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188-201 ÉVA LOVRA  
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ŠČITAROCI

TRANSFORMATIONS  
OF URBAN STRUCTURE  
EFFECTS OF RAILWAY CONSTRUCTION  
ON THE URBAN TISSUE IN THE CITIES  
OF AUSTRO-HUNGARIAN EMPIRE  
(1867-1918)

PRELIMINARY COMMUNICATION  
UDC 711.7(436/439)"1867/1918"

PREOBRAZBE  
URBANE STRUKTURE  
ULOGA ŽELJEZNICE U OBLIKOVANJU  
URBANOGA TKIVA U GRADOVIMA  
AUSTRO-UGARSKE MONARHIJE  
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TABLE I THE RELATIONSHIP BETWEEN THE BUILT AREA OF THE CITY AND RAILWAY LINES IN THE 1<sup>ST</sup> DEVELOPMENT PERIOD: PRE-1867 (1838-1867), 2<sup>ND</sup> DEVELOPMENT PERIOD: MID AUSTRIA-HUNGARY AROUND 1900 AND 3<sup>RD</sup> DEVELOPMENT PERIOD: LATE AUSTRIA-HUNGARY PERIOD TILL 1918.

TABL. I. ODNOS IZMEĐU IZGRADENE POVRŠINE GRADA I ŽELJEZNIČKIH LINIJA U PRVOM RAZDOBLJU RAZVITKA: PRIJE 1867. (1838.-1867.); DRUGO RAZDOBLJE RAZVITKA: SREDINA AUSTRO-UĞARSKOG PERIODA OKO 1900.; TREĆE RAZDOBLJE RAZVITKA: KASNO RAZDOBLJE AUSTRO-UĞARSKE DO 1918.

	1 <sup>ST</sup> DEVELOPMENT PERIOD	2 <sup>ND</sup> DEVELOPMENT PERIOD	3 <sup>RD</sup> DEVELOPMENT PERIOD
VIENNA			
PRAGUE			
BUDAPEST			
ZAGREB			
LEGEND	<p>Layers:</p> <ul style="list-style-type: none"> <li> urban structure before 1867</li> <li> railways</li> <li> greenery</li> <li> river</li> </ul>	<p>Layers:</p> <ul style="list-style-type: none"> <li> urban structure before 1867</li> <li> urban development till 1900</li> <li> railways</li> <li> greenery</li> <li> river</li> </ul>	<p>Layers:</p> <ul style="list-style-type: none"> <li> urban structure before 1867</li> <li> urban development till 1900</li> <li> urban development till about 1918</li> <li> railways</li> <li> greenery</li> <li> river</li> </ul>

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## TRANSFORMATIONS OF URBAN STRUCTURE EFFECTS OF RAILWAY CONSTRUCTION ON THE URBAN TISSUE IN THE CITIES OF AUSTRO-HUNGARIAN EMPIRE (1867-1918)

## PREOBRAZBE URBANE STRUKTURE ULOGA ŽELJEZNICE U OBLIKOVANJU URBANOGA TKIVA U GRADOVIMA AUSTRO-UGARSKE MONARHIJE (1867.-1918.)

RAILWAY  
URBAN STRUCTURE  
URBAN TRANSFORMATIONS  
URBAN TYPOLOGY

ŽELJEZNICA  
URBANA STRUKTURA  
URBANE PREOBRAZBE  
URBANA TIPOLOGIJA

This paper explores the role of the railway and railway stations in the development and structural changes of the towns in the former Austro-Hungarian Monarchy with the aim to create an adequate framework of urban typology. This part of urban typology can serve as a method for identifying different types of Austro-Hungarian towns and is defined by the relationship between the identified urban fabric and the railway.

Rad se bavi istraživanjem uloge željeznice i željezničkih stanica u razvoju i strukturalnim promjenama gradova bivše Austro-Ugarske Monarhije sa ciljem oblikovanja prikladnog okvira urbane tipologije. Taj dio urbane tipologije može poslužiti kao metoda za određivanje različitosti austro-ugarskih gradova, a definirana je međuodnosom identificiranoga urbanog tkiva i željeznice.

