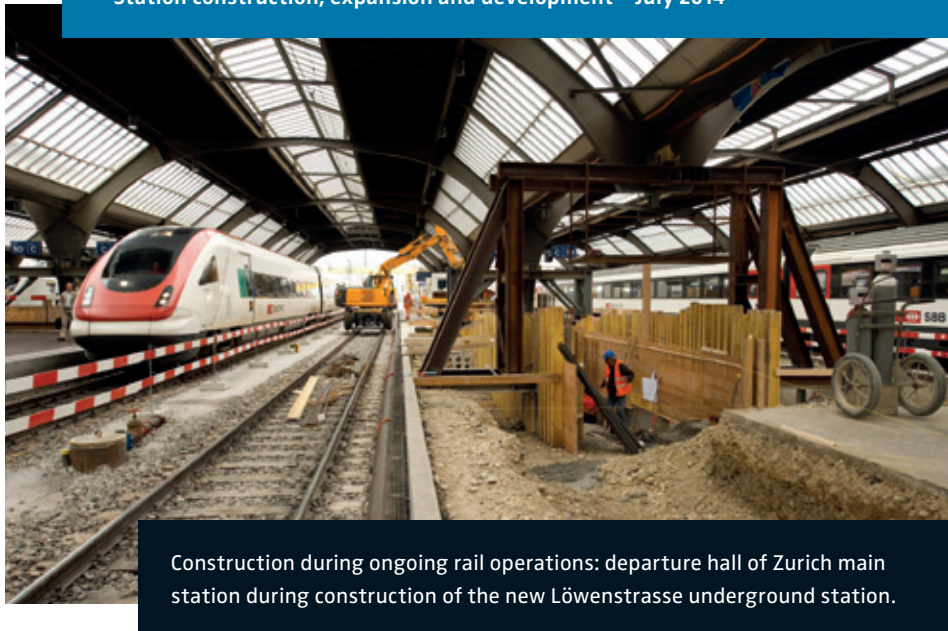


# Station Spotlight

Station construction, expansion and development – July 2014



Construction during ongoing rail operations: departure hall of Zurich main station during construction of the new Löwenstrasse underground station.

## Editorial

Railway station expansions are not built in the open countryside but right in the heart of the city. That usually leaves only one place with enough space for more tracks and passages: underground – often below the existing station. The biggest challenge during a station expansion is therefore clear: although the station will become a large construction site, it must remain fully functional. In addition, an expansion often involves much more than just work on the tracks. For example, trains must be able to arrive and depart on time, passengers must be able to reach their connecting trains safely and shops must be able to receive deliveries and remain attractive to their customers despite the construction work around them. These requirements are not compatible with a construction site, which needs space, brings risks and causes noise and dust. How can construction work and rail operations be reconciled? To maintain normal operations, solutions must be found in the earliest planning stages. This is decisive for the success of any station redevelopment project. In this issue, we provide an insight into the planning and practice of site management.

Ralph Bächli  
Leading expert station construction  
Basler & Hofmann

## Operations take priority

**Train services must be able to operate as normal during a station expansion. At the same time, space for the construction work has to be created on and around the tracks. On large projects, this can be achieved only by track closures. To accommodate the same volume of traffic on fewer tracks, all time and spatial margins must be exploited.**

### Reconciling the station and construction site

Most Swiss railway stations for which expansions are planned in the next few years are already operating close to maximum

capacity. But this situation becomes even more acute during the construction period, as the number of passengers continues to rise and the construction site increases in size. A simple rule of thumb applies: operations take priority. Train services must continue to operate as normal. However, it should be noted that a construction project will take longer and become more expensive if construction companies are forced to work under severe constraints. To reconcile rail operations and a construction site calls for sometimes unusual approaches. Investment in detailed planning pays off at the latest by the implementation stage.

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Integration with the city

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### Finding margins – and using them

In densely populated city centres, stations are usually expanded underground – whether new tracks are built under the existing station, or new underpasses are constructed for the growing numbers of passengers. For construction work below a station, temporary closure of tracks and platforms is usually unavoidable. For a station operating close to capacity, this is virtually impossible – unless all time and spatial margins are exploited. Various approaches can be combined in order to close a full track or a track section and still meet the timetable:

#### – Night work

Today, it is very difficult to move construction work to overnight. Many stations have no night break or only a very short one, which makes it impossible to work efficiently on the construction site. If something unexpected happens during construction work, it will have an immediate impact on rail operations. This solution is expensive and error-prone.

