

Railway station in Rzeszow – social impact building, building material structure survey

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Scientific Editor: Mateusz Gyurkovich,
Cracow University of Technology

Technical Editor: Aleksandra Urzędowska,
Cracow University of Technology Press

Typesetting: Anna Pawlik,
Cracow University of Technology Press

Received: January 2, 2025

Accepted: April 22, 2025

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Data Availability Statement: All relevant
data are within the paper and its Supporting
Information files.

Competing interests: The authors have
declared that no competing interests exist.

Citation: Gosztyła, M., Sikorski, K.,
Gosztyła, J., Pasztor, P. (2025). Railway
station in Rzeszow – social impact building,
building material structure survey. *Technical
Transactions*, e2025002. [https://doi.
org/10.37705/TechTrans/e2025002](https://doi.org/10.37705/TechTrans/e2025002)

Abstract

In the body of the article, as a preliminary issue, aspects from the history of the construction of the railroad station in Rzeszow were discussed. The main purpose of the research was to determine the structural characteristics of the materials used in the construction of the railway station along with their selection, use in the construction of the building and their sensory perception. In the course of the research, the chemical and crystalline composition of the sampled stones was determined. Also the origin of the building material was considered in the context of selected facilities of the Charles Ludwig Galician Railway, and the metrics of the building material were interpreted in terms of existing inscriptions/merc's. The realization of the intended objectives caused the selection of research methods. A synthetic analysis of the impact of designed architectural solutions of railway stations on the perception of travelers was carried out. To realize the research tasks, literature analysis was carried out along with an attempt to use specialized research equipment to determine the properties of the stone material used in the construction of the Main Railway Station. The choice of research methods resulted from the specifics of the subject under study.

Keywords: Rzeszów, railway station, FTIR, XRD, stone

1. Introduction

Railway infrastructure facilities, due to their continuous operation, their important role in the process of shaping the space of localities and initiatives related to, among others, Government Railway Development Plans or the functioning of economic sectors (*Railway Development Programmes*, 2018; *200 Years of Central Road Administration*, 2019), are the subject of interest of the broad public and state and local government administration bodies. Historic buildings with their associated infrastructure are the subject of interdisciplinary research conducted by Provincial Conservators of Monuments, archaeologists, architects, historians and civil engineers. An interesting element of the considerations concerning the development of railway station architecture, including the railway infrastructure of Galicia in the times of the Austro-Hungarian Empire, is the analysis of the technological and material solutions implemented during their construction on the Karl Ludwig Galician Railway.

The state of knowledge about methods of building historic constructions of Podkarpackie voivodeship indicates use of locally available materials (Goszyła, Sikorski, 2021; Motyl, Goszyła, 2019). The main reason for this was lower level of knowledge of methods of producing building materials (comparing to nowadays), as well as logistical issues that often affected the time and cost of project implementation. The indicated trends are also found in the infrastructure of the analyzed railroads from the Austro-Hungarian Empire (Preidl, 2009). In order to develop these issues, the publication attempts to use specialised research apparatus to determine potential localization of sources of stone material used in the construction of the Main Railway Station in Rzeszów.

It also outlines the process of perception of railway station complexes and the works of art encountered in these buildings, which in the human mind allows the characteristics of the building to be recognised and therefore influences the development of architectural designs for these buildings. In addition, it was emphasised how basic information about architecture: form, function and material construction influences the course of perceived impressions and, more generally, to parts of the surrounding environment. The phenomenon of perception as a tool of opinion formation in relation to cultural heritage was also touched upon.

Such an outlined research profile has not yet been addressed in the specialized literature considering railwaystations of Galicia.

2. Historical context and state of research

The idea of creating and developing a railway route connecting the capital of the Austro-Hungarian Monarchy with the Galician territories appeared in the first half of the 19th century, but due to the momentum of the project, the imperial government initially abandoned its investment plans. However, the development of rail transport in the USA and European countries (e.g. France, England, Germany), as well as the possible profits of private entrepreneurs, eventually determined the acceptance of the above concept (Rymar, 2009). Thanks to the efforts of Professor Franz Xavier Ripel and the Viennese banker Salomon Rothschild, the first Floridsdorf – Deutsch Wagram line was opened on 6 January 1837 (Rymar, 2009). It is worth mentioning that the established Galician Railways, apart from the economic aspect related to the transport of goods such as foodstuffs or minerals, had a significant impact on the mobility of the Monarchy's troops, thanks to which they constituted an important strategic element in the defence of the Austro-Hungarian state (Kaczmar, 1995).

