

Railways and Large Urban Development on the Paris Left Bank

Alain Boudon

To give more balance to the eastern side of Paris, in 1988, the local government launched preliminary development plans for the south-eastern section of the city on the left bank of the River Seine.

Due to the importance of railway lands in this part of the city and to protect assets needed by the railway for its operations, the city authorities and the French National Railways (SNCF) decided to work closely together from the early planning stages.

The first studies explored numerous alternatives dealing with fundamental considerations, such as configuration of public space, management of railway operations in rail corridors, and the future cityscape along the Seine.

A feasibility study examined the possibility of relocating Austerlitz Station outside the city limits to release most railway right-of-way inside the city for other purposes. However, the final results persuaded the city authorities and SNCF against relocation for several important reasons:

- There was a desire to keep Austerlitz Station in the heart of the city in order to maintain the attraction of rail travel;
- Relocation would have moved Austerlitz Station away from nearby Lyon Station and the proximity of the two stations is considered an important SNCF asset;
- It would have been very difficult to find another site with the same level of access to public transport services;
- Relocation would have had a very negative impact on rail services leading into Paris, necessitating the movement of all rail infrastructure up to 10 or 20 km from the station, including workshops, train formation yards, inspection pits, train cleaning machinery, etc.;
- The considerable investment would lead to high-interest loans adversely affecting the balance sheet.

However, as an alternative, SNCF agreed to reduce its right-of-way requirements to

the minimum necessary for rail operations, and to permit construction of structures over railway lines, thereby creating a new cityscape not divided by track. In other words, it was decided that rail infrastructure can be compatible with the urban environment as long as the railway does not occupy the entire space in high-density areas.

The Project

The urban planning project extends 2.5 km along the Seine and encompasses 130 ha or 1.2% of the total area of the city. The targeted zone had considerable rail operations that initially occupied almost half of the development zone. The rail facilities included:

- Austerlitz Station building (serving trunk and suburban lines)
- Boulevard Massena Resean Express Regional (RER) metro station
- An Auto-Train (Car-Sleeper) station
- A freight distribution centre

- Service tracks for train formation and preparation
- Main track
- A maintenance shop for passenger rolling stock
- Railway housing and social facilities
- Service buildings

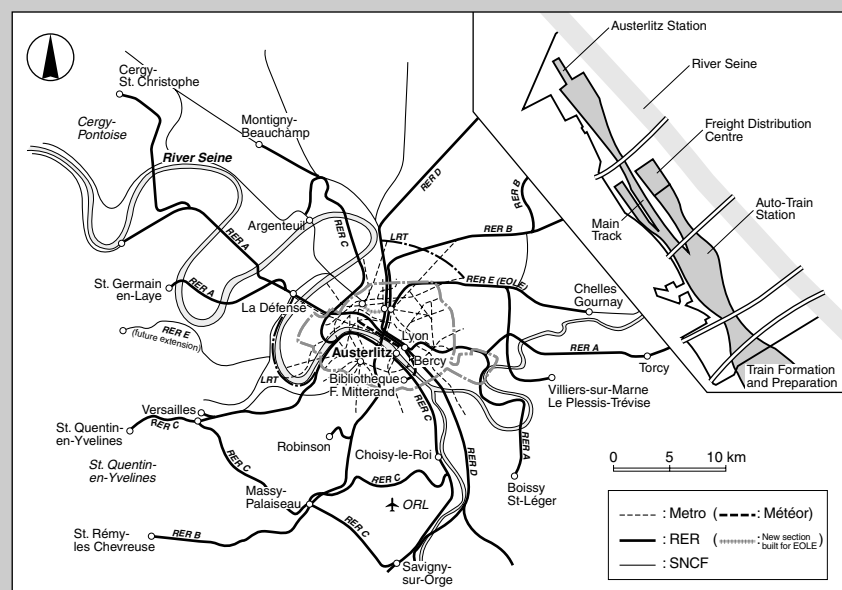
SNCF agreed to the long-term transfer of about 20 ha at ground level and 30 ha above ground (over tracks).

Project Organization

A partnership was established between the Paris city authorities and SNCF right from the start.

The city authorities gave responsibility for the project to *Société d'Économie Mixte d'Aménagement de Paris* (SEMAPA), a public-private entity. SNCF owns 20% of the SEMAPA capitalization, and has two representatives on the administrative board. Due to restrictions caused by rail infrastructure, SEMAPA gave the role of

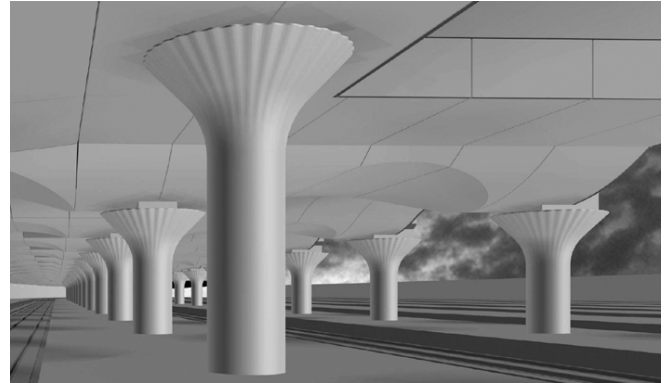
The Paris Railway Network





Transfer floor at Bibliothèque François Mitterrand Station

(SNCF)



Artist's impression of Austerlitz Station platform

(SNCF)

contractual supervision and responsibility for project management to SNCF (Table 1). Construction plans included:

- Laying slab superstructure over tracks and building supports and foundations for that superstructure
- Construction of supporting structures for facilities to be built on the slabs
- Laying of service conduits to create a supply network within the slabs
- Construction or reconstruction of road crossings over lines

Reseau Ferré de France (RFF) owns most of the railway lines, and in 1997, it granted SNCF the role of contract supervisor for modifying the rail network (construction of slab superstructure, and release of any transferred rights-of-way).