## INTRODUCTION

### UVOD

Urban structure of the 19<sup>th</sup> century cities was significantly transformed and developed with the establishment of the railway system in all scales in terms of the built environment.<sup>1</sup> In his work *The Architecture of the City* Aldo Rossi elucidates urban artefacts as primary elements since their presence has cooperated in the morphological and cultural evolution of the urban environment. According to Rossi, any element capable of accelerating the process of urbanization is a primary element<sup>2</sup>: railway stations in the 19<sup>th</sup> century could act as primary elements since they accelerated the process of urban tissue transformation. Along with railway lines, they were able to structure the city. On the urban tissue level, railway stations were major evidences of railways and industrialization, which often acted as symbols of modernization. Their position and the relations between the surrounding urban tissue types and the railway and railway stations, as well as their influence on the urban structure are considerable in urban typology of Austro-Hungarian cities. The study focuses on four Central-European cities with a mutual historical background as former Austro-Hungarian cities and on the urban tissue transformation caused by the railway in this period. The constitutional merger of two states, the Austrian Empire and the Kingdom of Hungary, followed by the Compromise (1867), created a unique state structure and development policy. Urban development of the dualist state

took on a new direction, partly because of the state-regulated city development (in case of the capitals, Vienna and Budapest), and partly because of the emerging economic development in the Transleithanian territories<sup>3</sup> since economic alignment by that time had a strong impact on the urbanization processes.

The four cities – Vienna, Prague, Budapest and Zagreb – have been chosen to represent the Trans- and Cisleithanian territory of the unified, yet diverse area of the Dual Monarchy, since their role in the dual monarchy was socially and politically significant. Vienna, as the capital of the Austrian Empire, and Budapest (unified in 1872/73), as the capital of the Hungarian Kingdom, played the main role in the progressive, state-regulated urban development, but the leading, yet provincial cities of the Bohemian Crown Lands (Prague<sup>4</sup>) and the Kingdom of Croatia-Slavonia (Zagreb<sup>5</sup>) also witnessed intensive development. The research focuses on the cities beyond the Leitha River, and in a wider context compared to the towns of the former Austrian Empire, to show the urban manifestation of the combined power of Austria-Hungary. The progressive urban development of the second part of the 19<sup>th</sup> century was the manifestation and the consequence of the industrialization and the new socio-economic and political status. Although Vienna was the first representative of a modernizing metropolis, it was a peripheral one in the 19<sup>th</sup> century, representing a paradigm of the Central European city, sharing common cultural and socio-historical (later political) background as a driving force of urban evolution. The construction

1 SCHIVELBUSCH, 2004

2 ROSSI, 1982: 12

3 Transleithania was an unofficial term for the Lands of the Crown of Saint Stephen: referred to the Austro-Hungarian Empire beyond the Leitha (Lajta) river. Cisleithania refers to the Habsburg lands of the Dual Monarchy. After the Austro-Hungarian Compromise (1867), Transleithania consisted of the Kingdom of Hungary (including the former Principality of Transylvania, Voivodeship of Serbia and Banat of Temeschwar), the self-governed Kingdom of Croatia-Slavonia (1868), and the free port of Fiume (Rijeka, Croatia).

4 Prague was chosen because it played a leading role in the Monarchy, since Francis Ferdinand d'Este was in favour of the Triple Monarchy, expanding Austro-Hungarian dualism into trialism.

5 Zagreb was chosen since the idea of the trialist monarchy (Austro-Hungarian-Croatian Monarchy) was proposed as well as in the case of the Czech Crown Lands.

6 Demographic expansion: Vienna (1850: 551,000; 1910: 2,031,000), Prague (1850: 118,400; 1910: 640,000), Budapest (1850: 180,000; 1910: 880,000), Zagreb (1850: 20,000; 1910: 69,000). [GUNZBURGER MAKAS, DAMLIJANOVIĆ, 2010: 27]

7 The industrial revolution in the Kingdom of Hungary occurred with delay, the country could join only the second wave of the industrial revolution (1871-1914), however it partly worked off its disadvantage until the First World War.

