

SBB Regional Transport: Evolution of the passenger services – Case Study of the Canton of Vaud

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SBB Regional Transport: Evolution of the passenger services – Case Study of the Canton of Vaud

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Abstract

In less than 15 years, the Swiss regional rail services for passengers went through a process of radical transformation.

During decades, regional lines were modelled on the national ones. To move between nearby main cities, a passenger could use not only direct trains but regional ones as well.

However, at the beginning of the 90s, new federal railway regulations transferred a significant part of responsibility from the Swiss Federal Railways (SBB) to the local public authorities. The latter have to determine the level of service they wish for regional rail, and to contribute to its cost. Step by step and gradually, the structure of the regional rail services has changed: borders between cantons and location of major labour concentrations became more and more significant. Still however, some rail regional services do not end at canton borders, due to constraints that result principally from the fixed interval timetable used in Switzerland for more than 20 years.

This contribution focuses mainly on the Canton de Vaud and describes how the reorganization of regional services has evolved, concentrating around Lausanne. It also deals with constraints due to the systematic use of fixed time intervals between trains, mainly because it sets a maximum running time for regional trains before they are overtaken by faster ones. In many cases, regional trains are replaced by buses just over terminal stations of rapid-transit rail services. Nevertheless, some RegioExpress services act as rapid transit trains linking two rapid transit systems.

Enlarging its scope to some others Swiss regions, the paper concludes that the current trend is to replace long regional services that linked main cities with shorter, diametrical services that radiate around main conurbations (S-Bahn).

Keywords

Public Transport, Regional Passenger Services, Rapid transit System, Timetable structure,
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1. INTRODUCTION

The main conurbations of Switzerland in descending order are Zurich, Geneva, Basel, Bern, Lausanne, Lucerne, St-Gall, Winterthur and Lugano. Each of them is populated with more than 100'000 inhabitants. In 1995, Zurich was the only one with a rapid-transit system (S-Bahn) at its disposal. Today, all of them are served by such a system, except Geneva.

The main purpose of this paper is to describe the significant changes of the regional train services provided by the Swiss Federal Railways (SBB). From long services linking administrative centres across cantonal borders, they were progressively changed into relatively short diametric lines, crossing the centre town of an agglomeration. As case study, this paper shows in particular the process of transformation for the canton de Vaud.

1.1 Revision of the Swiss Railway Law

During decades, the deficit of the SBB regional services was borne at a national level only. But the revision of the Swiss Railway law [1]¹ has forced the Swiss cantons to contribute to the deficits. Simultaneously, the Swiss cantons were appointed to become Transport Authority for regional services. This last decision has given cantons some freedom of choice on regional public transport in general, and the SBB regional services in particular [1, 2]. For inter-cantonal regional services, a financial agreement has been adopted [3].

1.2 Increasing of the number of express trains

At the same time, the national and interregional rail supply has increased significantly. For example, the line between Geneva and Morges was run by 3 express trains per hour and per direction in 1991. This number climbed by 66% during the last decade, reaching 5 express trains nowadays. This evolution has been adverse for the commercial strength of the regional services that connected those two towns. Actually, regional trains would had to stop frequently to be passed by express ones, which would have reduced their commercial speed.

¹ Number in brackets [...] is the item number in the Reference section.

2. EVOLUTION OF REGIONAL RAIL SERVICES

2.1 Long distance regional services in 1991

In 1991, many long distance regional services were carried out by the national railway company SBB (Table 2.1).

Table 2.1: Examples of long distance regional services in year 1991

Route	Length	Cantons involved
Morges-Lausanne-Fribourg-Bern-Thun	141 km	VD-FR-BE
Airolo-Chiasso	115 km	TI
La Chaux-de-Fonds-Moutier-Boncourt	105 km	NE-BE-JU
Luzern-Airolo	105 km	LU-SZ-UR-TI
Lausanne-Payerne-Kerzers-Lyss	101 km	VD-FR-BE
Bern-Luzern	95 km	BE-LU
Lausanne-Sion	92 km	VD-VS

In 1991, Lausanne, Vaud capital, was linked by regional trains to five others main cities: Sion, Geneva, Neuchâtel, Fribourg and Bern. In 2005, there are no more regional trains on those links. The following paragraphs describe this important change concerning the supply structure for regional services in the canton of Vaud.

2.2 From train to bus: gaps in the regional train services.

The Canton of Vaud shares border with five other cantons: VS, GE, NE, FR and BE. Main SBB lines in the Canton are the "Plateau" line (GE-VD-FR-...), the "Jura" line (GE-VD-NE...) and the "Simplon" line (France-VD-VS-Italy). It was specifically on these lines, that regional train services were subjected to transformations (cf. figure 2.8).