In 1840 the Galician Government submitted a project for the construction of a railway line between Bochnia and Lwów. As a result of the Austrian government's tardiness, the concept for the railway line came a decade later, i.e. in 1850, while the project for a railway connection on the aforementioned route was created in 1857 (Stankiewicz, 2008). In Rzeszów, the railway started operating on 15 November 1858, when the 46.9 km long section from Dębica was put into service (Stankiewicz, 2008; Lijewski, 1959; Wierzicki, 1907), which was part of the Imperial Royal Privileged Galician Railway of Charles Louis. This fact was logistically important to the inhabitants of the Rzeszów region and the city of Rzeszów itself (Janda, 2022) due to the possibility of travelling to the centre of the monarchy – Vienna (Stankiewicz, 2008). Initially (Stankiewicz, 2008), Rzeszów was to be the terminus for a period of several years, but plans were changed and further sections of the Kraków-Lviv route were opened as early as the end of 1859 (note Przeworsk 15.11.1859 etc.) (Lijewski, 1959). Officially, on November 4, 1861, the most important stations of the Galician Railway were connected, making travel to Lwów possible (Stankiewicz, 2008).



Fig. 1. Railway Station in Rzeszów in 1910–1914 Dworzec Rzeszów (source: <https://polska-org.pl>)

Among the buildings located on the territory of the present-day Republic of Poland which were part of the Galician Railway and which were of significant architectural importance were, first of all, the railway station in Lwów, and then in Bochnia, Dębica, Przemyśl, Rzeszów or Tarnów (Komorowski, Sudacka, 1995). Unfortunately, as a result of warfare and economic changes, some of the buildings were demolished (e.g. Łańcut Railway Station was blown up in 1915, Rzeszów and Jarosław Railway Stations were blown up in 1944) and/or underwent reconstructions resulting in the loss of the original architectural form (e.g. Rzeszów or Dębica Railway Station) (*Dębica Railway Station*, 2013; *Jarosław Railway Station*, 2009; *Łańcut Railway Station*, 2007; *Rzeszów Railway Station*, 2006). The transformations also did not bypass the Lviv Railway Station, considered the jewel in the crown of the Galician Railway, which was, as Komorowski and Sudacka point out, „barbarically transformed” (Komorowski, Sudacka, 1995). At this point it is worth referring to Tadeusz Szydlowski's work *Ruins of Poland*, published in 1919, in which the author refers to the period of World War I and the damage to around 1 million buildings in the then Galicia, including railway stations (Szydlowski, 1919). These activities continued during the Second World War, contributing to the devastation of the railway station architecture of former Galicia.

The architectural form of the Galician Railway stations was mainly influenced by the solutions adopted for the British Railways of the Victorian era and the Emperor Ferdinand Northern Railway (Rymar, 2009). The designs for the station buildings were drawn up at a construction bureau in Vienna (Hochbau), while the construction process itself was carried out according to tenders held in Kraków (Komorowski, Sudacka, 1995).

The main stations of the Charles Ludwig Railway, despite their monumentality, were rather economical in terms of architecture. Located on a rectangular plan with a clear advantage in the length-to-width ratio, they usually took the form of two or three storey pavilions, with a possible basement. The pavilions were connected to each other by one-story connectors. The elevations of the buildings had modestly decorated shutters and rustication located usually in their lower parts (Komorowski, Sudacka, 1995). An indispensable element of the development of railway stations were gardens, which resulted from their cultural and social function, different from today's.

Originally situated on a rectangular plan, Rzeszów Railway Station had three overground storeys and one underground storey. Lower, two-storey annexes adjoined the building on both sides. The entire structure was covered with gable roofs. During its functioning, the station was rebuilt in 1889 and in the years 1908–1909. The station building was damaged as a result of warfare in 1915 by the Russian army and twice by the German army in 1939 and 1944. Finally rebuilt to its present form in the 1960s, it is currently undergoing modernisation works (Kaczmar, Opaliński, 2004).

3. Psychological aspect in station architecture

From a logistical point of view, a railway station is defined as a specific element of the transport infrastructure, acting as a transport node that performs functions related to both passenger service and the clearance of means of transport (Zamkowska, 2011). Psychology also emphasises the role of the station as a node. However, in this case, it means that the station is a focal point for people's behaviour and an important part of their cognitive map, i.e. a personal representation of their familiar environment (Lynch, 1960).

A cognitive map is a reflection of how an individual sees his surroundings (Bubble, 2016). Hence, the points where communication routes begin, end or intersect particularly stand out in an individual's perception, are remembered by them more often, and thus contribute to greater legibility and understanding of their environment (Bell, Greene, Fisher, Baum, 2004).

