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Urban–Spatial Analysis of European Historical Railway Stations: Qualitative Assessment of Significant Cases

Aurora Martínez-Corral [1,*], Javier Cárcel-Carrasco [1], Fabiola Colmenero Fonseca [2] and Flora Francis Kannampallil [3]

[1] Construction Department, Institute of Materials Technology (ITM), Universitat Politècnica de València, 46022 Valencia, Spain
[2] Institute of Materials Technology (ITM), Universitat Politècnica de València, 46022 Valencia, Spain
[3] Architectural School, Universitat Politècnica de València, 46022 Valencia, Spain
* Correspondence: aumarcor@csa.upv.es

Abstract: This perspective analysis aims to show the most recent and relevant interventions in a representative sample of selected European railway stations, balancing different criteria by reviewing the most characteristic cases. We analyse its impact at the urban level, assessing whether there is urban regeneration and to what extent; its impact at a functional level, assessing the change in activity as well as the effect on the user, transfer, or dismantling of the railway activity; its impact at an architectural level, assessing whether the actions are global or merely at the level of facade. As a final reflection, we outline the issue of the possibility of reuse in historical railway stations associating it with heritage preservation. The proposed selection contemplates actions in small and large stations and locations; total, partial, and zero dismantling actions in the tracks or the station plot and, finally, new uses ranging from the mixed solution of railway activity and shopping centre to cultural or exclusively leisure solutions. The timeline covers approximately the last three decades (1985–2022).

Keywords: railway; industrial heritage; city; urban transformation

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1. Introduction

Industrial heritage is a collection of movable and immovable elements and systems built to serve activities that emerged from the industrial revolution, such as extraction, transport, transformation, distribution, and management. They consist of buildings, machinery, workshops, mills, factories, mines, sites for processing, refining, warehouses, and stores, as well as places where energy is generated, transmitted, and used, transport-related infrastructure, and where social, education, or housing activities are carried out [1,2].

Industrial heritage is critical in the evolution of our cities, spatial identities, and the definition of their environment. The industrial heritage of a region is also an aspect of its cultural heritage. Industrial assets are segregated into movable, immovable, and intangible. They are synthesized in a larger context in their landscape of insertion, the industrial co-relations of their structuring, their characteristic architecture, procedural techniques, activity files, management practices, and their symbolic character. Industrial heritage is evidence of historical human activities, in some cases being pioneering examples of unique value, providing an essential sense of identity, with intrinsic importance to the site, its fabric, components, and machinery, set in an industrial landscape and also in intangible records of the industry [1,2].

The study of the physical remains of past industrial activities and industrialized society is called Industrial Archaeology, which includes the analysis of existing structures and sites studied in an excavation. The study and conservation of these elements are equally essential to comprehend and document a vital phase in the history of humankind.

Industrial heritage is at risk of being lost for lack of awareness, documentation, recognition, or protection, as well as changing economic trends, perceptions, environmental

issues, the sheer size of the site, or its complexity. A growing focus over the past years on research, international and interdisciplinary cooperation, and community participation has led to a better understanding of industrial heritage and increased collaborations. Both the Nizhny Tagil Charter (2003) [2] and the Dublin Principles (2011) [3], together with the extension of the concept of landscape, demonstrate the progressive awareness and involvement of both the World Heritage Convention by UNESCO and relevant organizations such as ICOMOS (the International Council on Monuments and Sites) and TICCIH (the International Committee of Industrial Heritage) regarding the consideration of railway infrastructures as essential heritage [1–3].

Maintenance and conservation of industrial heritage are essential for the sustenance of this cultural heritage. The global process of industrialization over the past two decades is a part of industrial history, making this heritage critical to the modern world [1–3]. The value and integrity of the industrial site includes not removing components intrinsic to the site and preserving its functional integrity in situ with thorough knowledge of the area and its history. Besides the tangible heritage, the intangible aspect of the industrial heritage includes the human skills, memories, and social life of workers and their communities. The skills in many old and obsolete industrial processes are encouraged to be recorded, preserved, and transmitted [1–3].

Railway stations are considered part of the industrial heritage according to recommendation R(90)/20 and resolution 1924 of the Council of Europe on the conservation and protection of technical, industrial, and civil engineering heritage. The criteria proposed by ICOMOS to justify the inclusion of railways as World Heritage sites, especially criterion 2, which highlights the importance of technology, including the architecture of stations, and criterion 3, which emphasizes the uniqueness of railway stations, regardless of whether or not they continue to be used by railways. The Dublin principles (ICOMOS, 2011) include transport infrastructure as part of industrial heritage [3].

World Heritage sites on the UNESCO list [4] contain "cultural and natural heritage worldwide considered to be of outstanding value to humanity" (World Heritage UNESCO World Heritage Centre). Railways form an integral part of cultural heritage. They are valued concerning their effect on the region's socio-economic situation, environment and wildlife, urban structures, and regional property. The UNESCO World Heritage list and railway heritage conservation of a listed site go hand in hand, leading to the establishment of a heritage conservational unit, a buffer zone along the length of the railway line and station, and an adapted management plan of the railway line and the area and buildings of relevance.

The railway stations are complex spaces whose defining factors range from urban levels since they configure and condition the urban fabric, located in many cases in strategic points within cities [5]. On the other hand, at a functional level, these are currently complex spaces comprising different buildings with very different functions, distinct areas intended for passengers (railway and commercial), and sites intended for the functioning of the railway service [6]. In the proposed examples, although most of the stations have become centres with some degree of intermodality, we have included a few significant examples with exclusively railway use.

Railway infrastructures include architecturally relevant and strictly functional elements [7], occupying large urban land areas and constituting essential structural elements of urban planning. On a territorial level, the route of the lines is a crucial conditioning factor concerning the planning and location of urban concentrations and the landscape.

Architecture is representative of every style and material with a growing heritage. Initially, the focus was on the achievements of the 19th and early 20th centuries, whereas today, more post-Second World War II buildings and constructions are considered valuable.

However, despite being a representative heritage, configurator of the urban fabric, urban and territorial conditioner, and landscape generator, the presence of railway elements in the heritage protection list is very scarce. Specifically, the railway lines listed in the UNESCO World Heritage list from Europe only include two components: the Semmering

Railway in Austria and the Rhaetian Railway in the Albula/Bernina landscapes shared by Switzerland and Italy.

