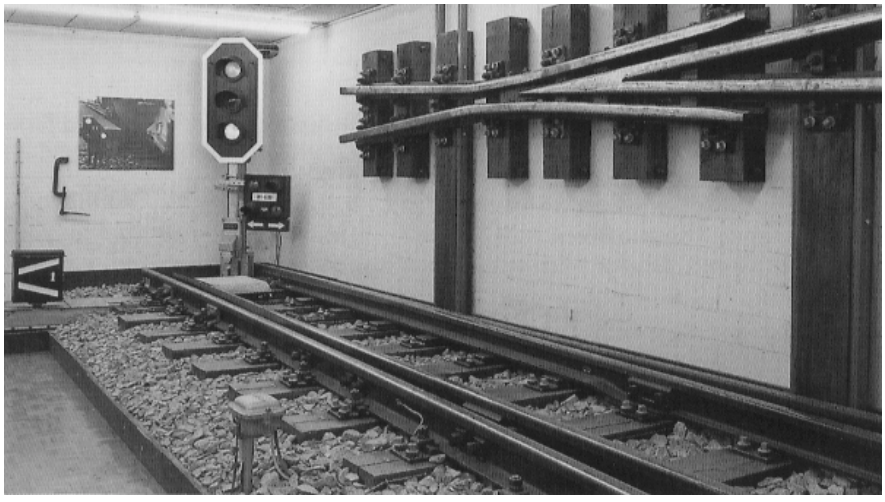
The section for public transport systems operates in the wide sector of planning, projecting, construction, operation, safety, and maintenance of

Fig. 3 source: IVT





■ Training facilities at IVT (IVT)



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public transport of all kinds. This includes, on one hand, transport-political questions like harmonization, regionalization, privatization, and deregulation, as well as demand and enterprise problems, and on the other hand unconventional public transport of all kinds. Mechanical and electrical engineering are excluded. The effect of this delimitation is that there is little engagement of private industry in active promotion of such research, which is to be expected.

The railway engineering section is engaged in all matters of railway tracks and power supply. Since the corresponding research in the standard-gauge field belongs to the domain of the large railway companies and their joint research institutes (for example European Rail Resenrch Institute), the IVT concentrates on research in the narrow-gauge and meter-gauge sector; presently with emphasis on welding of rails in very tight curves.

3. Training Cooperation

Our basic studies are intended to train civil, railway, and transport engineers. Since we want to maintain a study duration of 9 semesters (after high school graduation), and because we expressly promote thinking in context and systems, there is often little time for railway-specific in-depth training. Recently, this is becoming even more the case, because our graduates will also work in the private economy and management in the entire field of transport.

Consequently, we supply "all-round" experts in construction and transport, who should then receive specific training with the railway companies. This division has proven itself, and ETHZ graduates can be found in the highest positions and various areas of activity of the railways.

In this basic training, cooperation with SBB and VÖV creates no problems with regard to obtaining data for teaching, exercises of all types, and excursions. There is no financial support by the railways, except for our railway simulation and framing facilities, built and operated by the IVT, used for student training in railway

operation and safety, but used mainly by the SBB and also by private railways, for training station staff. The SBB also has participated substantially in financing the improvement of this installation.

With regard to continued education, the IVT provide various possibilities. With regard to railways, these include:

- Joint training courses of about 4 days at the SBB training center in a wide range of subjects. The instructors are representatives of IVT and SBB; the participants are an interdisciplinary circle of employees of the railway companies (SBB and VÖV) and competent representatives of the supervision authorities and cantons.
- Theme-specific meetings of 1 or 2 days, held by the IVT; in recent times, for example on connection tracks for companies using railfreight, superstructure calculation, meter gauge, future development of railway safety installations, and operation management.

  Here also, instructors from the railways are involved. There is no engagement by the railways.

The very extensive scripts are available to everyone almost free of charge and, are therefore, used frequently.

Unfortunately, until now, no temporary exchange of personnel with the railways, for continued training and closer connection between theory and practice has been possible.

4. Cooperation in Research

Unlike neighbouring countries, there is no institutional cooperation with regard to railway research in the sector of public transport of the IVT, nor are there personnel or financial support with or by the railways. Of course, this is unfortunate, especially because the already-limited means make systematic research on the railway system impossible, force research concentration, and make it more difficult to at least maintain an international position. However, there are also advantages because we can focus on "total public transport systems" as a whole. In addition, there are good connections with the respective specialized cadres of the railways, and special commissions from VÖV, based on personal communication, which permit continued exchange of experiences.

Further, we have been and continue to be entrusted with contract work, which has research content (below), but which is difficult to compress into a targeted research programme.

It is especially regrettable that the only appropriate large national railway company (SBB) has never been willing to participate financially, nor to provide work time for dissertations, even for their own personnel.

5. Contract Work

This work concerns clarification of concrete problems by scientific methods, and mainly concerns disputed projects and plans (frequently politically). With regard to the transport system, the orders can come from the participating railway enterprises involved or from other parties "opposing" the railway enterprises. Our conditions for accepting such work are that we are allowed to be strictly interest-neutral and are permitted to communicate with all parties concerned. Here, naturally the teaching and research independence from the railways is advantageous for us. Typical work has been:

- Operation simulations for testing planned service concepts or infrastructure investments
- Testing practicality of upgradings and network extensions
- Regional service concepts of public transport
- Suitability of tilt technology for defined individual cases
- Optimization of rail security concepts
- Vehicle evaluations
- Transportation evaluations (operation conversions)

Most of our third-party financing comes from such orders. They are very suitable for continued training of young assistants, but because the times and themes cannot be planned, they do not provide a basic load for systematic research programs.

6. Conclusion and Outlook

The specialized section for public transport is centered not only on the railways, but on all systems of public transport. The author has gained 15 years of experience not with the railways, but as head of the planning and operation department of a large local transport enterprise (Zurich). One head of section has many years of professional experience in planning, building, and maintaining the meter-gauge track of a large mountain railway; another is experienced in the construction management of a new SBB construction track, as well as in the Electronic Data Processing (EDP) sector (operation simulation).

The cooperation with the federal railways and the 56 private railways in Switzerland is excellent on the level of personal (specialist) contacts, but modest to non-existent in the sense of active research support, making synergistic effects almost impossible to achieve.

Since the ETHZ is based on the concept freedom of teaching and research, we have the chance to act as generalist independent assessors of public transport, as well as to work as specialists with modest research means, independently of the railways, in special areas (for example the meter gauge).

However, we do wish to build further contacts with railways in order to jointly develop promising transport systems for the future. ■

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Professor Brändli is Professor of Traffic Engineering at the Swiss Federal Institute of Technology in Zurich. He was president of the Swissrail Export Association from 1978 to 1987 and is the 1988 recipient of the Dr. Friedrich Lehrner Award. He has been a member of the Ministry of Research and Technology Public Transport expert group, and of the national City and Transport research programme.