#### – Compressing the track occupancy plan

Which train occupies which track is specified in an overall plan, the track occupancy plan. All tracks are usually occupied so densely that they cannot accept any more trains. But by working closely with the rail operators, it is sometimes possible to find small gaps that can accommodate trains from closed tracks.

#### – Shortening a track

If, for instance, a new passage is being built below the tracks, it can help to

shorten the tracks temporarily in order to make the closed-off area fully available for construction work. This is a good option for terminus stations or where a line ends at the station. The new Gessnerallee passage at Zurich main station was built using this method. During the construction period, passengers had to make small detours.

#### – Platform extension

If a track is shortened, the longest trains can no longer stop at the platform. If this restricts rail services too much, the platform can be extended temporarily at the other end, depending on the track geometry.

#### – Use of a track for two trains simultaneously

This is possible for a through track; that is, from which trains travel in opposite directions. In this case, the platform is split into two parts. This solution becomes more complex if trains have to pass one another, as at Bern railway station.

### The longest platform in Europe

Bern station is about to undergo extensive redevelopment. A new underground passage up to 80 metres wide will be built below the existing track area over the next few years. It is not possible to build such a structure without track closures, but without compensatory measures track closures would have serious consequences: Bern station would have to forfeit up to nine trains an hour for several years. With today's passenger volumes, a service restric-

tion of this dimension would not be acceptable. An unconventional solution will therefore be adopted: platform 5 will be extended by 360 metres to a total of 700 metres, making it the longest platform in Europe. As a result, two mainline trains and two regional trains will be able to stop at the platform at the same time, allowing up to two tracks to be closed off to create the necessary space for the construction work. Thanks to the adjoining passing track, the two trains can even be routed past one other. This solution requires considerable investment, since junctions, overhead lines and signals also need to be converted with extension of the platform (and its roof). In addition, significantly more passengers must be able to reach and leave the platform. Passengers will be guided to the end of the platform on two levels: via the platform and via the accessible platform roof, which is connected to the existing passage «Welle».

### Construction site timetable

Lausanne railway station will undergo massive expansion before the end of 2025. To be able to manage the sharp rise in passenger volumes, platforms need to be extended and widened, and linked to a new system of underground passages. Here, too, tracks have to be closed in phases to enable implementation of the construction work. Unlike Bern, track capacity in Lausanne is not being increased by structural extension, but through more intensive use of the tracks: a construction site timetable will be in place during the construction period from 2017. The same range of travel services will still be available to passengers, but the



Bern railway station will undergo massive expansion over the next few years. To ensure that rail operations can continue with minimal disruption, the longest platform in Europe is being created for the construction phase.

timetable will be condensed and adapted so that services can be provided on fewer tracks. With such a tight-knit network as Swiss rail, this has an unavoidable impact on the country's rail traffic as a whole. Nevertheless, it has still been possible to create a construction site timetable that ensures connections at all key interchange points, thanks to a working group in which all participants worked hard to find a common solution. As a result, two tracks will be closed during the construction work in Lausanne without the need for significant investment.

#### The decisive factor

The maintenance of operations is the crucial factor in the expansion of a station. Normal operations must be ensured without restrictions during the construction period, albeit on fewer or shorter tracks and platforms. The rail operation determines the construction phases, methods and costs – and sometimes even the layout of the new structure. One example is Geneva-Cornavin station, where the schedule leaves no room for track closures. A potential underground station would therefore have to be situated laterally to the existing station.

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## The logic of the crowd

**Passengers must be able to reach their trains quickly and safely during the construction period. What sounds simple is actually a science in itself: passenger flow studies. How to ensure that people reach their connecting train, but do not cross the safety lines.**

A railway station serves primarily as a transport hub. In other words, people must be able to reach their train or other form of transport as quickly and directly as possible. Just like a river, any obstacle in the way of a stream of people causes congestion and turbulence and holds up the flow. These obstacles may take the form of a newspaper box, a kiosk or a group of waiting people. A construction site is a massive operation in a station and can cause obstacles and bottlenecks in numerous places. That is why special attention must be given to the flow of passengers during the various construction phases. It is not just about how quickly passengers can move forward inside the station, but their safety.