The case study looks into the modernisation of railway stations in Europe, analysing aspects of transformations in activity and spatial and urban identity. In many of these cases, the afterlives of railway stations reformed due to necessity due to increasing passenger flow or modern requirements, and as a way to revive the structure, often bringing about a change in activity and leading to urban regeneration. Railway stations are desirable urban infrastructures attributed of their crucial location in the urban fabric. In this case study, we have analysed various European railway stations and their modernisation over the years.

It is necessary to consider that a railway station comprises a wide and complex variety of facilities, buildings, and infrastructures. It starts from the plot where the station is located, keeping in mind its conditions, and encompassing not only the nearby urban context but also the configuration of the city and conditioning its structural network. Thus, we propose the present analysis from this perspective, intending to analyse the most significant cases of those historical stations that have been reused and renovated throughout Europe. The examples are classified into three groups: those that imply substantial changes in the urban configuration of the city after the renovation derivatives, such as the dismantling of the tracks and the transfer of land or the burying of the same; those where the renovation is limited to the plot of the railway station itself, without affecting the urban environment either due to changes in the spatial distribution of the complex or some of its buildings, mainly the so-called "passenger building"; and finally, the third group comprising of those stations where the intervention focuses on the change in activity, only applying the functional criteria when the station complex is modified.

The purpose of the paper is to analyse some recent and relevant interventions carried out in a selection of European stations with a qualitative assessment at different scales: the city's urban context, the surroundings, the station plot, and the building's architecture. The aim is to broaden the focus from the sample selection criteria so that humble stations are also represented, and to address different variables such as urban, functional, and architectural. The aim is to provide a starting point for reflection and motivation to carry out more detailed case studies and to debate the concept of obsolescence of railway stations, the change of use or multi-use of these spaces, or the different ways of understanding and tackling the heritage conservation of these complexes. As this is a perspective paper, a qualitative panoramic analysis has been carried out, seeking an overall image from different territorial scales and conditioning factors, which allows us to observe the way of dealing with the passing of time and the various forms of updating or conserving railway stations. The aim has been to ensure that all the stations included in the sample analysed are not examples with significant heritage value, first-class stations, or located in privileged places within the towns. A case has even been included to contemplate not only the urban scale but also the territorial scale, thus being able to assess the impact of railway infrastructures on the territory. The aim is to stimulate reflections about the station's activity's influence on its surroundings, the urban development around the station, and its evolution over time. The proposed perspective study focuses on the relevance of the railway as a shaper and conditioner of territory and urban fabric, as well as a catalyst of urban dynamics and modification of socio-economic profiles, along the lines of relevant analysis carried out, such as [5,8–11] among others.

2. Materials and Methods

The methodology proposed is derived from previous analyses in some of the main railway stations [12–14]. It aims to integrate concepts from other disciplines outside architecture, such as history, sociology, transport networks, or economics, trying to understand and encompass—albeit in a very elementary way—the complex and multivariate context surrounding a railway station.

We propose a starting premise to consider the heritage issue: selecting of those European stations included in the UNESCO list [4]. We have verified that no European railway

station is included (only Chhatrapati Shivaji Terminus in India). However, it contains four railway infrastructures (Semmering railway, Rhaetian Railway in the Albula, Mountain railways of India, and trans-Iranian Railway), thus expanding the heritage issue to infrastructures, landscape, and configuration of the territory. To emphasise the heritage protection of railway stations and their present state, the cases analysed include those with legal protection or unique heritage characteristics in some buildings, encompassing the station as a whole or the development of the activity. Another premise is the selection of cases with a varied population in Europe, which present different degrees of intervention to contemplate from significant transformations to those of minor magnitude and their effects on the urban environment and the city.

Based on the expanded definition of the concept of landscape established by The Council of Europe Landscape Convention (CELC), which also includes everyday and ordinary landscapes, it is considered essential to introduce a case of a railway station. The station railway landscape is not limited to the city or built landscape. It addresses the territoriality of railway infrastructures, their impact on the territory as an essential infrastructure, and the connection between urban centres. After complying with the premise, the work methodology includes the analysis of the following levels: urban level (GR1), wherein stations whose intervention led to substantial changes in the configuration of the city, have been selected. The railway plot level (GR2) consists of cases where the intervention mainly affects the station plot itself. Lastly (GR3), at the building level of the railway station, where the transformation involves one or more buildings of the station complex derived from changes in their spatial configuration, increases in volume or partial additions and functional and interior distribution changes. It is important to note that in almost all the actions that modify the urban configuration, changes are made to the railway plot and the building. Noting that, in those cases where the transformation is limited only to the station's passenger building, the urban configuration modifications are much less evident, sometimes affecting the station plot partially, with an indifferent change. We start by establishing those related key concepts (conceptual ordering) whose analysis is subsequently compared and discussed for each of the groups (GR1, GR2, GR3) established. Thus, this table (Table 1) shows the starting definition for each key concept selected for the analysis.

Table 1. Basic concepts related in the research. Own elaboration from [15].

Abbreviation	Concept	Definition
MF	Multi-functionality	Possibility of simultaneous use related or unrelated to the original use
PA	Partition-ability	Ability to split up, rearrange or combine spatial units
TFER	Transferability	Ability to change of location
C	Convertibility	Ability to allow changes in function
TFORM	Transformability	Ability to change of shape and arrangement of spaces
S	Scalability	Ability to change the size
D	Dismantlability	Be dismantled
R	Reuse	Change of use (partially or totally)

The aspect of reuse in all the cases analyzed is partial or total. It is necessary to understand reuse as adaptive repurposing in the sense of adapting the building to the new demands in considering the performance of the original or modern uses. It should be regarded a positive effect since it is a common issue in industrial buildings and traditional historical-artistic heritage [16]. We must emphasize that it is through reuse/repurposing that we can save the majority of railway stations that have fallen into disuse [17].

Once the entire groups and criteria have been established, the general literature study complements the analysis by highlighting [7,18–21], amongst others. It also includes the

study of archival sources and projects we have accessed, fieldwork (only in the Spanish case), and the analysis of other research carried out on the subject [22–24].

In short, the following figure (Figure 1) outlines the methodological sequence followed in the present study. The methodology followed structures the analysis from a panoramic and extrinsic view (urban analysis) to a detailed and intrinsic level (analysis of the building, station, or plot of the station) [25–27].

