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IX

Reconstruction of a Railway Station in Budapest

Reconstruction de la gare de l'Ouest à Budapest

Rekonstruktion des Budapester Westbahnhofs

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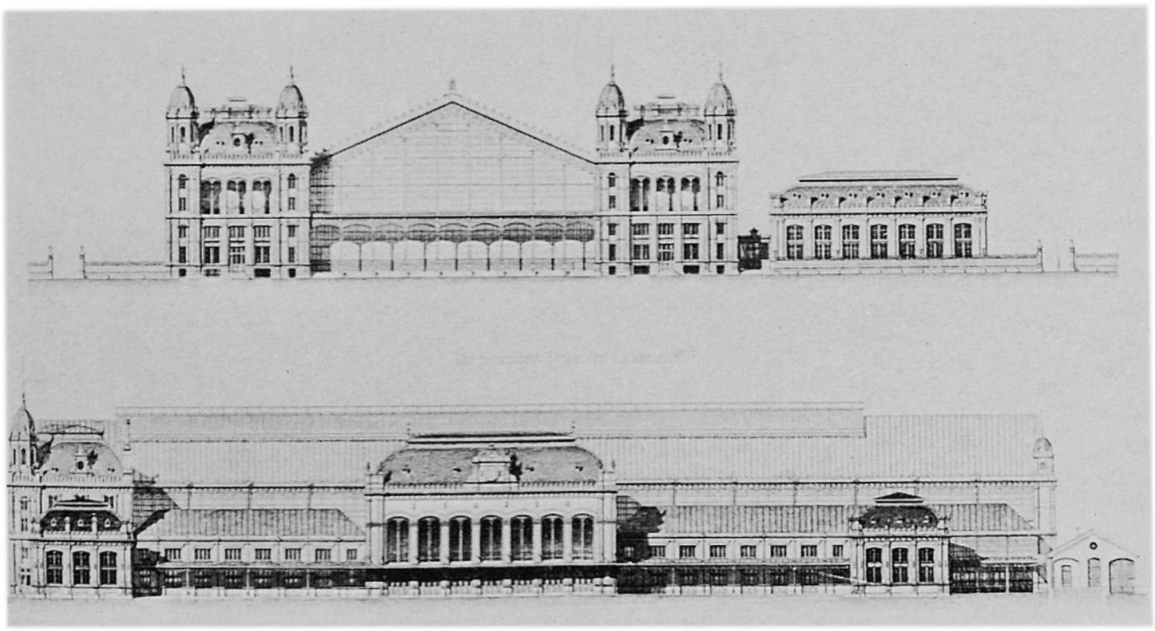
SUMMARY
The track-hall of the Nyugati Western Railway Station of Budapest, built 1875–1877, is a steel structure with a span of 42 m, and a length of 153 m consisting of Polonceau trussing. The hall was to be reconstructed because of the damages caused by corrosion. The reconstruction was carried out during 1978–79, by taking into consideration the aspects of the protection of historical buildings. The less damaged but valuable structural parts were preserved and the newly manufactured parts were fitted to them.

RESUME
La halle de la gare de l'Ouest à Budapest bâtie en 1875–77, est une construction métallique en cloisonnage Polonceau. A cause des dommages dus à la corrosion, elle devait être reconstruite. La reconstruction s'est effectuée en 1978–79 en tenant de la protection des monuments historiques. Les parties peu endommagées mais précieuses ont été maintenues et intégrées aux parties reconstruites.