Two Major Projects Completed Under SNCF Supervision

At present, about 8 ha of slab have been

laid under SNCF contract supervision. The rest of this article discusses two major parts of the redevelopment project that have been achieved.

Construction of Bibliothèque François Mitterrand Station

The Paris Left Bank Planned Development Zone (PDZ) is undergoing significant changes. At its completion, the zone will support 20,000 residents, 60,000 jobs and 30,000 students, as well as visitors to the *Bibliothèque Nationale de France* (French National Library).

Construction of the Bibliothèque François Mitterrand Station will permit transfer between the new automatic subway line and the RER C commuter rail line, greatly improving public transport within the PDZ. The station opened in December 2000 after 8 years of study and construction work to overcome three major hurdles:

- Limitations imposed by natural environment

The platform and track for Line 14 is 15 m below ground level and lower than the water table fed by the nearby Seine. The poor ground required cut-and-cover excavation with molded walls to assure water-tightness.

- Coordination of subway construction phases with rail operations
The cut-and-cover construction ran under railway lines, so railways tracks had to be moved in phases to ensure minimum disturbance of trains serving Austerlitz Station. Temporary tracks were laid to free areas for civil engineering works. First, the tracks were centralized as far as possible, permitting construction on each side of the project to proceed while trains ran through the middle of the site. Then, the rail services were moved to temporary tracks in the completed sections of the site, freeing up the central right-of-way and making it possible for the station civil engineering to take shape. The final track layout was put into service after slabs were laid over the station. The last step was completion of PDZ slab work for areas previously occupied by rail line detours.
- Need for complex architectural structure
The height of the transfer concourse was limited by level constraints, so the architects designed an arched ceiling to give the impression of space. The

Table 1 Major Parties in Construction Project

Infrastructure slabs	<i>Société d'Économie Mixte d'Aménagement de Paris</i> (SEMAPA)
Railway construction	<i>Reseau Ferré de France</i> (RFF)
RER C Commuter line station	(<i>SNCF Ile de France Office</i>)
Line 14 subway station	<i>Regie Autonome des Transports Parisiens</i> (RATP)
Project management	<i>SNCF Direction des Opérations Nouvelles</i> <i>Etablissement Equipement de Paris Austerlitz Invalides</i> <i>Ingenierie de la region de Paris Rive Gauche</i>
Architects	J. M. Duthilleul and E. Tricaud of <i>SNCF Agence des Gares</i>



Construction site of Austerlitz Station

(SNCF)



ATM reinforcement

(SNCF)

concourse features some 20 different arched shapes. Consisting of fair-faced concrete, the visible parts of arches are light-coloured concrete chosen for its architectural qualities, while non-visible parts consist of regular grey concrete. Due to the complex structure, the configuration of each steel reinforcement in the concrete was planned by a total of 80 engineers and designers. To build the forms and frames, the planners had to create about 900 calculation models and 2300 construction plans!

Since different slabs are superimposed on each other, the design had to ensure solidity and durability. This was achieved by erecting three-pillar sets that are independent from each another and from the arched ceiling across the transfer concourse. The center pillar bears the slab with the railway tracks, while the two flanking pillars support the infrastructure slabs on which the buildings are constructed. This design prevents transfer of vibration caused by passing trains to the buildings.

Platform covering at Austerlitz Station

The 3-m thick slabs over the platforms at Austerlitz Station are a mixture of steel frames and reinforced concrete. Their foundations rise from limestone bedrock 15 m below. The structure consists of base

pads, pillars and netting, header joints, girders and a hollow concrete flooring. They house conduits supporting infrastructure for electricity, telecommunications, sewers, water runoff, potable water, heating and cooling, etc. Smoke and ventilation shafts at regularly spaced intervals lead above the station. Tree pots with a volume of 12 m³ each line the passageways. These various installations influenced the design work and load-bearing calculations.

The design for the future Austerlitz Station has been inspired by the Bibliothèque François Mitterrand Station in its use of white concrete and circular motifs. This very novel architecture hints at Austerlitz Station's connection to the Spanish railway system—the SNCF *Agence des Gares* designers were inspired by the Gaudi-esque architecture of Barcelona. The ceiling above the platforms features arches and counter-arches. The arches allow passage for trains while the counter-arches permit passage of conduits. The ceiling is composed of prefabricated shells enhanced by soft, indirect lighting. The

supporting pillars open upwards with finely fluted corollas, giving the concrete a light, almost airy appearance.

The complex geometric structure necessitated by railway and technical constraints is harmoniously integrated into the overall design.

The smoke shafts form a relatively inconspicuous part of the ceiling architecture and contribute a soft natural light. Extensive effort was made to optimize the curved sections of the platforms and give a quarter of the ceiling surface a unique shape with barely noticeable discrepancies in joint spacing. The undulating shape of the ceiling facilitates fire safety by creating bays that direct smoke towards the smoke shafts.

At present, the five tracks closest to the Seine are being covered, while permitting continued use of the station. The covering will be extended gradually over all 20 tracks. ■

Alain Boudon



Mr Boudon is Director of Operations at SNCF where he has held various posts in operation and infrastructure maintenance since joining SNCF after graduating from the Ecole Centrale des Arts and Manufactures, one of top engineering schools in France.