Station buildings themselves, on the other hand, through their expressive and monumental structures, are landmarks, enabling people to navigate and learn urban space more easily (Bell, Greene, Fisher, Baum, 2004). Such landmarks are fundamental markers of environmental knowledge, helping people to assess distance and direction, and enhancing their sense of identity and identification with a place (Bubble, 2016).

In addition to the station building itself, the square of the station plays a very important role, which is the structural link between the station hall and the urban fabric. It is a space that concentrates people's diverse activities and allows their needs to be met (Heels, 2014).

Furthermore, railway stations are an essential part of any city. Together with town squares, office buildings, parks or shopping facilities, they co-create the public space of an urban agglomeration, i.e. an area intended to serve both the needs of a given community and the co-creation of an integrated settlement organism with a distinct image and defined identity (Groeger, 2011; Kochanowska, 2010). They are first and foremost transit spaces whose main task is to properly control the flow of passengers and ensure their safety. However, due to their architecture and due to the presence of various art elements within the facilities and within their surroundings, stations become an element that helps travellers identify a place and also navigate the urban agglomeration. Architecture, ornaments and art elements also make the station space seem more welcoming, and the stations themselves become the gateway to cities and act as their showcase (Pięć, 2014).

In this regard, it should be noted that the historic Rzeszów railway station under study and the location of the site are distinguished by the features discussed.

4. Purpose of the study

The results of the research presented in the article should be regarded as a continuation of previous research that complements the current state of knowledge about the history and construction of the Railway Station in Rzeszów. The publication also addresses the important issue of the influence of architectural solutions of railway stations on the perception and comfort of travellers. An attempt was made to determine the location of the stone blocks used during the building construction using tools to assess their chemical and crystalline composition. As part of the analysis of the history of the construction of the Rzeszów Central Railway Station, it was also decided to use the available knowledge of the railway infrastructure of, among others, the Karol Ludwig Galician Railway to further compare it with the Rzeszów results obtained by analysing the chemical and crystalline composition of the stone samples taken. Accordingly, it was envisaged:

- ▶ an analysis of the impact of station architectural solutions on the perception and comfort of travellers,
- ▶ determination of the chemical and crystalline composition of the stone samples taken,
- ▶ an analysis of the origin of the building material in terms of its composition and potential deposits,
- ▶ an analysis of the origin of the construction material in the context of selected Austro-Hungarian railway buildings, including the Karl Ludwig KG,
- ▶ an analysis of the origin of the building material in the context of existing inscriptions/mercs.

5. Methodology

On 25.04.2023r. an in situ visual inspection was carried out to enable the selection of sites for excavation for research purposes. The scope included in this publication represents only a part of the data obtained that indicate the existing condition of the building material that makes up the structural material of the underground floors of the station building.

The samples in question were taken with mechanical tools. The process was documented by marking the locations of existing test fields on drawing documentation and taking photographs of both test fields and samples. Each sample was initially assessed through in situ organoleptic tests carried out in the Railway Main Station building in Rzeszów (f.e. the size of sample was measured). The test material prepared in this way was packed into ziplock bags in order to protect it from secondary contamination that could disturb the test results.

For each sample a laboratory tests were carried out – instrumental analyses (PN-EN 12407:2019; Krzywobłocka-Laurów, 2004). Absorption spectroscopy based on the analysis of the infrared absorption spectrum is indicated as the first method. Measurements were made in a weakened total internal reflection configuration using a Vertex 70v FT-IR Fourier spectrometer equipped with a Platinum ATR diamond crystal module. Measurements for individual samples were made in the range $4000\text{--}500\text{ cm}^{-1}$ (mid-infrared).

To complete the study, XRD X-ray diffraction analysis was carried out using a Philips X “Pert diffractometer with an X” Celerator Scientific detector.

The instrument has a lamp emitting $K\alpha$ lines₁ of length $\lambda = 1.540598\text{\AA}$ (Szroeder, Doering, 2020; Szroeder, Doering, 2023; Szroeder, no date).

As part of the description of the results of the measurements performed, it was decided to use a scale indicating the intensity of the spectra and reflections (three-level scale) according to the order: + component occurring sporadically, ++ co-present component, +++ dominant component. The indicated procedure will enable a concise illustration of the content of individual components in the sample volume (Goszyła, Sikorski, 2021; Szmygin, Trochonowicz, Klimek, Szostak, 2018).