2.2.1 From train to bus from Villeneuve to the VD-VS border

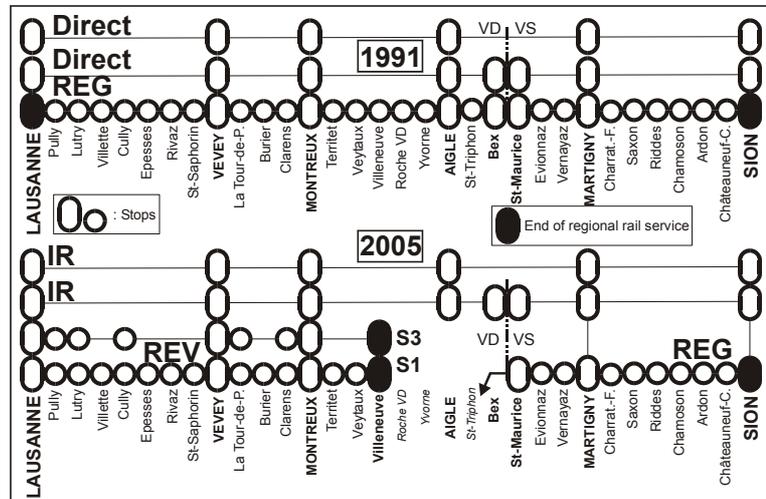
Until 1992, the regional trains Lausanne-Martigny-Sion were running during one hour and a quarter before being passed by express trains in Martigny(VS). The stop duration at Martigny lasted about a quarter an hour. A so long run was possible as they shared track was shared with only two express trains per hour and some freight trains. In 1993, the end of the regional service from Lausanne was set at Aigle (VD). The consequences were the discontinuation of systematic stops in the small station of St-Triphon-Gare. There was not a great change as rather no one used to use this station. Six years after, in 1999, the changes were more significant: the end of the regional service from Lausanne was moved back to Villeneuve, and bus services were provided for the stations of Roche VD and Yverne. The situation did not evolve since (cf. figure 2.2).

Figure 2.2: One-hour-cyclic timetable for passenger services between Lausanne and Sion in years 1991 and 2005

Nowadays, the gap for regional trains between Villeneuve and St-Maurice is 22-km long.

InterRegio (IR) trains between Montreux and St-Maurice have an average interval length between stops of 9 km.

Running time between Lausanne and Villeneuve with REV S1 services is about 40 minutes.



2.2.2 From train to bus in the middle sector between Lausanne and Geneva

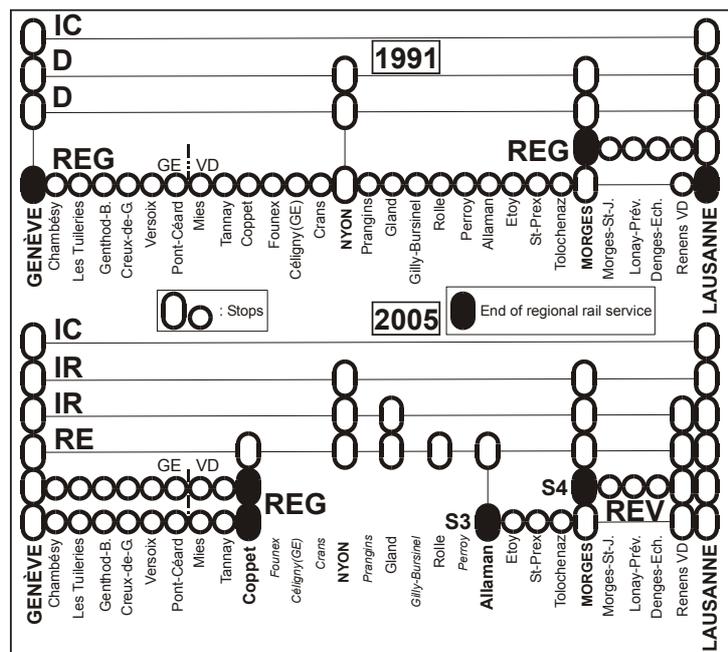
Until 1996, the regional trains Lausanne-Nyon-Geneva were running during 40 minutes before being passed by express trains in Nyon. The stop duration at Nyon lasted about 10 minutes. In 1997, the regional services were cut in Nyon in two parts: Lausanne-Nyon on one side and Nyon-Geneva on the other. This new situation resulted from the increase in the number of national and interregional trains. When the Rail 2000 project was implemented at the end of the year 1994, the double track line between Lonay and Coppet was so saturated that the regional service between Allamand and Coppet was transferred from rail to road (cf. figure 2.3).

Figure 2.3: One-hour-cyclic timetable for passenger services between Lausanne and Geneva in years 1991 and 2005

The gap for regional trains between Allamand and Coppet is 26-km long.

RegioExpress (RE) trains between the same stations have an average interval length between stops of 6.3 km.

Running time between Lausanne and Allamand with REV S3 services is 22 minutes.