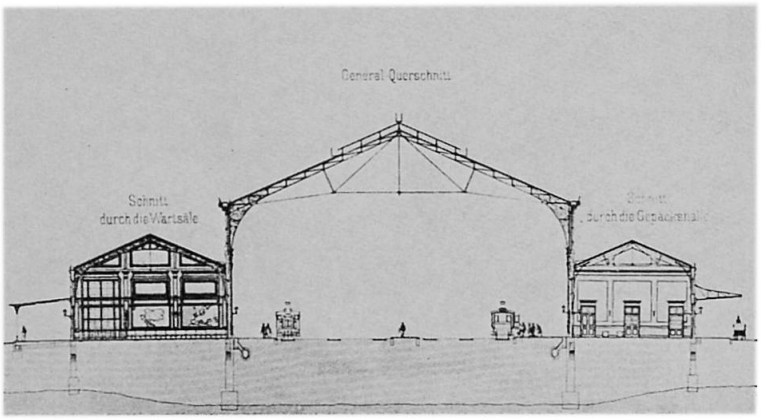
ZUSAMMENFASSUNG
Die Gleishalle des Budapester Westbahnhofs, eine Stahlkonstruktion mit „Polonceau" Bindern, deren Spannweite 42 m und Länge 153 m beträgt, wurde 1875–1877 gebaut. Die Halle musste wegen Korrosionsschäden umgebaut werden. Die Rekonstruktion wurde nach Gesichtspunkten des Denkmalschutzes ausgeführt. Die weniger beschädigten wertvollen Teile der Konstruktion blieben erhalten und wurden mit den neuen Teilen zusammengebaut.

The design of the Nyugati (Western) Railway Station was completed in 1873 under the direction of August W. de Serres, then the director of the Railway Company. The construction began in the Spring of 1875, the main contractor was the Eiffel and Co. Engineers that designed, manufactured, and erected the steel structure of the three-bayed big track-hall. Details of the steel structure were designed by Theophil Seyry, then one of the partners of the Eiffel firm.



1. Original plan, elevations

The Nyugati Railway Station was opened in October 1877. The design of the station went parallel with the building of the Great Boulevard in Budapest, thus the railway station became important part of the general townscape, too. The train receiving track-hall was the largest hall of such kind in the Austro-Hungarian Monarchy.



2. Original plan, cross-section

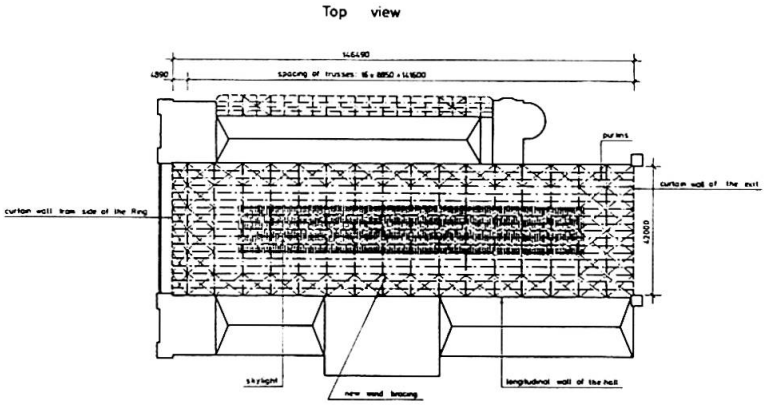
During the last hundred years including two world wars the railway station suffered serious damages. In the war years the maintenance was insufficient. Consenquently and due to the nature of the railway operations, serious damages began to appear on the steel structure. Because of the townscape significance of the building and the exceptional worth of the steel structure, the Nyugati Railway Station was declared to be a historic monument. Therefore the Government officials decided on the complete reconstruction of the whole structure.

In order to find the best solution the authorities called for a country-wide design competition. The design and the reconstruction have been car-

ried -out according to the prize- winning plan.

3. The Great Boulevard with the Station at the end of the last Century

The length of the track-hall is 153.00 m, its width is 42 m. The Great Boulevard frontage and the exit side of the station are closed by a curtain-wall. The later one is supported by a three-span bridge. The main loadbearing structures are the two hinged frames, supported under floor level, spaced 9.0 m apart. To most of these frames sidebays are attached. The frame columns constructionally constitute the columns of the sideaisle, too, and are walled into the longitudinal wall of the track-hall up to a height of 10 m. In addition to these a 6.00 m high glass screen was built above the top of the wall between the columns. The beams of the frames are Polonceau (French) trusses. The trussings are connected by latticed purlins. The length of the roof glazing is 88.5 m, its width is 9.24 m. At both ends of the track-hall the two spaces between the last 3-3 trussings are connected by wind-braces.