8 VADAS, 2005: 23-34

9 GEREVIČ, 1978: 306

10 CSENDES, 2005: 37-45

of first railway lines (Vienna in 1838, Prague in 1845, Budapest in 1846 and Zagreb much later, in 1862) and the establishment of first railway stations took place in mid-19<sup>th</sup> century in the majority of (Central) European cities. Due to the demographic growth<sup>6</sup> which was stimulated by the industrial revolution<sup>7</sup>, cities faced the need of spatial expansion and urban regulations.

As old city walls were demolished in Vienna (1857), an international urban planning tender was issued and the winning plans modified and accepted in 1859: the idea was based on two ring roads, the inner ring (Ring and Franz-Josef-Kai) which followed the line of former city walls and ramparts, and the outer ring (Lastenstraße) which enclosed the area around the former glacis from the outside. Areas suitable for further expansion lay at the edge of the city. In 1861, the Emperor approved the establishment of the Gürtel Straße, as the outer ring following the line of the Linienwall (demolished in 1894).<sup>8</sup>

On the Pest side of the later unified Budapest, an inner ring road (Kiskörút) was formed parallel to city walls, while the main radial roads led to former city gates. The lack of fortification around Budapest made urban regulation more expensive and less effective, given that in many cities (including Vienna) eradication of the fortification and integration of the glacis created huge open spaces available for urban development. Due to expensive land expropriations, the urban structure of Budapest, with some exceptions, is characterized by a small number of large ur-

ban spaces and parks compared to Vienna. The adoption of the general regulatory plan was preceded by an international competition in 1871.<sup>9</sup> Lajos Lechner, who was awarded with the first prize, elaborated the plan that would connect ring roads on the Buda side with the ring road in Pest (Nagykörút 1872-1897/1906).<sup>10</sup>

In 1880 Zagreb was hit by an earthquake which caused great damage and contributed to the town's modernisation, since most of the built environment was demolished. In 1887 the first Urban Development Master Plan was made which shaped the Green Horse-shoe (*Zelena potkova* or the Zagreb Ring<sup>11</sup>), a framework of park squares around the centre of the Lower Town, established on an unbuilt land (fields and gardens). Milan Lenuci was a city planner and engineer credited with the idea of constructing a U-shaped green belt around the city centre.

Compared to other European cities, the central area of Prague remained largely untouched by the late 19<sup>th</sup> century, apart from the redevelopment of city walls (medieval fortifications were demolished in 1874 to make space for the growing city) and parts of Josefov, a quarter that was demolished between 1893 and 1913 as part of an initiative to model Haussmann's Paris.<sup>12</sup> Medieval streets and houses of Josefov, the Jewish quarter, were replaced with modern roads and apartment buildings.

In European cities in general it is possible to distinguish urban characteristics, while in historical towns of the former Austria-Hungary, especially in cities of the former Hungarian Kingdom, there are numerous overlaps of different historical structures combined with strong local character.

The aim<sup>13</sup> is to identify the factors of influence on the urban fabric caused by the railroad system, and to determine the character and directions in which urban tissue evolved as a result of the construction of railway lines and stations within the framework of urban typology. Further on, research results and methodology could be applied as the theoretical background and as part of practical methods in urban revitalization projects (restoration and revitalization of historic parts of the city), since the research deals with urban structure transformation and urban relations related to railway lines and stations.

## THEORETICAL AND METHODOLOGICAL FRAMEWORK

### TEORIJSKI I METODOLOŠKI OKVIR

The research methodology is based on two different practices, combining some aspects of the Heritage Urbanism [HERU] method<sup>14</sup>

<sup>11</sup> BLAU, RUPNIK, 2007: 58

<sup>12</sup> KOHOUT, VANCURA, 1986

<sup>13</sup> The current research was partly carried out within the framework of the Central European Exchange Program for University Studies (mentor: prof.dr.sc. Bojana Bojanić Obad Šćitaroci) at the University of Zagreb Faculty of Architecture. The research is a part of the *Heritage Urbanism [HERU] – Urban and Spatial Models for Revival and Enhancement of Cultural Heritage* [HERU-2032] project, financed by the Croatian Science Foundation, carried out (2014-2018) at the Faculty of Architecture, University of Zagreb, project leader: prof.dr.sc. Mladen Obad Šćitaroci. The methodological background was created by taking into consideration the HERU method and the integrated morphological method that is a part of an on-going doctoral dissertation research of Éva Lovra, as well as the "urban typology and urban tissue typology" related sections are based on the upcoming Ph.D. work: *Urban Tissue and Urban Typology of the Dualism (1867-1918)*. The current research is based on the previous studies, but is an elaborated and developed version of the previous researches that has taken a new direction and new topic.