2.2.3 From train to bus from Yverdon to the VD-NE border

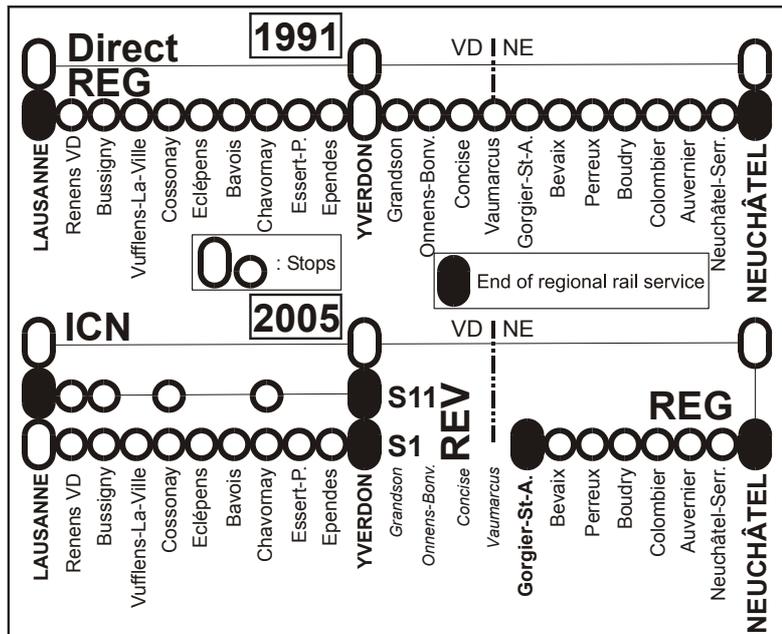
Until 1996, the regional trains Lausanne-Yverdon-Neuchâtel were running during approximately 40 minutes before being passed by express trains in Yverdon. The stop duration at Yverdon lasted more than an quarter an hour. In 1997, a bus service replaced the rail service during the evening, between Yverdon and Gorgier-St-Aubin (NE) (cf. **figure 2.4**).

Figure 2.4: One-hour-cyclic timetable for passenger services between Lausanne and Neuchâtel in years 1991 and 2005

Two years later, the bus was definitively chosen instead of regional trains for all the regional services.

The gap for regional trains between Yverdon (VD) and Gorgier (NE) is 19-km long.

Running time between Lausanne and Yverdon with REV S1 services is about 38 minutes.



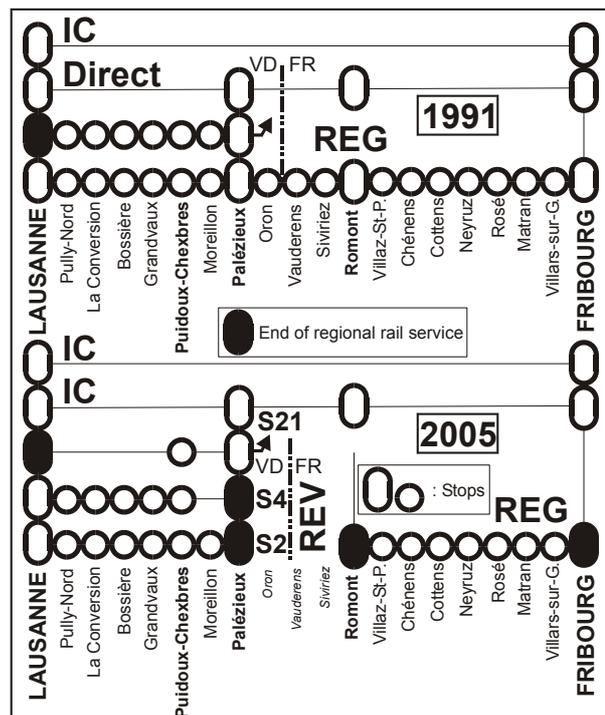
2.2.4 From train to bus from the VD-FR border to Romont

Figure 2.5: One-hour-cyclic timetable for passenger services between Lausanne and Fribourg in years 1991 and 2005

Until 1996, the regional trains Lausanne-Romont-Fribourg were running during approximately 40 minutes before being passed by express trains in Romont. The stop duration at Romont lasted a small quarter of an hour. In 2005, a bus service replaced the rail service between Palézieux-Gare and Romont (FR) (cf. **figure 2.5**).

The gap for regional trains between Palézieux (VD) and Romont (NE) is 21-km long.

Running time between Lausanne and Palézieux with REV S2 services is 23 minutes.



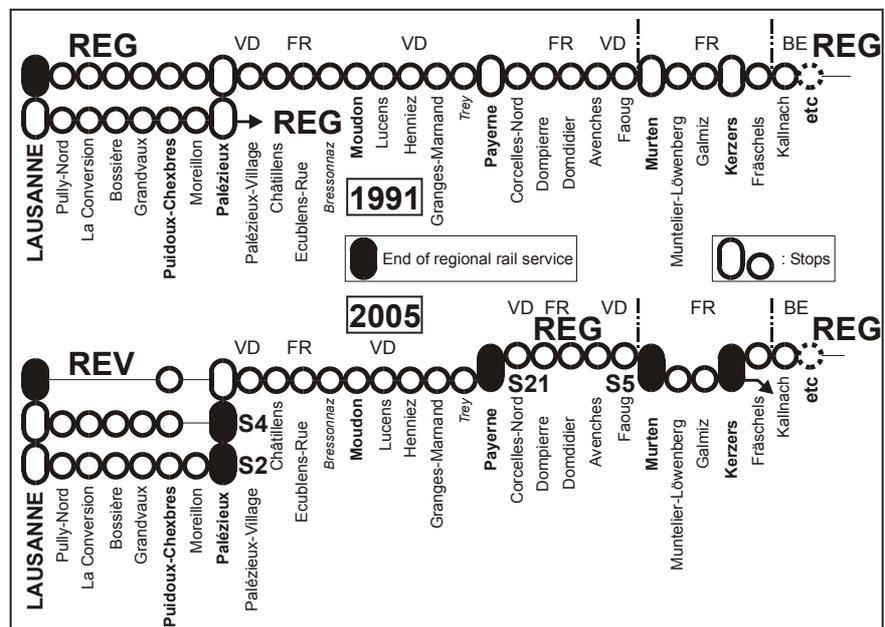
2.2.5 Segmentation of the "Broye" line

A fifth "cut" in regional services at the outer edges of the canton de Vaud was the segmentation of the "Broye" single track line. Until 1996, the Lausanne-Palézieux-Payerne-Murten-Kerzers-Lyss route was run by regional trains (cf. **table 2.1**). In 1998, the regional services were cut in two parts at Payerne, and new changes were made yearly, according to the expansion of the rapid-transit system of Bern (S-Bahn-BE). In 2005, the former route is split in four parts (cf. **figure 2.6**).