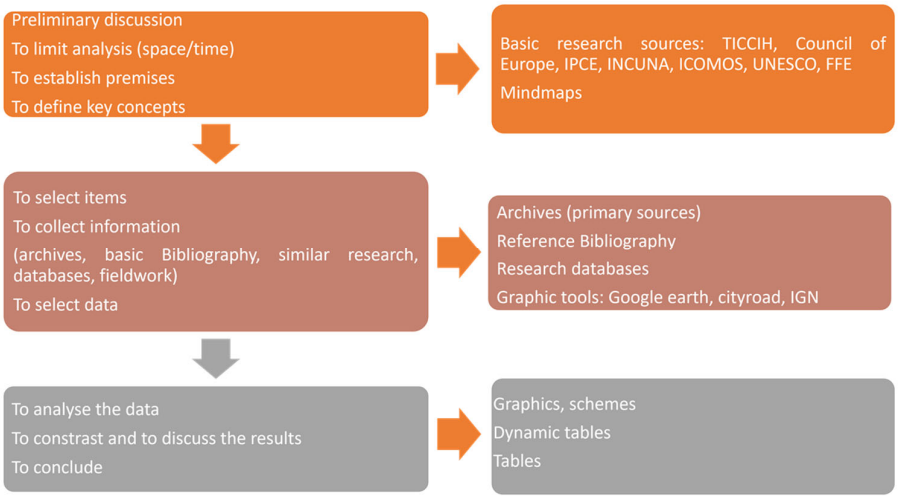


Figure 1. Sequence of research methodology. Own elaboration.

This qualitative research is based on the grounded theory in the version of Strauss and Corbin [28], where it establishes both techniques and procedures that provide validity to the analysis. It proceeds from establishing a coherent methodology and an appropriate sample for the selected objective, the concurrent collection and analysis of the available data, the theoretical thinking about them, and the subsequent elaboration of conclusions or theories of broader scope [29].

3. Case Study

After establishing the primary criteria and the methodological sequence, the points of analysis, and the starting premises, the analyzed group consists of 16 cases that contemplate the aspects raised at different scales. The selected railway stations and locations are shown below (Figure 2). The essential data of the selected stations are included in the table (Table 2).

As this is a prospective study, the cases selected for the analysis are diverse and heterogeneous to show the different forms of action taken in the renovation carried out in these European railway stations.

Before the individual analysis of the established sub-groups (GR1, GR2, and GR3), we performed a joint investigation of the analyzed data. Specifically, exploring the affected area (photo interpretation), the original and the present-day relative urban positions, observing—although briefly because it is outside the scope of this study—the growth dynamics of the respective population centres, and the current use and the degree and size of the transformation that took place. Thus, having analyzed small stations (Torrenieri-Montalcino) and large stations (e.g., Gare Montparnasse, Atocha) in towns of different sizes, we observe that both issues (size of station and population) are indifferent to the transformation and the extent of the change.

Figure 2. Location map. Own elaboration from Encyclopedia Britannica, Inc.

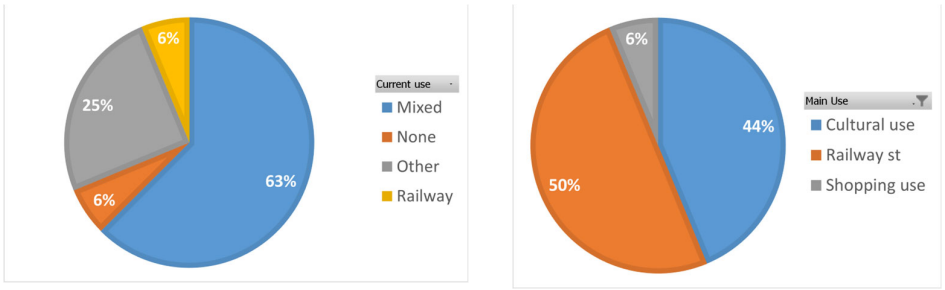
Table 2. Basic data of the elements under study. Own elaboration.

Railway Station	City	Country	Year of Construction	Year of Renovation
Atocha	Madrid	Spain	1851	1985
Canfranc	Canfranc	Spain	1928	2022
Haapsalu	Haapsalu	Estonia	1904	2014
Lagos	Lagos	Portugal	1922	1980
Hamburguer	Berlin	Germany	1847	1996
St. Pancras	London	U. Kingdom	1868	2007
King's Cross	London	U. Kingdom	1852	2013
Ostrava Svinov	Ostrava Svinov	Czech Republic	1847	2006
Orsay	Paris	France	1900	1986
Chabówka	Chabówka	Poland	1884	1993
Torino Porta Nuova	Torino	Italy	1864	2016
Torrenieri -Montalcino St. (Orcia Valley)	Torrenieri	Italy	1865	1996 *
Maretime	Brussels	Belgium	1907	2020
Uelzen	Uelzen	Germany	1847	2000
Montparnasse	Paris	France	1840	2021
Krakow Main	Krakow	Poland	1847	2014

* Museum proposal approved for the future; date not specified.

Regarding urban dynamics, except in those stations built in a central position (Gare d'Orsay) or those where urban growth has been minimal (Canfranc), urban development has favoured an improvement in the rest of the cases in the relative position of the station concerning the city centre.

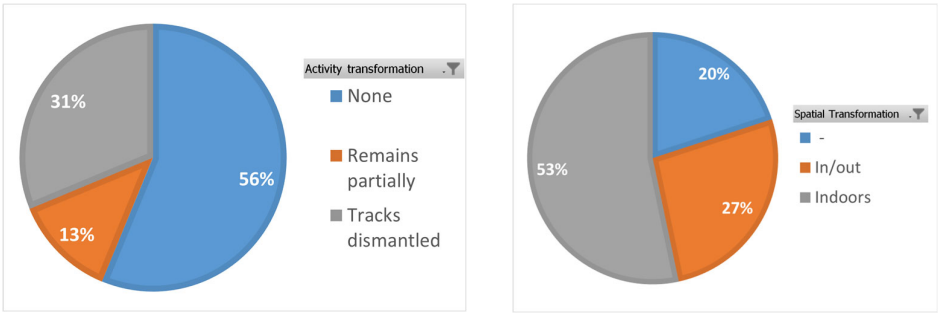
Regarding the new uses, the following graphs (Figure 3) show that in 63% of the cases, the original exclusive railway use has become mixed. In 25% of the cases, the service is non-railway related (cultural, hotel, museum). In hardly 6% of the cases, original use is conserved (this is the case of Torrenieri, given that it is a station belonging to a touristic train line).



(**a**) (**b**)

Figure 3. (**a**) Current use of the station analyzed. Own elaboration. (**b**) Main use of the station analyzed. Own elaboration.