#### Do not cross this line

For any work in a railway station, the Swiss Federal Office of Transport (FOT) requires proof that passengers on the platforms will be safe, since they tend to cross the safety lines when the platform becomes too congested – which is precisely what must be avoided, as a train can move at any time. For each project, the FOT stipulates the

maximum crowd density per square metre for passengers boarding and disembarking a train. These target values must be respected even during the construction phase, which requires detailed calculations for peak times. How much space is there on the platform? Can two trains stop at the platform simultaneously? How many people get on and off? How many people are already waiting on the platform? Are they evenly distributed? How far is the closest exit? What is the capacity of the exits? When will the next train pull in? The platform should be cleared by this point.

#### Enough time to change trains

The second important factor in addition to safety is well-functioning connections. A construction site can drastically alter a railway station: longer pathways between the platforms, closed exits, diversions. Nevertheless, passengers must still be able to reach their connecting trains quickly. There are no fixed guidelines on how quickly a platform has to be cleared or how dense the flow of passengers may be in a passage, but it is essential that even the last person on the platform must stand a chance of catching the next train. The connection times differ for each station: five minutes in Lausanne, seven in Zurich. These times are also decisive in determining whether a passage is wide enough, whether the capacity of an exit is sufficient or whether a walkway is too long.

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### Human behaviour: sometimes unexpected

If the passenger flow calculations calculations show that the target values cannot be met during the construction phase, specific measures must be taken: can the site enclosure be moved? Will a kiosk need to be relocated? Can temporary additional stairs to the passages be installed? Predictions about the flow of people ultimately come down to human behaviour – and that can't always be predicted accurately. For extension of the Sihlquai passage in Zurich, a pile had to be bored into the ground from an underpass that was already narrow and very busy. The required construction site would have reduced the size of the passage by half – an impossibility, everyone agreed. Nevertheless, the decision was made to perform a test using a mock-up. Lo and behold, just like a stream that increases its speed at a narrow point, people also flowed through this bottleneck more quickly. No one stopped to study the timetable or make a phone call and there was no 'turbulence'. The construction project could therefore be implemented as planned.

### Quick orientation during the construction phase

Construction work in a railway station is usually temporary. Nevertheless, to ensure that people can still flow, the surroundings need to be arranged in an optimum way. Commuters in particular are creatures of habit and should not be diverted too often, as this will lead to congestion and turbulence. This should be considered when planning the construction project. Clear signals are also important for a smooth flow of people, with just the right amount of information – too much or too little and people become irritated. Even though many construction enthusiasts deplore the fact, peepholes in the site fencing are taboo in train stations, since people tend to gather round them and cause congestion.

### Current passenger flow studies at Basler & Hofmann

- \_ Lausanne railway station
- \_ Renens railway station
- \_ Hardbrücke railway station
- \_ SZU railway station at Zurich main station
- \_ Lucerne underground station

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## «Understanding is needed on both sides.»

Many railway stations have become shopping centres and construction work in stations also affects businesses. An interview with Nadine Schwarz, who was a site manager on the cross-city link at Zurich main station from 2007 to 2013.

### What were the shopkeepers' biggest concerns during the construction period?

Construction noise is always a problem. Demolishing concrete, for example, is very loud. I can understand how it can be a nuisance to shopkeepers – but there's just no way round it, unfortunately. It's sometimes possible to reach a compromise, such as an agreement not to work during the shop's busiest hour. But at the same time, we're under pressure to meet the construction site's tight schedules.

### The layout of a construction site can often be confusing.

Yes, many shopkeepers are worried that people will no longer be able to find their shops behind construction walls, so we used the walls as signposts and advertising boards. In the case of one food stall where the owner was particularly worried, the construction site even led to an increase in sales. Although the stall was

not visible, customers were diverted right past it because of the construction work.

### What is the role of site management?

We always have to consider how to make improvements at a justifiable cost. Communication is key: we always let SBB, as the landlord, know months in advance when work needed to be performed and where restrictions could be expected. As simple as it sounds, it really does help to talk to each other. Those who have seen the construction site with their own eyes are usually more understanding. And understanding is needed on both sides.



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**Publisher:** Basler & Hofmann AG, www.baslerhofmann.ch  
**Editing:** Dorothee Braun **Design:** Caroline Aebi

**Circulation:** 1500