Figure 2.6: One-hour-cyclic timetable for passenger services between Lausanne and Kalnach(Lyss) in years 1991 and 2005

Travel time between Lausanne and Palézieux with REV S21 services is about 55 minutes.

This has no special consequences on the capacity of the line due to two reasons. Firstly, express trains service is not cyclic. Secondly, single track is the main constraint.



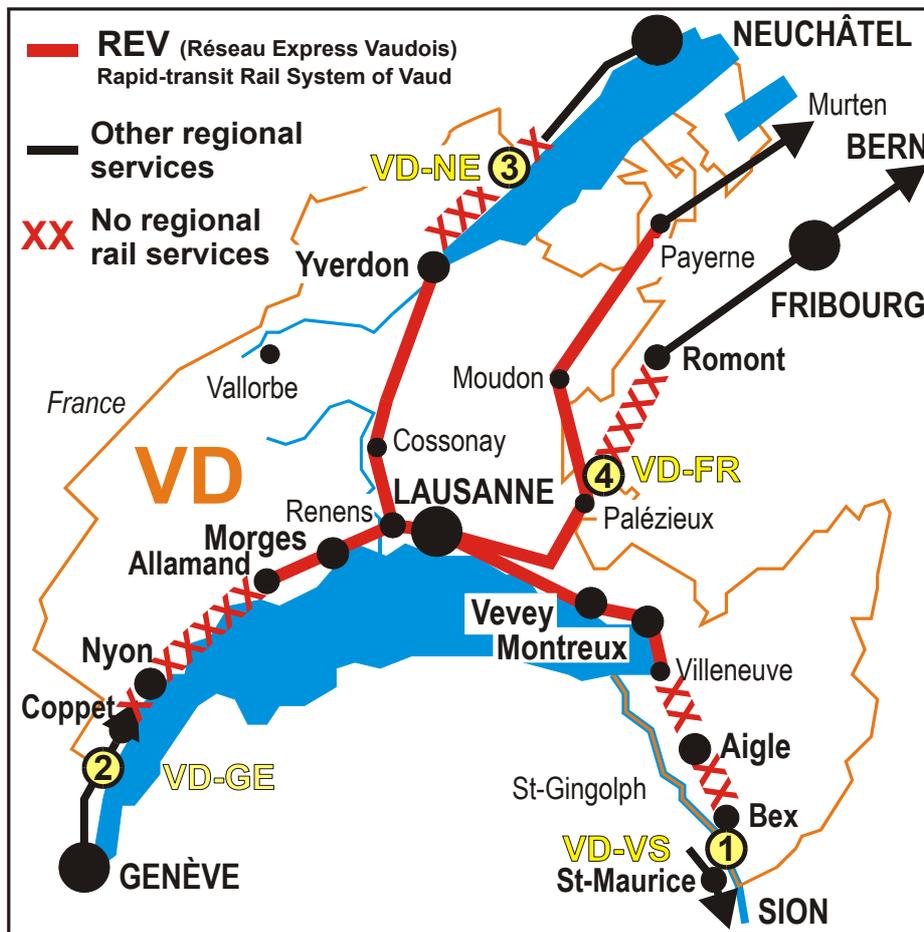
2.2.6 The REV (Réseau express vaudois) in 2005

At the end of 2004, the REV rapid-transit system started with four diametrical lines (S1 to S4) and two radial lines (S11 and S21) listed below.

Figure 2.7: Some characteristics of the REV in year 2005 (acc. = accelerated trains)

REV Lines	Distance [km]	Travel time [min]	Commercial speed [km/h]	Service level	# compositions / % of time wasted at ends
S1 – Yverdon-Villeneuve	68 km	81 min	50	1 tr/h	4 / 32%
S11 – Lausanne-Yverdon	39 km	31 min	75 (acc)	1 tr/h	2 / 48%
S2 – Vallorbe-Palézieux	67 km	72 min	56	1 tr/h	3 / 20%
S21 – Lausanne-Payerne	59 km	56 min	63 (acc)	1 tr/h	3 / 38%
S3 – Allamand-Villeneuve	51 km	57 min	54 (acc.)	1 tr/h	3 / 37%
S4 – Morges-Palézieux	34 km	40 min	51	1 tr/h	2 / 34%