4. Ground plan

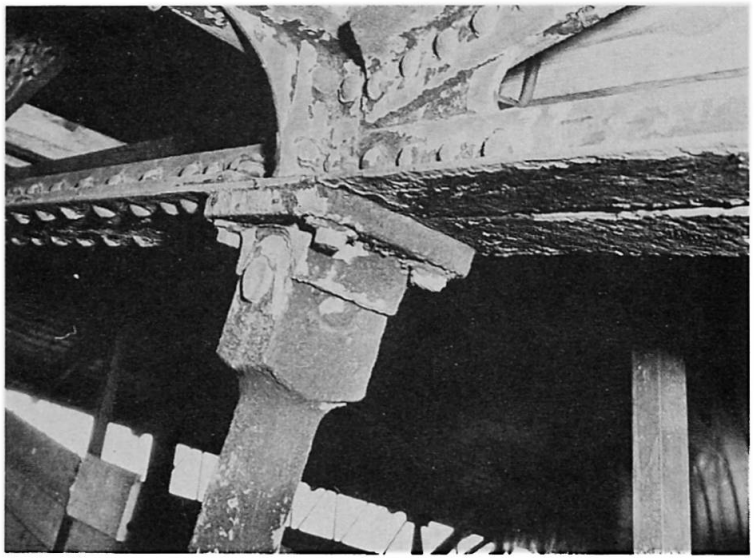
The extent of the corrosion at the middle part of the trussings, that are the most exposed to the fumes reached or surpassed the 50% limit. The corrosion of the bearing columns was caused by the faults in the rainwater drains. At the same time in the case of the decorative frame corners and the tension bars, the extent of the corrosion was negligible. The corrosion was also negligible at the two frame trusses to be found near the Great Boulevard, where the locomotives did not pull in.

Therefore the basic principle of the reconstruction was on the one hand the saving of the less demaged but historically most important part of the structure, on the other hand the replacing of the practically destroyed and non-renewable ones.

The re-usability of some structural parts was proved by material testings. The strength of the old material corresponds to that of grade 37 of today's but not weldable materials.

Special problem was created in the reconstruction of the more than 100 years old structure by the fact that it would have not met the requirements of the up-to-date specifications, even its new state, esprecially in the case of compressed struts.

Therefore it was necessary to provide the framestructure at the height of the junctions of the aisles with horizontal rigid supports at both sides. This requirement was satisfiable, because floor plates were built into the aisles for functional reasons. The frame columns could be attached to these plates. The existing wind-braces were connected with new, longitudinal wind-braces, along the sides of the track-hall, for the sake of increasing the rigidity of the structure. Finally for the vertical loads two-support, latticed Polonceau trussing, and of the horizontal loads two-hinged frame structure –supported on two sides– functioned as a statical model. Since the weak flat-plate rods of the remaining frame corners were not adaquate to take-up the compressive loads, they were taken into account only in the case of tensile forces.

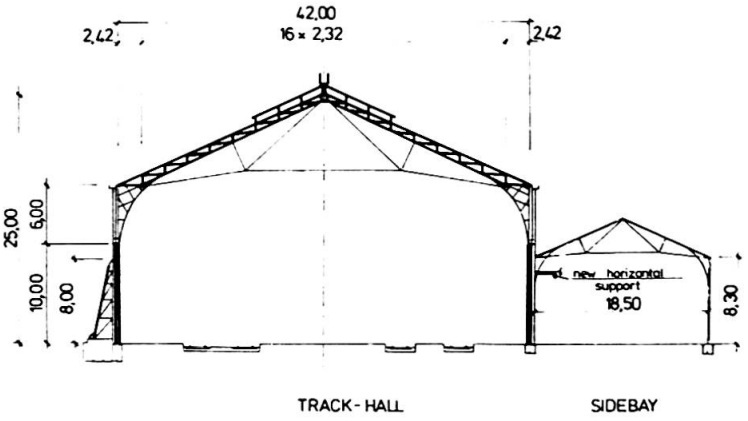


5. Detail of a corroded trussing

The reconstruction took into consideration the point of view of the historical interest. It was based on saving of the less corroded structural parts, on the construction of a horizontal support system, on the load relief of the frame corners, and finally –taking into account that the problem was the mixed construction of the remaining and new parts– based on a conception that needs a very thorough manufacturing and assembly technology. The new track-hall, regarding its appearance, is almost the same as the old one, apart from minor details. The curtain wall, facing the Great Boulevard of Budapest, remained as it was and also remained the first two frames attached to it. These were cleaned by metal-spraying and were stiffened at the necessary places. The same principle applies to the decorative corners of the other frame structures. The latticed frame trusses between the frame corners are made anew by welding. The shape, the dimension and arrangement of the sections follows the original very closely.