<sup>14</sup> The Heritage Urbanism method that rethinks the revitalization and enhancement of heritage in the spatial, urban and landscape context, comprises four steps: 1. determining the cultural identity factors, features of heritage impact; 2. determining the valorization criteria for the existing heritage and new interventions in heritage; 3. recognizing the historical/existing model, determining new models for revitalization and enhancement; 4. creating sustainable scenarios. The method implies consideration of individual themes from various points of view.

TABLE II RAILWAY STATIONS ACCORDING TO TIME DIVISION  
TABL. II. ŽELJEZNIČKE STANICE PREMA VREMENSKOJ  
PODJELI

Vienna	
A.	1838: k. und k. Nordbahnhof (Imperial and Royal North railway station); rebuilding period: 1858/1865 (by Theodor Hoffmann); 1865; Praterstern
B.	1841/1846: Gloggnitzer Bahnhof (South railway), later in 1869/73 it was rebuilt to Wien Süd-Bahnhof / Vienna South Station (designed by Wilhelm Gustav von Flattich) and the Raaber Bahnhof (East railway), in 1867/1870 was replaced by Centralbahnhof (Central station designed by A. Schumann); 1910: Staatsbahnhof (State station); 1914: Ostbahnhof (Eastern station). The original Gloggnitzer and Raaber were built by Mathias Ritter von Schönerer.
C.	1857/59: Wien Westbahnhof (originally called the k.k. privilegierte Kaiserin-Elisabeth-Bahn), designed by Moritz Löhr; 1910/12: enlargement
D.	(1848?) 1859: Hauptzollamt Bahnhof; later called Mitte; 1899/1901: it was rebuilt
E.	1870/73: Nordwest Bahnhof
F.	1870/72: Wien Kaiser Franz-Josefs Bahnhof (1872 new building)
G.	1880/83: Bahnhof Aspeng
Prague	
A.	1845: Prague Masaryk railway station (then Praha nádraží)
B.	1850: Praha-Bubeneč railway station (closed in 2014)
C.	1862: Praha-Smíchov railway station; 1872/73: new lines
D.	1863: Praha-Veleslavin railway station (minor)
E.	1868 (1866-1875): Nádraží Praha-Bubny
F.	1871: Praha-Vršovice railway station (minor)
G.	1871: Praha hl.n (Main) railway station (originally Franz Josef station)
H.	1872: Nádraží Praha-Satalice (minor)
I.	1872: Praha-Vysočany railway station (Vysočany is part of Prague from 1922)
J.	1877: Praha-Libeň railway station (the railway passed through the village, but the station was opened in 1877 – minor) Praha-Čakovice – minor station
Budapest	
A.	1846: Indóház (final terminus of the Pest-Vác railway line); *1877: rebuilt – Nyugati (West) railway station
B.	1861: Budai station, later Déli (South) railway station
C.	1861: Kelenföld railway station
D.	1867-1885: Józsefvárosi (Losonczy) railway station (from 1885 lost its reputation and function) *1877: Nyugati (West) railway station (by Eiffel Office)
E.	1877/78: Budapest Ferencváros railway station
F.	1883/84: Keleti (East) railway station (designed by: Gyula Rochlitz) Kőbánya alsó and Kőbánya felső are minor stations.
Zagreb	
A.	1862: Juzni (South) railway station, later Zapadni (West) railway station
B.	1892: Glavni (Main) railway station by Pfaff Ferenc

and some of the integrated urban morphological method (created by Éva Lovra), to provide an adequate research framework.