Figure 2.8: REV in year 2005



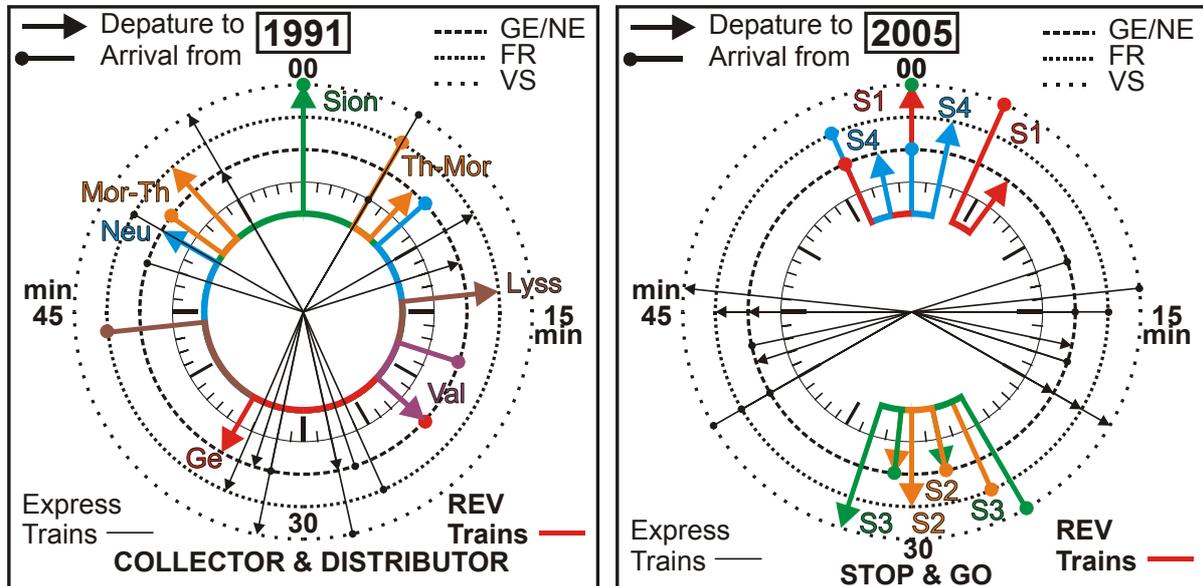
2.3 Lausanne, turntable for the passenger rail traffic

2.3.1 Collector/distributor function and/or "stop & go" function in Lausanne

In 1991, operation in the Lausanne main node used to work according to the collector/distributor principle. Regional services used to arrive short before express trains to ensure the connection between regional and express trains (collector function of regional trains). Furthermore, regional services used to depart shortly after express trains left the station (distributor function of regional trains).

In 2005, the situation is completely different, as the regional services stop only a few minutes in Lausanne. The density of trains at some specific minutes ("15" and "45") is so high that no time gaps are left for the regional trains to arrive just before express trains or to depart just after them (cf. figure 2.9).

Figure 2.9: Departure and Arrival times around the clock in Lausanne in years 1991 and 2005 (Systematic timetable for passenger services)

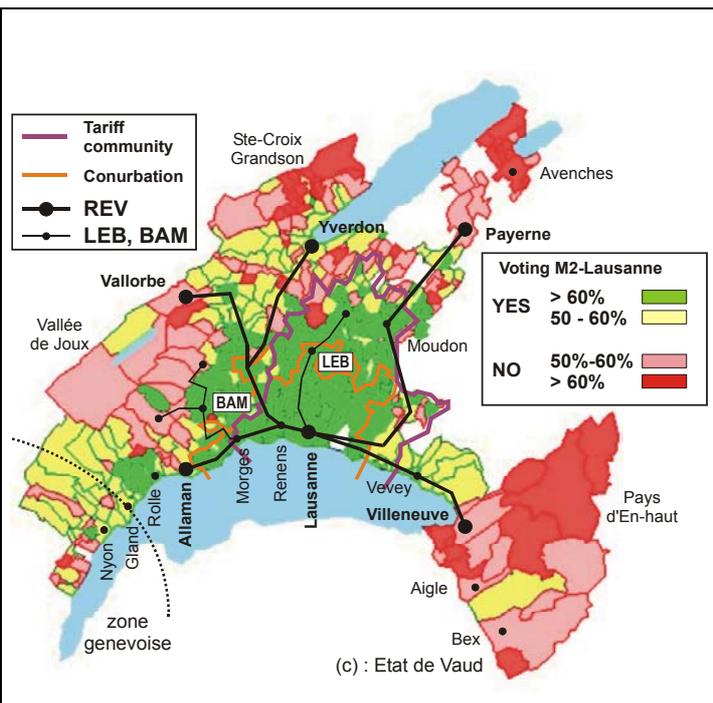


It is obvious that the first goal of the new REV system is to be a true rapid-transit rail system. Two minutes is the most usual stop time for REV trains at Lausanne. Connections between REV trains and Express trains are granted, but the waiting time is about a quarter of an hour. Such a waiting time may be considered as relatively high, even in the case of Lausanne, which is an important railway node [6].