6. Findings and conclusions

For each of the excavated material pieces taken for testing, both the site of collection and the type of material evaluated organoleptically were documented. Subsequently, the chemical and crystalline composition was indicated.

Table 1. Example of stone sample marking, K. Sikorski

Sample number	Download date	Place of collection	Type of material
P19	25.04.2023	cellar wall – staircase No. 1	stone
P34	25.04.2023	cellar wall – staircase No. 2	stone

Carrying out excavation surveys is the first step towards correctly estimating the location of the stone cuttings forming the walls of the Rzeszów Railway Station. By indicating the composition of the stone, it is possible to determine its type and, in addition, its presumed origin. Analysing the ratios of the intensity of silicon reflections in relation to calcite obtained in the XRD study for stones from both parts of the cellars, it can be indicated that they are similar (sample No. 19–1:2.993 and sample No. 34–1:2.445). In addition, the occurrence of feldspar was indicated for both samples (Szroeder, Doering, 2023). The FTIR analysis distinguished silicates, calcium carbonate and aluminosilicates.

When analysing the mineral and chemical composition obtained from the studies carried out, the the diversity of sandstone composition was taken into account. Both the mineral composition and the features that can be assessed macroscopically, i.e. structure or colour, are diverse and characteristic of individual sandstone types (Jarmontowicz, 1998: 35–37; Main types of rocks and mineral raw materials of Poland, no date; Szambelan, 2023; Biały piaskowiec Długosz, 2019; Sandstones from the Cracow region and south-eastern Poland, 2007).

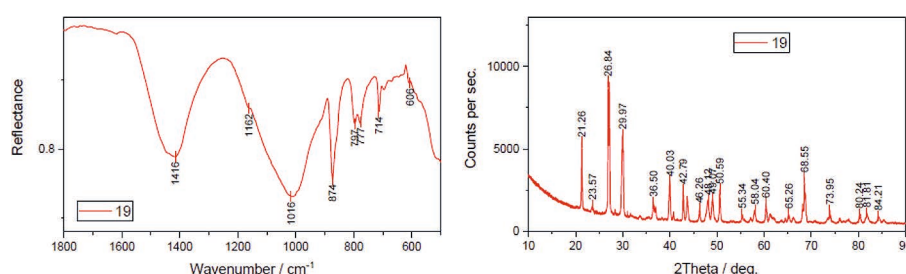


Fig. 2. Examples of FTIR-ATR and XRD test charts for stone, acc. (source: Szroeder, Doering, 2023)

In accordance with the studies carried out, attention was drawn to the possibility of the occurrence of carbonate-bearing sandstone (calcite) deposits. Analysing geology of the Rzeszów area, the available literature on the subject (Kozłowski, 1986) was consulted and a selection from Geoenvironmental Maps of Poland was made. Finally, the Rzeszów (982), Błażowa (1005) and Kańczuga (1006) sheets were indicated (Kamiński, Piotrowska, 2014; Krzak, Krupa, 2007; Rauch, Sokołowski, Olszak, 2016). Sandstone deposits, as well as sites of current

and historical mining, have been recorded in the included areas. Sandstones exposed in the areas of the villages of Matysówka, Borówki and Kielnarowa were selected among the sites of interest for the prospected deposit.

With the architectural aspect in mind, attention was paid to the stages of construction of the building that was the object of the study, which made it possible to indicate that the material was likely taken at one time. As noted, sandstone is one of the stones commonly found in historic buildings (Domasłowski, 1975; Domasłowski, 1993; Jarmontowicz, 1998; Jarmontowicz, Krzywobłocka-Laurów, 1995; Marszałek, 1994; Bolewski, 1954).



Fig. 3. A layered arrangement of sandstone blocks in the transverse basement wall of the Railway Station building, (photo by Krystian Sikorski)



Fig. 4. Bonding of the stone transverse wall with a ceramic lintel (photo by Krystian Sikorski)