According to the HERU method, to identify the factors of identity (in our case the direction of territorial development caused by the railway system), distinctive characteristics of the subject of study have to be determined by establishing a "catalogue" in which characteristics and peculiarities are identified via different points of view (in our case spatial and urban point of view are taken into account). The criteria for the evaluation of the existing urban heritage have to be determined on the basis of selected examples processed in a research catalogue (Table I and II) based on the studied archival maps of the 1<sup>st</sup> (pre-1867), the 2<sup>nd</sup> (mid Austria-Hungary period around 1900) and the 3<sup>rd</sup> period (late Austria-Hungary period till 1918).<sup>15</sup>

The integrated urban morphological methodology is based on the practice of Italian and English urban morphology schools: in his work, morphological practice and studies Muratori focused on the typology via four scales (building-district-city-territory) due to his understanding of the directions shaping the building fabrics, urban organism and territories.<sup>16</sup> Caniggia further developed Muratori's theories with a focus on typo-morphology and an understanding of the built form by examining the historical process of its formation. In the case of cities in the former Austria-Hungary, if we adopt the Caniggian approach, historical processes played major role in the urban morphological development. Besides the Caniggian urban typology/morphology, the Conzenian approach<sup>17</sup> is applicable with limitation to the analysis and typology of the dualist cities, since the goal of the Conzen's town-plan analysis<sup>18</sup> is to trace the character of towns via their elements and development through time. The urban tissue [Caniggia, Maffei] or plan-unit [Conzen] is a diverse combination of streets, plots, and block-plans. Furthermore, Conzen's morphological approach is based on morphological periods<sup>19</sup>, as they are urban manifestations of diverse social and cultural history. In order to establish the urban tissue typology of the former Austro-Hungarian towns within the framework of the English and the Italian morphological school, and later to determine the urban typology, it is important to create an integrated and developed research practice.<sup>20</sup>

The integrated and developed morphological research practice consists of several aspects/elements (plot; streets and street systems; and their more complex form: urban tissue; fringe belt; morphological region/townscape<sup>21</sup>) due to the creation of the urban tissue

typology and their more complex form, the city typology.

According to Éva Lovra, urban typology (town types) in the dual monarchy period (Austria-Hungary: 1867-1918) can be outlined via the formation of a matrix of characteristics and driving forces, via definition, description and combination of urban tissue types defined by the different features and combinations of urban forms, taking into account dominant urban tissue types. Railway systems, parks, green spaces and other urban formations and their location within the city, as well as the relations to the various types of urban fabric are significant in terms of determining and defining the urban types/urban typology. The establishment of urban typology has to take into account the position of the town centre according to different urban tissues. The combination of urban tissue types, relations<sup>22</sup> and dominance of certain urban tissues determines the urban tissue type. The relationships according to urban tissues and the surrounding: 1. Urban tissue type and the centre; 2. Urban tissue type and the green areas; 3. Urban tissue type and the main roads/railway; 4. Urban tissue type and the river/lake.

This research focuses on the "urban tissue type and the railway" and demonstrates the role of the railway in the direction of urban development and the importance in urban typology (determination of the urban types of the cities in the studied period) via the combination of the HERU methodology and the integrated approach of urban morphology and urban relations.

## IDENTITY FACTORS OF URBAN TISSUE ALONG RAILWAY TRACKS

### ČIMBENICI IDENTITETA URBANOG TKIVA DUŽ ŽELJEZNIČKIH TRASA

Since our research focuses on the post-industrial urban tissue and urban types, it has to be highlighted that the regulation of the growing (industrial) city was one of the main concerns of the 19<sup>th</sup> century engineers in general. Architects of the time, among others Robert Owen, Tony Garnier and Ebenezer Howard, studied the issue and the potential of the growing city from different directions, while in the case of the modernizing cities in the former Austria-Hungary, the works of Camillo Sitte (*The Art*

<sup>15</sup> 1<sup>st</sup> [CS No 1, 6, 7, 12, 17], 2<sup>nd</sup> [CS No 2, 3, 8, 9, 13, 14, 18] and 3<sup>rd</sup> development period [CS No 4, 5, 10, 11, 15, 16, 19, 20].