2.3.2 Connection between regional and urban transport

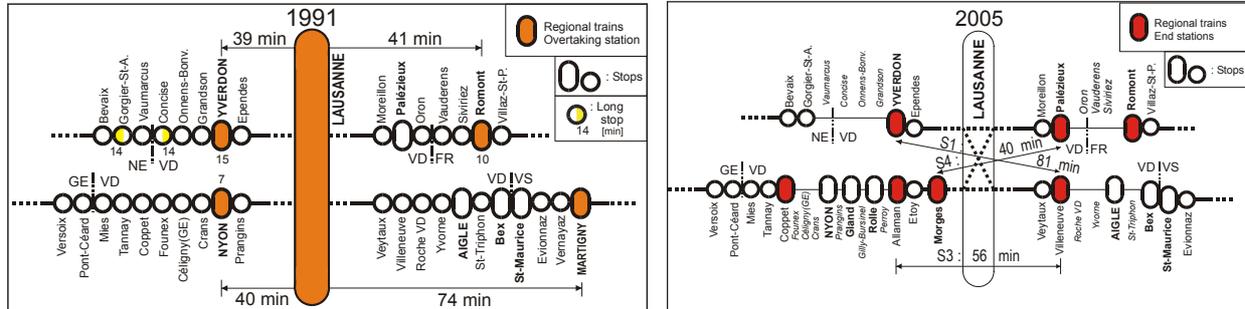
Figure 2.10: Lausanne M2-Metro Acceptance by the population of the Canton of Vaud

It is also interesting to notice that the inhabitants of the Canton of Vaud were conscious that the REV system is mainly dedicated to serve commuters. The vote concerning a new urban public transport line in Lausanne (M2-Metro), in November 2002, showed that people who will be included in the tariff community of Lausanne in 2005 may find some interest in the improvement of the Lausanne's urban services



2.4 Travel time of regional trains and overtaking constraints

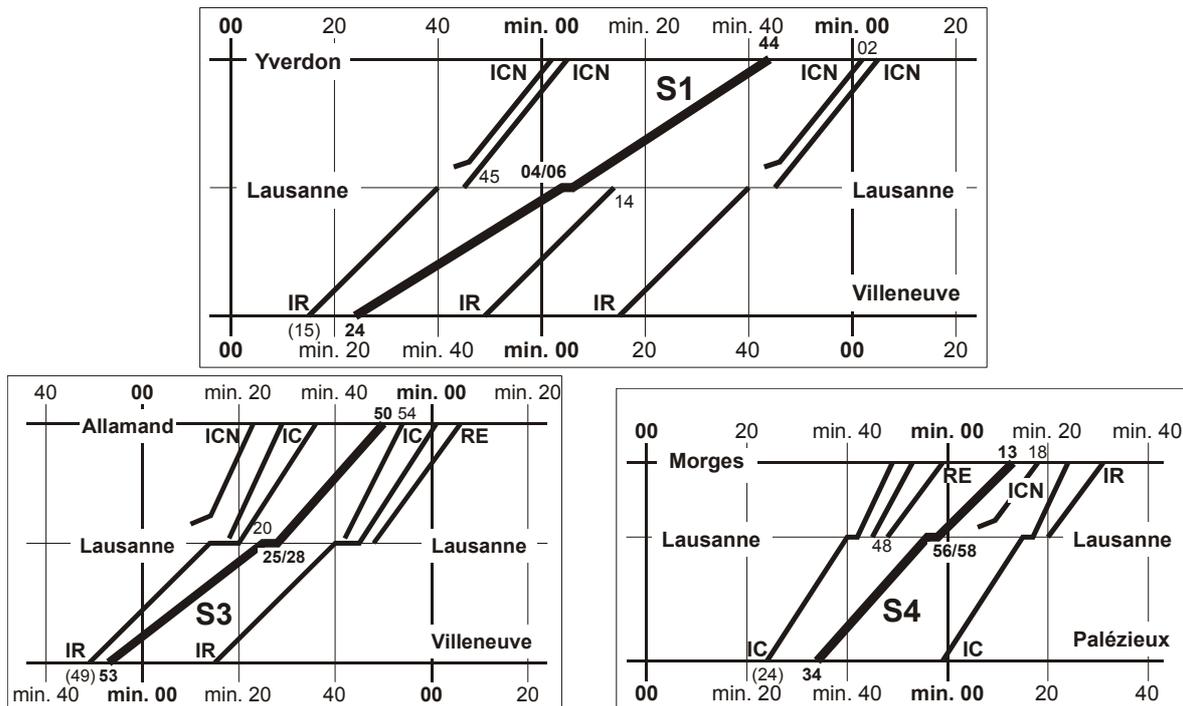
Figure 2.11: Travel time and overtaking stations for regional trains in years 1991 and 2005



2.4.1 REV-S1/S3/S4 Travel times and ends of line

For a regional train on the S1 line, running up to 81 minutes without being overtaken by express trains is exceptional. It is mainly due to the fact that time intervals between express trains are sufficient on the Lausanne-Yverdon section (cf. figure 2.12):

Figure 2.12: Timetable structure constraints for REV-S1, S2 and S4 lines



For the S3 line, 57 minutes of travel time without being overtaken by express trains is quite large. It is mainly due to the fact that time intervals between express trains on the Villeneuve-Lausanne section match those on the Lausanne-Allamand section (cf. figure 2.12).

For the S4 line, the time interval between express trains left on the Lausanne-Morges section is very tight. Saturation of the Lausanne-Morges-Allamand section is obvious (cf. figure 2.12).

It is not surprising that travel times of REV services do not match perfectly the theoretical predictions (cf. **Appendix A**). Actually, regularity of time intervals between express trains is far from perfect (cf. **figure 2.12**). On the contrary, express trains are grouped on the Lausanne-Geneva and Lausanne-Yverdon lines. On the other lines, "½ hour" time intervals between express trains fluctuate actually between 25 and 35 minutes.