Significantly, the builders of the Galician Railway served their apprenticeships in the USA and western European countries, which allows the assumption of a relatively free flow of information and data on the conditions and techniques of constructing railway infrastructure (stations, tunnels, viaducts) (Preidl, 2009). This provides a rationale for concluding that, for economic and logistical reasons, the process was subject to standardisation resulting in the use of stone from local deposits. Such regularities were noted in the case of numerous tunnels belonging to the Transversal Railway, the Galician Railway and minor connecting pipes. An example is the 602 m long tunnel in Szklary, built in 1904 as part of the infrastructure of the Przeworsk – Dynów line. This structure has a casing made of locally quarried stone. Similar examples of the use of local stone deposits have been recorded in other areas of former Galicia (Preidl, 2009; Bolewski, 1954), these include: the Austro-Hungarian railway viaduct in Kraków-Grzegórzki, built between 1861 and 1863 for the railway, which has stone pillars, or the Stone Bridge viaduct in Przemyśl, built at the end of the 19th century (the viaduct structure is clad in stone blocks) and the viaduct over the railway tracks in the course of Zana Street, which has abutments made of stone blocks (Michalski, 2015; *Railway viaduct in Kraków Grzegórzki*, 2014). When considering the material used in the construction of railway station buildings, a valuable note is contained in the entry by M. Gosztyła and B. W. Motyl, which indicates that the material for the foundations of the currently functioning Przemyśl Railway Station is mixed stone and brick, while the plinth zone of the building was made of sandstone (Motyl, Gosztyła, 2019).

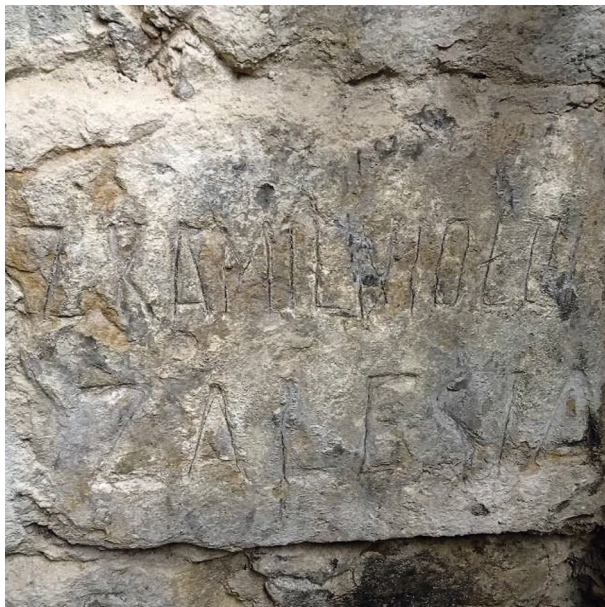


Fig. 5. A sign on the cornerstone in the basement of the station located in communication route (photo by Krystian Sikorski)

In addition to similarities in the composition of the stone, the gmerk documented on the foundation stone located in the basement in the eastern part of the station building also supports the rationale for selecting the indicated locations belonging to the Geoenvironmental Map of Poland Sheet Błażowa. The inscription “Z KAMIENIOŁOM ZALESIA” allows us to assume that the designer and builders intended to make use of local stone deposits, probably from the area of the present Zalesie settlement, which is about 5 km from the railway station as the crow flies. The indicated settlement borders directly on the village of Matysówka, where sandstone deposits have been recorded.

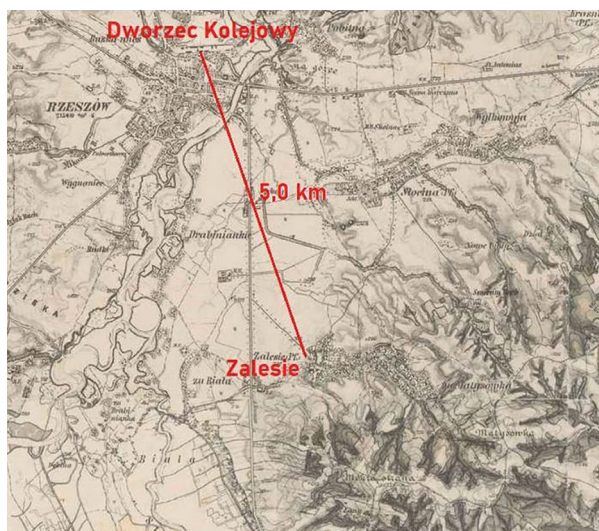


Fig. 6. Distance between the Railway Station and Zalesie (own elaboration)

7. Summary

The research and analysis carried out completes the history of the construction of the Rzeszów railway station and its role and significance in public perception. The railway station, whose form grew out of its function, historical context, environmental landscape, and advanced technologies, also received its architectural expression based on the style trends adopted in a given historical period. Despite the common functions, the architecture of the stations differed. The rebuilt complex retained many valuable architectural elements created from local material sources and made by local craftsmen's guilds. The original Rzeszów railway station had original architecture with decorative planes. The architectural forms and details consisted of plastic work made of good quality stone and ceramics. For structural elements, hewn stone was used. Sandstone cladding panels were used for the plinths. The designed railway station building stood out in the city's composition with its form, construction and artistic expression. It was designed with the concept of the station's perception in mind.

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