<sup>16</sup> CANIGGIA, MAFFEI, 2001 (1979)

<sup>17</sup> In his study, he deals with general aspects of the urban morphological analysis, among which he differentiates the town plan, land utilization pattern and building fabric within the townscape. The more important subdivision is related with the town plan that is in the case of the dualist cities is the most important source of the typology.

of *Building Cities*, 1889) and his critic Otto Wagner (*The Large City*, 1911) are the most relevant, since urban tissues of the Austria-Hungarian cities are diverse.

For the current study, literature review and analysis of maps were chosen to describe the historical process of the development of the city form and its spatial consequences. The literature provided the methodological base [Conzen, Caniggia] and the historical studies are important for establishing the framework of urban typology, which was not studied in these circumstances before.

### URBAN CONTEXT<sup>23</sup> BEFORE AND RIGHT AFTER THE CONSTRUCTION OF RAILWAY LINES AND STATIONS

#### URBANI KONTEKST PRIJE I NEPOSREDNO POSLIJE IZGRADNJE ŽELJEZNICE I ŽELJEZNIČKIH STANICA

As shown in Table I, the selection of location and the construction of railway lines were limited not only by the technical level and geo- and hydrographical features, but also because the price of land in the wider city territory was foregrounded since at the beginning of the industrialization most of the railroads and stations were built by private companies.<sup>24</sup> According to available studies, first railway stations were built in the four cities, but they were mostly terminal stations placed outside of the built area, often on the outskirts of the city. The Kaiser Franz-Josefs Bahnhof (Fig. 1) was the only station that penetrated into Vienna's inner districts (Fig. 2), and since mid-19<sup>th</sup> century Prague (Fig. 3) was built up within baroque city walls, the first railway station and railway lines (1845-1849 - Masaryk, marked with A in Table I, II; Fig. 4) were positioned only partly within city walls (passenger part / the station itself), with the