3. CONNECTIONS BETWEEN RAPID-TRANSIT SYSTEMS

3.1 Overview of Swiss rapid-transit systems in year 2005

Figure 3.1: Rapid-transit system areas in year 2005

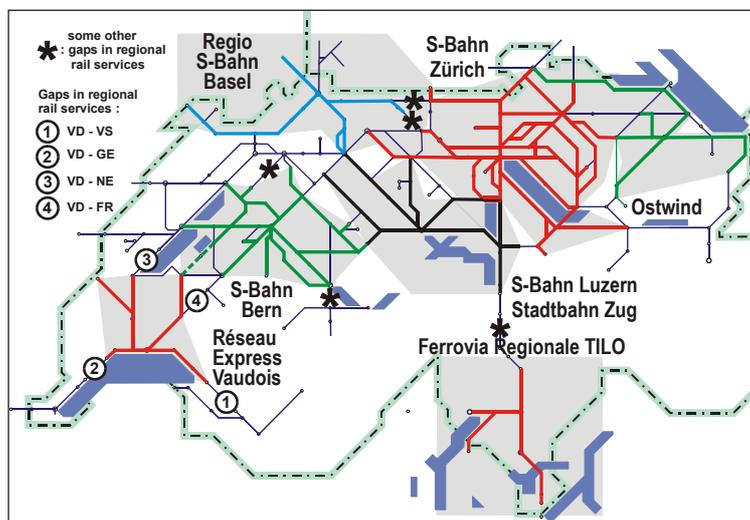
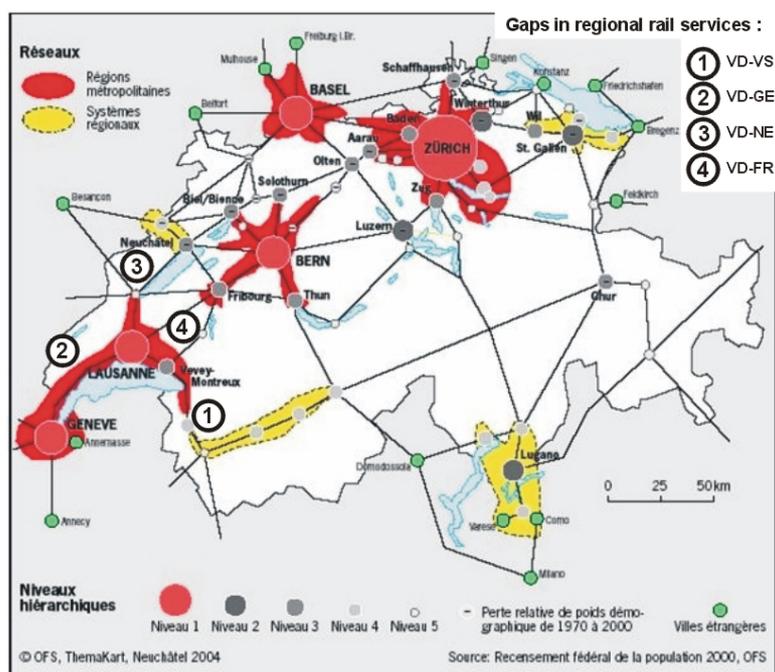


Figure 3.2: Main conurbations in year 2005



Comparison between **figure 3.1** and **figure 3.2** lets confirm that rapid-transit system development areas are those of major conurbations. Rapid-transit systems are expected to sustain and enhance development of those areas [7,8]. Overlapping of existing rapid-transit systems is already observable (**table 3.3**).

Table 3.3: Town served by two rapid-transit systems in year 2005

Town	Rapid-transit system #1	Rapid-transit system #2
Schaffhausen	Zurich-S22/S33	Ostwind-S3
Stein am Rhein	Zurich-S29	Ostwind-S3
Wil	Zurich-S35	Ostwind-S5
Zug	Zurich-S9/S21	Luzern-S1
Lenzburg	Zurich-S3	Luzern-S9
Olten	Basel-S2/S9	Luzern-S8
Trubschachen	Bern-S2	Luzern-S6
Payerne	Bern-S5	Lausanne-S21

3.2 Lack of rail regional services

Figure 3.1 shows some gaps in the rail regional services. This situation is mainly explained by capacity bottlenecks (for ex. Bötzingen tunnel or Gotthard line, and Lausanne-Geneva line), but also by the weak demand levels in the outlying regions.

3.2.1 "VD-VS" gap between Villeneuve and St-Maurice (1)

Three villages are no more served by rail: Roche VD, Yvorne and St-Triphon-gare. Roche VD is in the immediate vicinity of Aigle and bus is efficient. The village of Yvorne is 50 m high above the rail station altitude and bus seems more appropriate. Finally, St-Triphon-Gare is a "no man's land" where only a local railway (TPC-AOMC) makes a stop.

Furthermore, present InterRegio (IR) services are comparable to RegioExpress (RE) or REV accelerated services (cf. **table 3.4**). Therefore, no major changes are expected for the next decades in that region.

3.2.2 "VD-GE" gap between Allamand and Coppet (2)

Not least than six villages have no more rail stops. As already mentioned, lack of capacity explains this choice (cf. **figure 2.12**).

Figure 3.2 shows clearly that it is only a temporary situation, while waiting the construction of one or two new tracks. For the moment, the RE Geneva-Lausanne service may be considered as the first element of a "Leman" rapid-transit system linking Lausanne and Geneva (cf. [7], **figure 3.2** and **table 3.4**).