6. A renewed frame corner

During the strengthening of the columns only those parts of the original columns were demolished which reached into the track-hall. The new and partly double-walled column section encases the remaining part of the original column, securing this way the composite action. Thus the remaining frame corners are located between new frame-beams and new columns. The full set of the tension bars of the trussings remained in the original state. But all of the latticed purlins had to be replaced. Also completely new are the construction of the roof glazing, the side glass-screens and the wind-braces, where the longitudinal wind-brace appears as a new structural element. The curtain wall on the exit side was totally destroyed and had to be completely rebuilt.



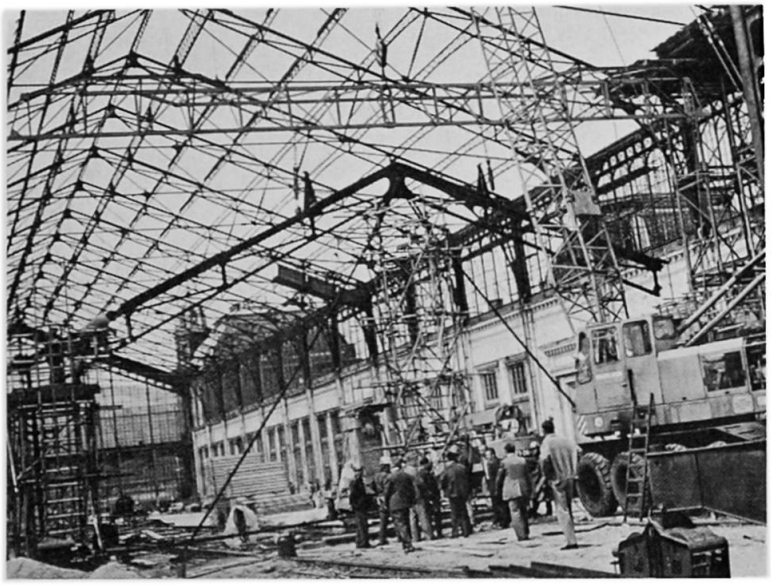
7. The remaining and the new parts of the frame structure

The new curtain wall was constructed as a closed frame-structure by building into a new vertical Vierendel-truss on each edge.

The weight of the remaining steel parts is 140 tons, 27% of the original steel structure weighing 515 tons. Nevertheless the value of the saved parts surpasses many times that of the heavier new parts because of the high cost of manufacturing of the bars.

The demolition started at the exit side with the curtain wall, for this ascaffolding was built on which the demolished structure was cut into transportable pieces. The demolition of the trussing was carried-out with the help of a rocker device that was fixed to the structure, and after the trusses were cut at the boundary line of the remaining frame corners they were lowered by an autocrane to the floor.

The construction was started by strengthening of the remaining two trussings and this was done with a full scaffolding. The repaired corner elements were replaced on the reinforced columns, then the connecting longitudinal walls were lifted-in and the junctions were made.