Regarding the track's dismantling, the change of the station site, the urban environment, and the city's configuration, in 56% of the cases, the transformation has yet to involve any relevant action on the railway site. The total dismantling of the tracks has occurred in 31% of the cases analysed and partial dismantling in the remaining 13%. This analysis of the spatial transformations would result in 53% of the cases where the spatial change is limited to a part of the station, generally the passenger building; in 27% of the cases, the transformations cover the entire railway plot, and in the remaining 20% there is no transformation whatsoever (Figure 4).



(**a**) (**b**)

Figure 4. (**a**) Activity transformation in the stations analyzed. Own elaboration. (**b**) Spatial transformation in the stations analyzed. Own elaboration.

After analyzing the available documentation for each of the stations, the elements are distributed in turn in the three levels of analysis established, constituting group 1 (GR1), five stations; group 2 (GR2), five stations and group 3 (GR3), six stations (Figure 5). It is important to note that in all cases where changes in use (partial or total) occur, the actions occur to a greater or lesser extent at the three levels exposed. Thus, although the selected stations have been included in the group where the transformation has been most relevant, the intervention covers the other two levels considered or all of them, in most cases. Further, at the territorial level, those cases of relocation and dismantling produce significant changes in the structural configuration, whose scope is outside the present study (Figure 6).

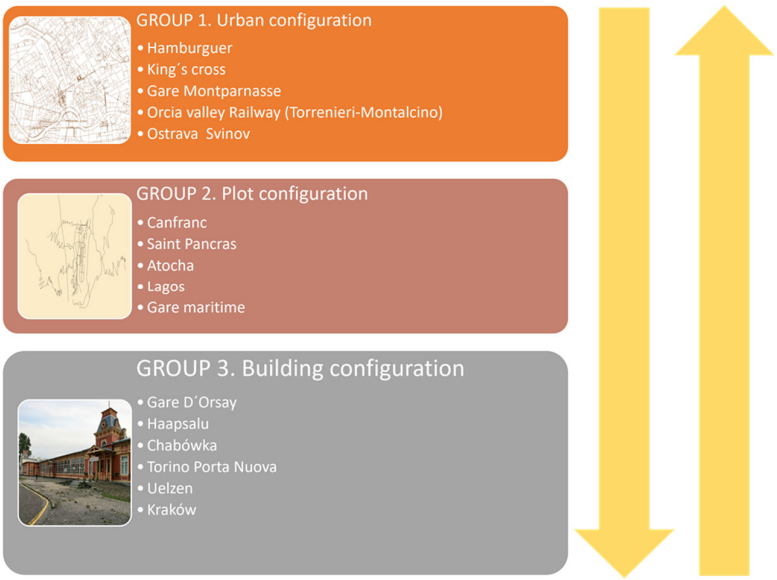


Figure 5. Classification by groups of analysis. Own elaboration.

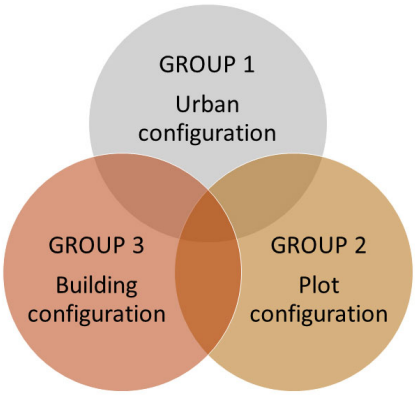


Figure 6. Scheme of interrelationship between the study groups (GR1, GR2, GR3). Own elaboration.

After analysing shared aspects of the selected group, the following subsections have been established with their detailed analysis (GR1, GR2, and GR3). The subdivision is carried out to cover the complexity of railway stations and their modernisation since they are, in many cases, essential transport nodes. However, they are also urban places and heritage elements inserted in towns with very different dynamics. Therefore, in addition to the common problem of combining the duality of being essential infrastructures and urban spaces, local peculiarities are important to consider.

3.1. Group 1: Urban Configuration

The railway stations discussed in GR1 (Table 3) represent how railway stations and routes are urban catalysts and define the urban fabric, focusing on aspects of its strategic location within the city and urban regeneration. Different studies show that the railway and the stations have conditioned the urban fabric and its growth [5,9,30]. Their subsequent dismantling requires alternatives to urban accessibility and brings about changes both in terms of urban space and in terms of economic and social profile.

Table 3. Urban configuration analysis. Degree of transformation. Own elaboration.

Station/Concept	MF	PA	TFER	C	TFORM	S	D	R
Hamburg								
King's cross								
Montparnasse								
Orcia valley								
Ostrava Svinov								

Legend	High	Medium	Low	None

In all the cases analysed—except for the Orcia Valley line, because the conversion to a tourist line entails maintaining the original appearance of the stations as far as possible—the intervention involves modifications to the buildings and spaces. These modifications are assessed as Multifunctional (MF), Partition ability (PA), and Reuse (R) variables, mainly maintaining some signs of identity such as the original volumetry or the main façades of the passenger buildings in many cases. Hamburger Bahnhof (Frederick Neuhaus and Ferdinand Wilhelm Holz) was designed as a Prussian transport hub linking Berlin to Hamburg. After the railway's nationalisation and disuse in 1884, the tracks were dismantled to become gardens for the railway personnel. Over the next two decades, it was used for residential and administrative purposes before it became the contemporary art museum in 1996 (Josef Paul Kleihues, arch.). As the analysis shows, the intervention completely transforms the original use and spatiality where the masonry buildings of the station complex are demolished, creating new open-plan galleries but maintaining specific references to them through the layout of the new lattice structure. At the urban level, the intervention has not entailed any restructuring of urban transport but has changed the user profile and urban space. Italy developed touristic trains to preserve and reuse historic trains and their heritage. In the case of Orcia valley, we look at an exceptional case where the railway lines have been changed from their original purpose to tourism which outlines and links the landscape and the urban context. Orcia valley is part of the Italian touristic lines, and the Torrinieri-Montalcino railway station, analysed, has one of the tremendous architectonic values in the railway line. Together with the touristic demands, a future museum has been approved, leading to the local restructuration [31]. This case has been selected as representative of the railway's territorial impact. Further, it represents a change of use following the original landscape and where the preservation of the station's traditional image is essential to the new service. The King's Cross Station (Arup partners) is one of London's most successful redevelopment projects with a broader urban context—infrastructural, commercial, and social changes influenced by the St. Pancras station. The modernisation of King's Cross transformed it into an important transportation hub. This action represents the most relevant urban action of those selected, achieving the revitalisation of the area on a social, economic, and environmental level, integrating Saint Pancras station and respecting a specific heritage component of the representative Victorian stations. Despite the complexity of these actions, the responses have been provided to all the variables involved, which involve bringing together administrative, transport policy, social, economic, financial, heritage, sustainability, and other factors [8,32].