3.2.3 "VD-NE" gap between Yverdon and St-Aubin (3)

Except for the Onnens-Bonvillard station, far away from the villages, three other villages (Grandson, Concise et Vaumarcus) have lost their good connections with Neuchâtel and their fast ones with Yverdon. This situation has a high probability to remain unchanged for a long time.

3.2.4 "VD-FR" gap between Palézieux and Romont (4)

Three towns or villages are no more served by rail: Oron-la-Ville, Vauderens and Siviriez. For Oron-la-Ville, bus service seems to be more efficient as the rail station was located 80 m high above the village altitude and 500 m afar. For the two other villages, the lost of train stops is not fully compensated, but train service seems to be too expensive for only a few inhabitants.

Table 3.4: Some characteristics of the REV accelerated trains, RegioExpress, and InterRegio services in year 2005

REV Lines	Distance	Travel time	# of intermediate stops	Average length between stops	Commercial speed
S3 – Villeneuve-Lausanne	29.3 km	32 min	7	3.7 km	55 km/h
S2 – Cossonay-Lausanne	14.5 km	15 min	2	4.8 km	58 km/h
S3 – Morges-Lausanne	12.3 km	10 min	1	6.2 km	74 km/h
S11 – Yverdon-Lausanne	39.1 km	31 min	4	7.8 km	76 km/h
S21 – Palézieux-Lausanne	20.6 km	18 min	1	10.3 km	69 km/h
Other RegioExpress/InterRegio services					
IR St-Maurice-Montreux	27,0 km	22 min	2	9,0 km	74 km/h
RE Geneva-Lausanne	60.3 km	51 min	7	7.5 km	71 km/h

4. CONCLUSION

The systematic growth of conurbations in Switzerland and changes in the Swiss railway law have had an significant impact on the organisation of rail regional services. The evolution is not fully accomplished yet, but the process seems irreversible. In densely populated regions, it is likely that, in some years, most of rail lines will be integrated within a rapid-transit system.

An efficient rapid-rail system needs not only central stations with enough platform lines, but also sufficient access lines. In order to expand direct services, some flyovers have to be planned, too.

Some rail stops, currently cancelled for capacity reasons, will eventually be restored as they are located along development axes of main conurbations, although – generally – this will require implementations of extra new tracks.

Finally, while some regional stops are cancelled in peripheral areas, new stops are set up close to main rail stations.

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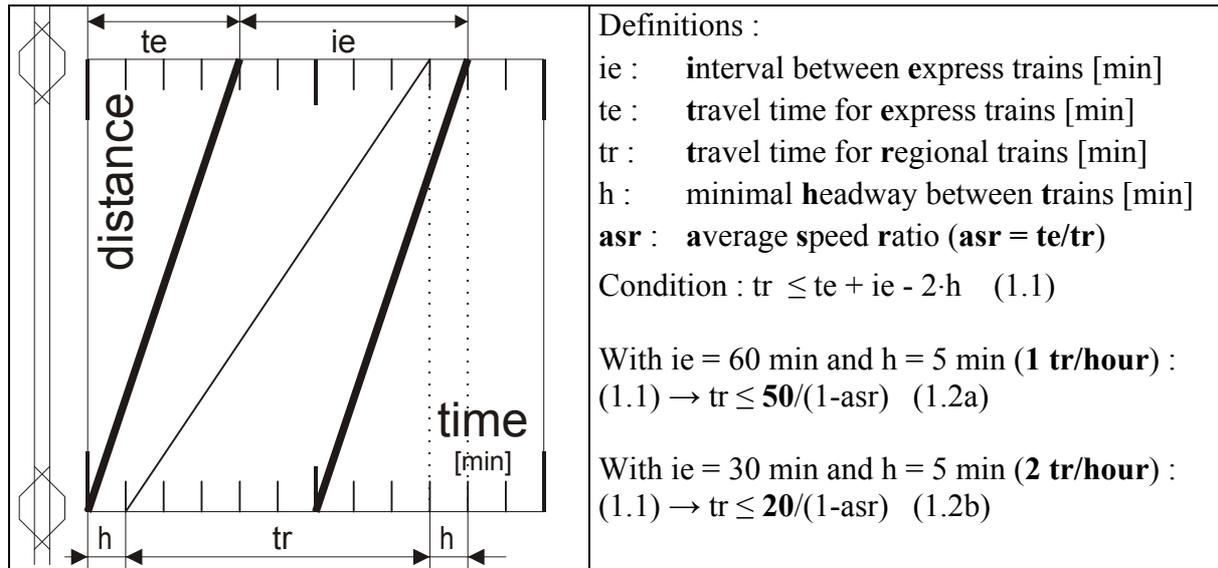
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Appendix A:

GENERAL CONSIDERATIONS ABOUT EXPRESS AND REGIONAL TRAINS WITHIN A CYCLIC TIMETABLE

Figure A.1 : Maximal travel time for regional train "tr" before being overtaken by express train



The average speed ratio between express and regional trains depends on many different variables. The most significant among them are:

- the average maximal speed on the line;
- the average length between stops for regional trains;
- the stop durations of regional trains;
- the acceleration performances of regional rolling stocks.

Figure A.2 : Maximum travel time allowed for regional trains according to the interval between express trains and the commercial speed differences ($asr=te/tr$)