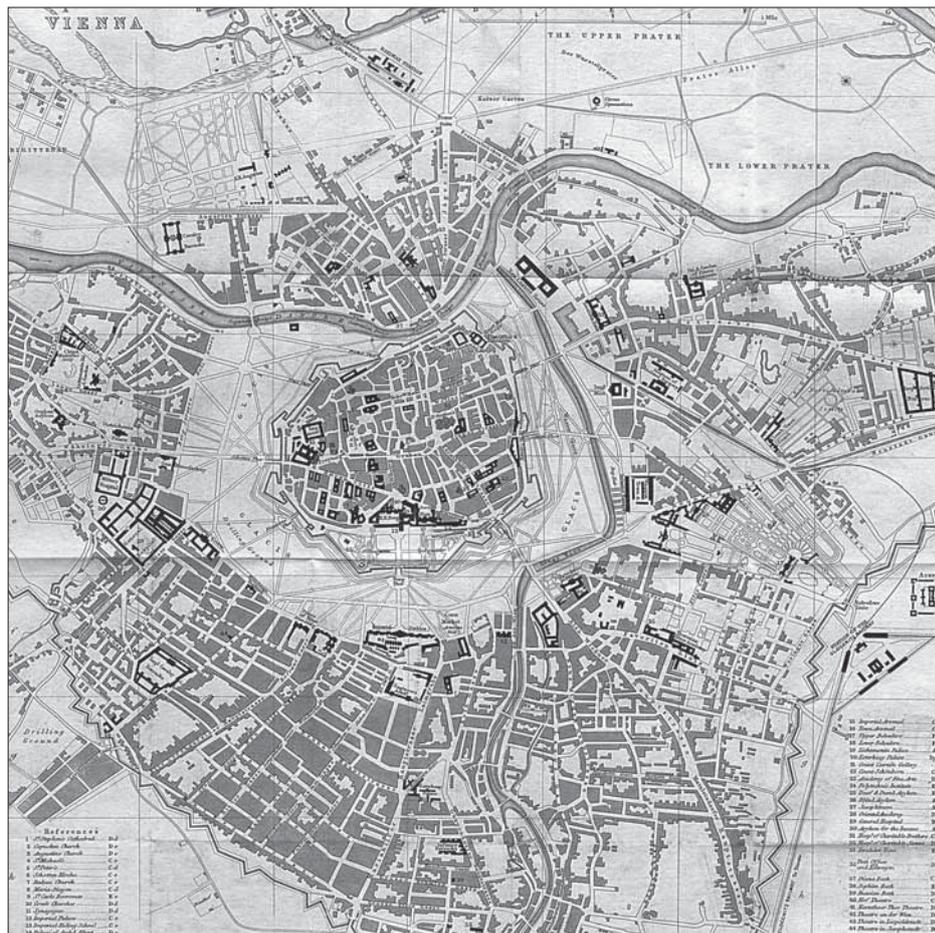


FIG. 1 VIENNA IN 1858

SL. 1. BEČ, 1858.

FIG. 2 F – FRANZ JOSEFS BAHNHOF (1872) IN VIENNA. URBAN TRANSFORMATION FROM 1858 TILL 1888. COMPARISON OF MAPS FROM 1858 AND 1888 SHOWS MINOR TRANSFORMATIONS IN THE BUILT ENVIRONMENT, SINCE THE STATION WAS BUILT IN AN OPEN SPACE.

SL. 2. F – KOLODVOR FRANZA JOSEFA (1872.) U BEČU. URBANA TRANSFORMACIJA IZMEĐU 1858. I 1888. USPOREDBA ZEMLJOVIDA IZ 1858. I 1888. POKAZUJE MANJE TRANSFORMACIJE U IZGRAĐENOM OKOLIŠU BUDUĆI DA JE STANICA IZGRAĐENA NA SLOBODNOM PROSTORU.

<sup>18</sup> CONZEN, 1960 (1969)

<sup>19</sup> Morphological regions or townscape units are areas of homogeneous urban form (building and plan type).

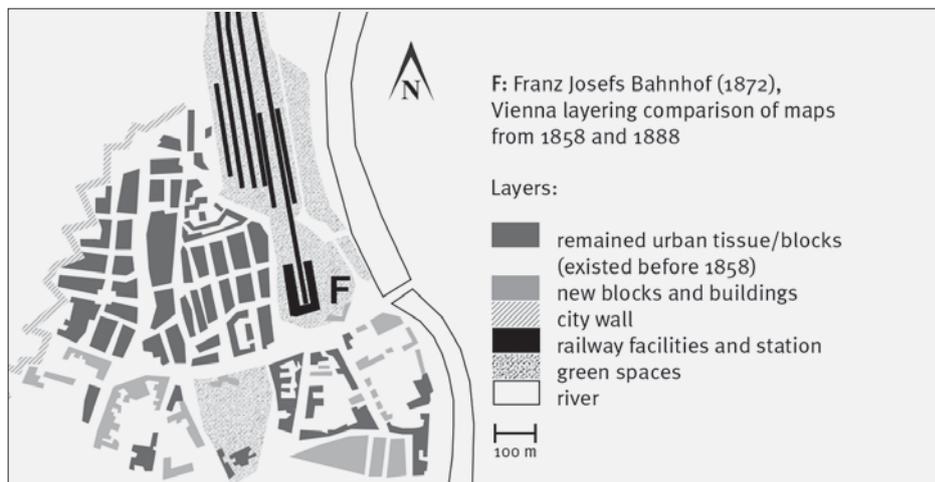
<sup>20</sup> The integrated methodology is the methodological base and theorem of the upcoming Ph.D. dissertation of Éva Lovra.

<sup>21</sup> Changes in the road structure influence the division of plot shapes. Numbers of plots form plot series (urban blocks). The blocks make up the city's urban tissue and can thus indirectly define the urban tissue metamorphosis via street network changes. Determination of urban tissues requires identification of roads, followed by buildings – plots – plot series. Based on the street network changes, the direction and the character of the city's development can be observed.

<sup>22</sup> Relations: mutual relationships, relationship to the park, river, centre, city walls, castle, railway and periphery etc.

<sup>23</sup> The urban context study is based on Table I [Heritage Urbanism method] and integrated analyses of maps of the 1<sup>st</sup> [CS No 1, 6, 7, 12, 17], 2<sup>nd</sup> [CS No 2, 3, 8, 9, 13, 14, 18] period.