Gare Montparnasse (Figure 7) follows the early timeline of most railways by extending and adapting to meet growing passenger flow. Being located in a complex urban space with fewer possibilities to grow in size, the station later relocated to a new site south of the original location. Gare Montparnasse, along with its surroundings, forms an integral part of the urban fabric of Montparnasse [33]. Modernisation brought about effective changes in restructuring and expanding existing spaces to cater to mixed functionality [34,35].

Figure 7. Gare Montparnasse. Aerial view (Henrard, Roger). PH344-15551. Paris Musées. Creative Commons Zero.

Built in 1847, Svinov became a critical junction in the Austrian Northern Railway. After its modernisation in 2006, the Ostrava-Svinov railway station has become an important transportation hub. This case has been chosen as an example of the relative nature of the concept of obsolescence and the often-unnecessary construction of new terminals in less privileged urban positions for users without being justified by the increase in frequencies or the incorporation of high speed.

3.2. Group 2: Plot Configuration

The group 2 analysis is summarized in the following table (Table 4). It consists of the transformations carried out within the original station site, which, as described below, entail substantial changes both in the immediate surroundings and in the city as a whole.

Table 4. Plot configuration analysis. Degree of transformation. Own elaboration.

Station/Concept	MF	PA	TFER	C	TFORM	S	D	R
Canfranc [1]								
St. Pancras								
Atocha								
Lagos								
Gare Maritime								

Legend	High	Medium	Low	None

[1] The Spanish stations of Atocha and Canfranc are considered Sites of Cultural Interest (BIC), which is the most important legal figure of heritage protection in Spain. Therefore, in both cases, the actions to be carried out with respect to the concepts considered are very limited.

In group 2, the changes in the railway plot in Atocha and Canfranc stations are very relevant. Atocha is one of the most significant cases where the historic station has endured the arrival of the High-Speed Rail (1992) and its extension to integrate it with the redistribution of suburban and long-distance trains. By allowing its separation by levels and zones and becoming one of Europe's most important railway complexes [36], it has thus shown a high degree of functionality and convertibility to new uses (botanical garden and shopping/leisure centre) without undermining either the historic building or the memory associated with the railway. The form, scale, and the most identifying elements of the envelope (large roof, façades) have been respected. However, at the level of the urban plot, the "Atocha operation" is a relevant example of successfully integrating a historic station, despite the need to reconvert it in order to continue fulfilling its railway function

by adapting to the intermodality, current traffic needs, and urban planning requirements (eliminating the Atocha "Scalextric" and reconditioning the Carlos V emperor roundabout).

The case of Canfranc is limited to the area previously occupied by the station, unlike the one described above, where the land transformation affects the town configuration. The recent conversion of the passenger building of the international station into a hotel (opening in 2023) provides public space to the municipality of Canfranc-Estación, converting it into a "railway park-museum" and an access area to both the hotel and the new building of the national station, which is in operation (Figure 8).

(**a**) (**b**) (**c**)

Figure 8. (**a**) View from Canfranc-St. plot (2022). Own Archive. (**b**) View of Canfranc-St. main façade (2022). Own archive. (**c**). View of the historical Canfranc-St. (2022). Own archive.

The case of Lagos represents the most common case when the new building constructed entirely takes over the functions of the old building. In this case, the addition to the building infrastructure did not foresee a further use for the historic building abandoned [25] and is likely to be demolished. A similar case in Spain is the Almeria station [13], although the historic building—being legally protected—cannot be demolished.

Finally, the case of Gare Maritime (Brussels), transformed in 2020 into a multifunctional space with the addition of energy sustainability as one of the critical elements of the restoration [37], is the case where there is the most significant degree of compatibility about the concepts defined. It takes a restorative approach and understanding the space as a single large element, maintaining exclusively the exterior volume whilst being consecutively subjected to a substantial change in the railway plot. It involves the dismantling of the tracks and the associated functional installations and the expansion of the urban space that the intervention provokes. Regeneration of the nearby surroundings with the construction of new houses and a pedestrian area is a positive consequence. Regarding the group results, the high possibility of reuse and convertibility in all cases stands out, regardless of the rest of the parameters analyzed, mainly due to the large availability of land from a single owner, which is one of the main differentiating characteristics of railway stations. Concerning the change of location, the case of Lagos stands out. The historic station remains unused, building a new station nearby, entailing a progressive deterioration of the station and the urban environment, thereby justifying and increasing the possibility of its demolition as time passes if there is no legal heritage protection for the building or the complex put into place. Except for the case of Lagos, the other stations selected, with the interventions carried out, have led to an increase in the space for public use and an improvement in the surrounding urban environment. Atocha confirms especially this aspect.

3.3. Group 3: Building Configuration

The group 3 analysis is summarized in the following table (Table 5). The following table aims to summarise the interventions carried out mainly in the passenger building of the stations.

This is the group with the most cases and is generally confined to the passenger building as it is the part of the station complex with the urban façade and where the artistic manifestations are concentrated. In addition to being the representative and public building of the station, on many occasions, it was the symbolic representation of the railway company. In the case of the heritage protection of Spanish railway stations, linking of the station plot and the preservation of the railway activity have been ignored, focusing the

action on safeguarding the exterior volume of the passenger building and/or the main façade [38]. In the case in question, we note that, regardless of heritage preservation, the choice is to preserve the passenger building or its most representative façades. The case of Saint Pancras, a station representative of the Victorian style [39], is representative of an action where the safeguarding of the historic building was one of the cornerstones of the project, which the railway line extension to accommodate the Eurotunnel lines had to respect. Along with the revitalization of the urban area in the St. Pancras and King Cross station and their uses, it is the case where the impacts are made on the three levels analyzed (urban-city, urban-station plot, and isolated buildings). Furthermore, this case shows actions on most of the established parameters with a high degree of transformation.

Table 5. Building configuration analysis. Degree of transformation. Own elaboration.