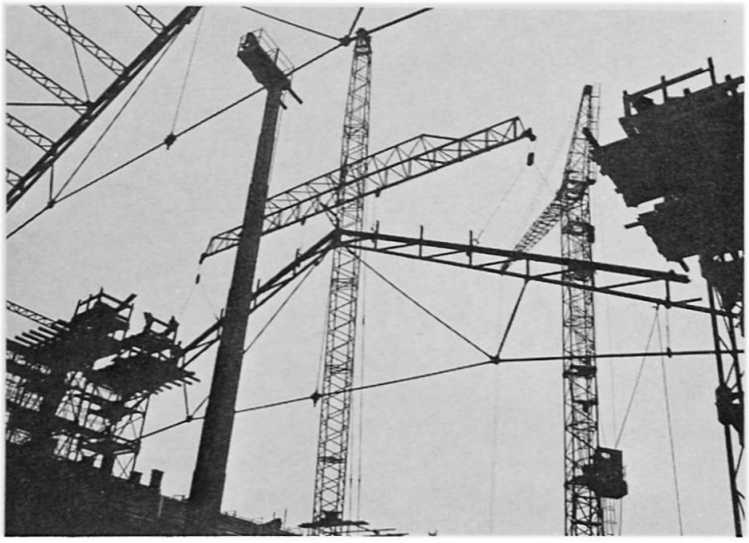


8. The demolition of a trussing

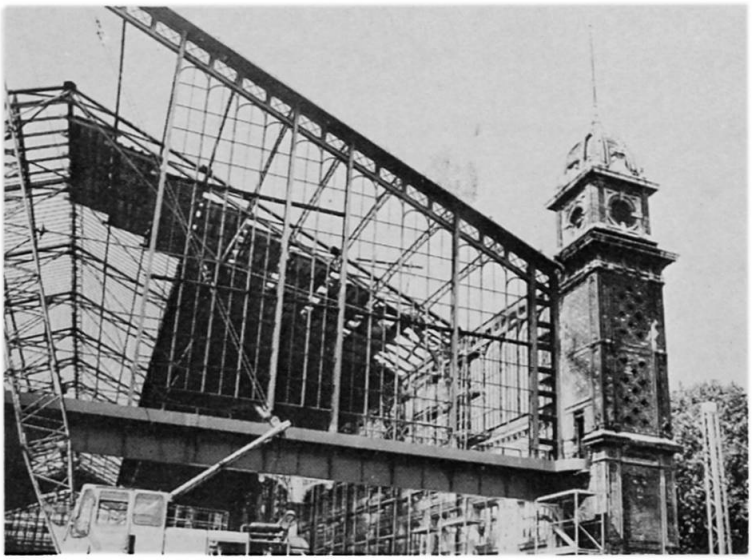
The new trussing part was assembled on the ground in the vertical position and the tension bars were adjusted in this position. With the help of the rocker device, the trussing

was lifted-in between the two corners. The tension bar was connected and the trussing was placed into its final position by further lifting to allow the connection of the trussing onto the corner parts with the plates. Afterwards the purlins and the windbraces were lifted-in. During the erection of the steel structure of the end wall for the exit side the 42 m long bridge, manufactured in three pieces was lifted in by three cranes simultaniously. The connections were made in the air, then the bridge was lowered onto its supports. The reconstruction of the roof boarding was made according to its original shape and over the boarding one layer of roofplate water-proofing was placed finally on its top a zinc sheet covering was laid.

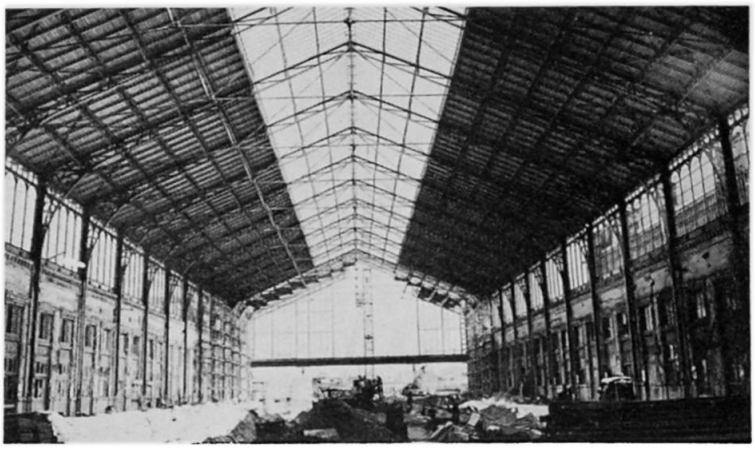
The reconstruction of the track-hall began in January 1978 and completed in December 1979.



9. The lifting in of a new trussing



10. Erection of the new curtain wall



11. The track-hall before completion