Station/Concept	MF	PA	TFER	C	TFORM	S	D	R
Orsay								
Haapsalu								
Chabówka								
Torino P. Nuova								
Uelzen								
Krákow								

Legend	High	Medium	Low	None

The case of Gare Orsay [40] (Figure 9) is one of the pioneering and early cases when railway stations transformed into museums where mixed-use was not implemented, which later became the most applied solution in recent interventions, especially in those where railway activity continues to operate [41]. The transformation involved the total reconfiguration of the interior space while maintaining the envelope, once again highlighting the large roofs' high capacity by dismantling the tracks and leaving large open spaces without intermediate supports. Their spatial interior configuration is one of the main reasons for the multifunctionality in reuse associated with railway stations [24].

Figure 9. Orsay station. Source: Izhar Laufer. Flickr. Licence C.C. by Nc-ND 2.0.

Torino Puorta nuova (Alessandro Mazzucchetti) represents the case of adaptation to strict functionality while maintaining the monumental appearance of the station. The preservation of its privileged position in the city has been a critical factor in its transformation into its main transport hub. Several extensions, including the one in 2016 with an extension of 15,000 m2 for leisure services, restaurants, and shopping, have understood that

the maintenance of the volume and historic facades, as well as the location, were essential to succeed.

On a different scale, the case of Haapsalu is interesting because it represents an excellently preserved example of 20th-century wooden architecture. Haapsalu railway station is now listed as a historical building, and the tracks have been replaced with bicycle paths. The ornate wooden building and grounds of the Haapsalu Terminal have been modernized into a Railroad and Communications Museum. We have also selected this case because the transformation of old railway lines into cycle paths is another of the solutions currently used when closing or dismantling stations and lines.

Finally, the Uelzen train station from 1847 was renovated by the Austrian artist and architect Freidensreich Hundertwasser for the Expo 2000. Today the station known as Hundertwasser-Bahnhof Uelzen has a unique combination of art, ecology, and modernity. It is a popular tourist attraction, again demonstrating the remarkable adaptability of railway stations. The case of Krákow is chosen to demonstrate the coexistence between the historic building or station complex and the updates in use. However, in all cases analysed, the most repeated action when rehabilitating railway stations is the maintenance of the main façade while contemplating changes in the functions and interior partitions with a greater or lesser degree of transformability.

4. Discussion and Conclusions

This study aims to show the complexity and breadth of the evolution and adaptation of historic stations concerning the urban environment. Although fundamental aspects are outlined, as detailed below, an interdisciplinary view is necessary that encompasses the historical, economic, and social sciences. The station's scope is produced—with greater or lesser incidence—on a territorial scale, but also dynamically over time and territory; therefore, population, economy, and degree of development, among others, are fundamental factors to consider. Another essential starting point we have tried to clarify through the analysis is to understand the stations as a complex whole, changing over time, with a tremendous physical impact on the city and the territory. Railway stations cannot admit the simplification that the passenger building is representative of the whole. The three main concepts dealt with in the study are the following: the total or partial dismantling of the stations and their effects on the urban environment, their obsolescence, and the co-existent or change in use.

About the dismantling of the station: it is essential to emphasise that the station has a profound impact on the urban configuration with great land occupation, and the layout of the lines has a direct and material effect on the morphology of the cities. Therefore, total or partial dismantling leaves significant traces in the urban fabric allowing us to observe the changes in the morphology of cities and the urban dynamics [5,42,43].

Obsolescence, a controversial concept with a lot of value judgement, [44] is essential to study in-depth. As the cases analysed show, it is possible to maintain the station in its original location. More than 60% of the cases hold railway use, although most cases include mixed commercial and leisure use. It is detected that the maintenance of the central urban position is essential for maintaining the railway use and incorporating the mixed-use described above.

The analysis shows that the coexistence of the historic building, the central location, the adaptation to the new technological requirements, and the growth in passenger flow are viable. However, it is linked to either a thorough regeneration of the station's surroundings (King Cross) or adequate maintenance of the station and its fencing, as these areas tend to become degraded environments, often justifying the relocation of stations. Speculative factors are also sometimes behind these relocations, the Spanish case being representative [23].

Finally, the new use where this must be planned and programmed. Transformations in the Gare Maritime (Brussels) or the international station of Canfranc represent the latter aspect, where regardless of the heritage consideration about the preservation of memory or

the intangible values associated with railway activity, the actions have allowed the station to enhance and survive, including the criteria of sustainability in the rehabilitation of the buildings. The opposite is the case of Lagos station, where the need for more planning for reusing the old station has led to its progressive deterioration. The revitalization of railway stations is a complex problem. In addition to the variables considered (territorial, urban, and architectural), contextual variables such as financing, regulations, transport policies, and future use planning—among others—are often decisive. On many occasions, economic factors are often predominant over the rest, deciding whether or not to carry out the operation. On the other hand, actions that affect the improvement of the surrounding public space are influenced by economic factors [32]. The case study shows different degrees of completion concerning the aspects considered, from Saint Pancras and King's Cross operations, where a more significant number of completed variables have been observed, to processes such as Haapsalu or Lagos, where the number of variables to be answered is considerably simplified. The temporal aspect must also be considered, given the unpredictable and changing social, political, and global conditions in this type of operation that takes several years to complete. The implementation of actual and past transformations in the facade and utility design with intelligent control techniques to improve efficiency (Sant Pancras, King's Cross, Gare Maritime, among others) have been observed. According to similar studies, these actions can lead to energy savings of around 20% on average [45]. We must recognize that, in addition to energy efficiency improvement considerations, these are historic buildings, and both variables must be considered [46]. On the other hand, the action carried out in Saint Pancras—King's Cross proposes intervention not only in the station building but also in the surrounding public space, the revitalization of which is one of the keys to the project, bringing added value to the whole. The management of this type of action (public–private consortiums in many cases) must contemplate the improvement of urban environments, understanding that this also promotes social, economic, and environmental development. The analysis shows that in more than 60% of the cases, the operation viability depends on incorporating new uses along with rail use—generally commercial or leisure uses that take advantage of the flow of people derived from the use of the infrastructure. Therefore, it is essential to establish optimal and effective transport policies, given that the survival of the complex depends on them, bearing in mind that multifunctionality is critical for survival, especially for the stations with the largest surface area and urban impact.

The evolution in the regeneration of stations involves materializing that they are no longer limited to communication nodes. The coexistence of different activities and the urban treatment of the complex and its surroundings are essential for their survival; some relevant contributions in [16,47–51].

Other relevant aspects implicitly dealing with and closely linked to the previous ones are, on the one hand, the consideration of heritage, both of the historic buildings or their façades, and of the station as a whole and the creation of the landscape. In this regard, some relevant references are [7,52].

As future lines of research, we consider it necessary to go deeper into the interaction between station–city and territory through exhaustive case studies. It is required to evaluate the evolution over time, with special attention to those historical stations that have been relocated. The reasons for these location changes have yet to be sufficiently analysed. Finally, the present analysis shows the continued relevance of the study and research of railways due to their high impact on various interconnected disciplines.

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References

1. Ticcih. Available online: https://ticcih.org/about/about-ticcih/ (accessed on 15 October 2022).
2. Nizhny Tagil Charter. Available online: https://ticcih.org/wpcontent/uploads/2013/04/NTagilCharter.pdf (accessed on 20 October 2022).
3. The Dublin Principles. Available online: https://ticcih.org/wp-content/uploads/2013/10/GA2011_ICOMOS_TICCIH_joint_principles_EN_FR_final_20120110.pdf (accessed on 18 October 2022).
4. UNESCO Heritage List. Available online: https://whc.unesco.org/en/list/ (accessed on 18 October 2022).
5. Santos y Ganges, L. *Urbanismo y Ferrocarril. La Construcción Del Espacio Ferroviario en Las Ciudades Medias Españolas*; Fundación de Los Ferrocarriles Españoles: Madrid, Spain, 2008. Available online: https://1drv.ms/b/s!Alw91UAhEipthq5Ju3VENIcTvHklpg (accessed on 15 October 2022).
6. Kandee, S. *Intermodal Concept in Railway Station Design*; Transportation Facilities and the Design Railway Station: Bangkok, Thailand, 2004; p. 9.
7. Meeks, C.L.V. The Railroad Station. In *An Architectural History (1ª edición, 1956)*; Dover Publications, Inc.: Mineola, NY, USA, 1995.
8. Bertolini, L.; Spit, T. *Cities on Rails: The Redevelopment of Railway Stations and Their Surroundings*; Taylor & Francis Group: Abingdon, UK, 1998. Available online: http://ebookcentral.proquest.com/lib/bibliotecaupves-ebooks/detail.action?docID=237370 (accessed on 5 October 2022).
9. Roth, R.; Polino, M.-N. *The City and the Railway in Europe*; Ashgate Pub Limited: Farnham, UK, 2003.
10. Bruinsma, F.; Pels, E.; Rietveld, P.; Priemus, H.; van Wee, B. The Impact of Railway Development on Urban Dynamics. In *Railway Development: Impacts on Urban Dynamics*; Bruinsma, E.F., Pels, E., Rietveld, P., Priemus, H., van Wee, B., Eds.; Physica-Verlag HD: Heidelberg, Germany, 2008; pp. 1–11. [CrossRef]
11. Capel, H. *Los «Ferro-Carriles» en la Ciudad Redes Técnicas y Configuración Del Espacio Urbano*; Fundación de los Ferrocarriles Españoles: Madrid, Spain, 2011.
12. Garda, E.; Gerbino, A.; Mangosio, M. Italian railway stations heritage. *Int. J. Herit. Archit. Stud. Repairs Maintence* **2017**, *2*, 324–334. [CrossRef]
13. Cuéllar, D.; Martinez-Corral, A. History, architecture, and heritage in the railway station of Almería (1892–2017). *Labor E Eng.* **2018**, *12*, 306–330. [CrossRef]
14. De Matos, A.C.; Sobrinho Simal, J.; Lourencetti, F.D.L. The Lisbon and Seville stations: Their place within railway station typology and their impact on the organization of urban space. *EdA Esempi Archit. Int. J.* **2020**, *1*, 19.
15. Bazazzadeh, H.; Nadolny, A.; Mehan, A.; Hashemi Safaei, S. The Importance of Flexibility in Adaptive Reuse of Industrial Heritage: Learning from Iranian Cases. *Int. J. Conserv. Sci.* **2021**, *12*, 113–128.
16. Capel, H. La rehabilitación y el uso del patrimonio industrial. *Doc. D'Anàlisi Geogràfica* **1996**, *29*, 19–50.
17. Podwojewska, M. Opportunity to Save Historical Railway Infrastructure—Adaptation and Functional Conversion of Facilities. *IOP Conf. Ser. Mater. Sci. Eng.* **2017**, *245*, 82031. [CrossRef]
18. Barman, C. *An Introduction to Railway Architecture*; Art and Technics: London, UK, 1950.
19. Burman, P.; Stratton, M. *Conserving the Railway Heritage*; Taylor and Francis Group: Abingdon, UK, 1997.
20. Aguilar Civera, I. *La Estación de Ferrocarril, Puerta de la Ciudad*; Universitat de València: Valencia, Spain, 1988; Volume 1–2.
21. Aguilar Civera, I. *El Patrimonio Arquitectónico Industrial*; Instituto Juan de Herrera: Madrid, Spain, 2007.
22. López García, M. *MZA: Historia de Sus Estaciones*; Turner: Madrid, Spain, 1986.
23. Martínez-Corral, A. Estaciones de ferrocarril de la Compañía del Norte en España. Intervención y reuso. *Apunt. Rev. De Estud. Sobre Patrim. Cult.* **2013**, *26*, 24–37. [CrossRef]

24. Silva, A.S.P.D. Reabilitação e Reconversão de Um Espaço Ferroviário: A Antiga Estação Ferroviária de Lagos. Master's Thesis, Universidade Lusófona, Lisboa, Portugal, 2015. Available online: https://recil.ensinolusofona.pt/handle/10437/9204 (accessed on 11 October 2022).
25. Meira da Silva, M.; Oliveira, E. Metodologías de paisagem apliacdas ao patrimônio industrial ferroviario: A utilização do sistema de infromaçâogeográfica no complexo fepasa (Jundiaí, Brasil). *Oculum Ens.* **2021**, *18*, 1–20. [CrossRef]
26. Alba Dorado, M.I. Concepção de Uma Metodologia Para A Identificação, Caracterização, Valoração e Intervenção Na Paisagem Do Patrimônio Industrial. In *Memória Ferroviária e Cultura Do Trabalho: Balanços Teóricos e Metodologias de Registro de Bens Ferroviários Numa Perspectiva Multidisciplinar*, 1st ed.; de Oliveira, E.R., Ed.; Cultura Acadêmica: London, UK, 2019; pp. 307–332. Available online: https://memoriaferroviaria.assis.unesp.br/wp-content/documentos/livro_v1.pdf (accessed on 15 October 2022).
27. Silva, M.M.D. Categoría de Paisaje y Metodologías Espaciales Aplicadas al Patrimonio Industrial. 2019. Available online: https://drive.google.com/drive/u/7/folders/1XqpFVGOvJemKHYdeVZSZx2IGQRqNK4xL (accessed on 22 October 2022).
28. Strauss, A.; Corbin, J. Bases de la Investigación Cualitativa. Técnicas y Procedimientos Para Desarrollar la Teoría Fundamentada (Colección Contus). Editorial Universidad de Antioquía. 2002. Available online: https://diversidadlocal.files.wordpress.com/2012/09/bases-investigacion-cualitativa.pdf (accessed on 5 October 2022).
29. Morse, J.M.; Barrett, M.; Mayan, M.; Olson, K.; Spiers, J. Verification Strategies for Establishing Reliability and Validity in Qualitative Research. *Int. J. Qual. Methods* **2002**, *1*, 13–22. [CrossRef]
30. Palau, E.J.A.; Asensi, M.H.; Aymerich, A.T. Modelo morfológico de crecimiento urbano inducido por la infraestructura ferroviaria. Estudio de caso en 25 ciudades catalanas. *Scripta Nova. Rev. Electrónica Geogr. Cienc. Soc.* **2016**, *20*. [CrossRef]
31. Maggi, S. Railway Heritage in Italy. A Case of Study: The "Orcia Valley Railway". *IV Congr. Hist. Ferrov. Málaga Septiembre* **2006**, *2006*, 38. Available online: https://dialnet.unirioja.es/servlet/articulo?codigo=2235665 (accessed on 2 October 2022).
32. Jóźwik, A. Modernization of Saint Pancras and King's Cross Railway Stations In London. *Civ. Environ. Eng.* **2015**, *18*, 65–74. [CrossRef]
33. La gare Montparnasse, un laboratoire d'idées. *Archit. Intérieure Créé* **1994**, *262*, 50–57.
34. Riot, E. A European perspective on the planning of major railway stations: Considering the cases of St Pancras Station and Paris Gare du Nord. *Town Plan. Rev.* **2014**, *85*, 191–202. [CrossRef]
35. Loriers, M.-C. Une ligne océane: La nouvelle Gare Montparnasse et le TGV. *Tech. Et Archit.* **1989**, 108–109.
36. Aróstegui Chapa, B. Auge y abandono de las grandes estaciones europeas y su transformación con la llegada de la alta velocidad. *P + C Proy. Ciudad. Rev. Temas Arquit.* **2017**, *8*, 63–78.
37. Bockelandt, T.; Jamali, N. Towards Climate Neutral Buildings—Case Study of Positive Building in Brussels: Gare Maritime project. *IOP Conf. Ser. Earth Environ. Sci.* **2022**, *1078*, 012127. [CrossRef]
38. Martínez-Corral, A.; Cárcel-Carrasco, J.; Carnero, M.C.; Aparicio-Fernández, C. Analysis for the Heritage Consideration of Historic Spanish Railway Stations (1848–1929). *Buildings* **2022**, *12*, 206. [CrossRef]
39. Yorke, T. Victorian Railway Stations. Countryside Books. 2015. Available online: http://ebookcentral.proquest.com/lib/bibliotecaupves-ebooks/detail.action?docID=5496378 (accessed on 2 October 2022).
40. Joshi, S. Mus' ee d'Orsay. *Archit. Plus Des.* **1999**, *16*, 85.
41. Cardoso de Matos, A.; Lourencetti, F.D.L. Reusing railway infraestructures in the spirit of circular theory. A contribution to an operational concept. *VITRUVIO Int. J. Archit. Technol. Sustain.* **2021**, *6*, 12–23.
42. Alves, V.A. A geografia histórica como campo de pesquisas: Definições, tenções e metodologias. *Cidades* **2011**, *8*, 623–643. [CrossRef]
43. Alcaide, R. El ferrocarril como elemento estructurador de la morfología urbana: El caso de Barcelona, 1848–1900. *Scr. Nova Rev. Electron. Geogr. Cienc. Soc.* **2005**, *194*, 1–25. Available online: https://revistes.ub.edu/index.php/ScriptaNova/article/view/980#:~{}:text=La%20llegada%20del%20ferrocarril%20a%20la%20ciudad%20de,desarrollo%20del%20ensanche%20barcelon%C3%A9s%20dise%C3%B1ado%20por%20Ildefonso%20Cerd%C3%A1 (accessed on 17 December 2022).
44. Calduch, J. El declive de la arquitectura moderna: Deterioro, obsolescencia, ruina. *PALAPA Rev. De Investig. Científica En Arquit.* **2009**, *4*, 29–43.
45. Asian Development Bank. *Improving Energy Efficiency and Reducing Emissions Through Intelligent Railway Station Buildings*; Asian Development Bank Institute: Tokyo, Japan, 2015. Available online: http://ebookcentral.proquest.com/lib/bibliotecaupves-ebooks/detail.action?docID=4453832 (accessed on 10 November 2022).
46. Vieites, E.; Vassileva, I.; Arias, J.E. European Initiatives Towards Improving the Energy Efficiency in Existing and Historic Buildings. *Energy Procedia* **2015**, *75*, 1679–1685. [CrossRef]
47. Ballart, J. *El Patrimonio Histórico y Arqueológico: Valor y Uso (1a)*; Ariel: Barcelona, Spain, 1997.
48. Ali, N.; Qi, Z. Historical Study and Strategies for Revitalisation of Burt Institute (A Railway Heritage Building). *Hist. Environ. Policy Pract.* **2020**, *11*, 40–55. [CrossRef]
49. Orlenko, M.; Ivashko, Y.; Niebrzydowski, W.; Trammer, H.; Krupa, M.; Paprzyca, K. Restoration and preservation procedure of architectural monuments. Railway stations with monumental art of the socialist period (on the examples of Ukraine and Poland). *Int. J. Conserv. Sci.* **2021**, *112*, 1344–1376.
50. Pinheiro, M. Ferrocarriles, Ciudades y Estaciones en Portugal, de finales del siglo XIX al siglo XXI. *TST: Transp. Serv. Y Telecomun.* **2019**, *38*, 42–62.

51. Mojica, L.; Martí-Henneberg, J. Railways and population distribution: France, Spain and Portugal, 1870–2000. *J. Interdiscip. Hist.* **2011**, *42*, 15–28. [CrossRef]
52. Simmons, J. *The Railway in Town and Country 1830–1914*; David&Charles: Newton Abbot, UK, 1986.