<sup>24</sup> In Budapest the Hungarian National Railway [Magyar Állami Vasút – MÁV] was founded just in 1868 (1869).



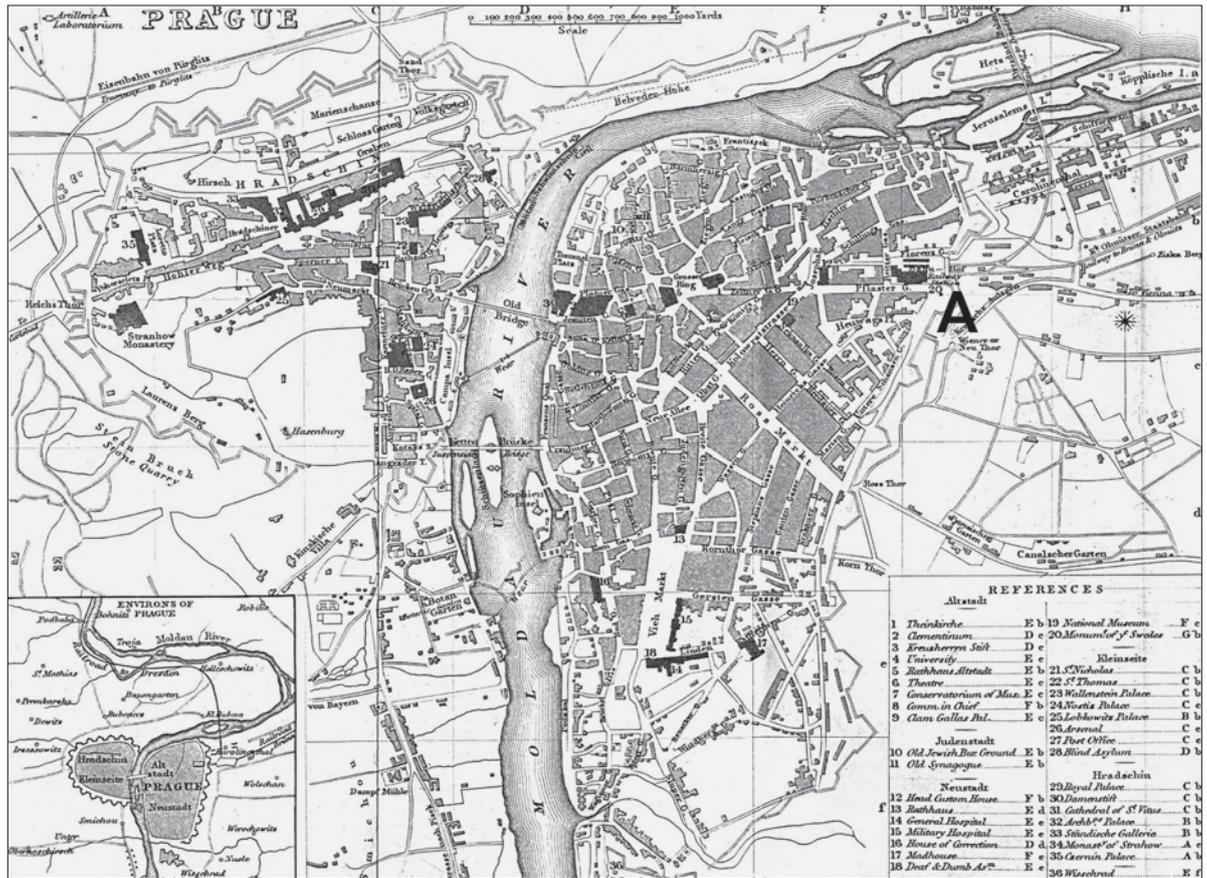


FIG. 3 PRAGUE IN 1858: A – MASARYK RAILWAY STATION LOCATED PARTLY INSIDE AND PARTLY OUTSIDE CITY WALLS SL. 3. PRAG, 1858.: A – ŽELJEZNIČKA STANICA MASARYK SMJESTENA DIJELIČNO UNUTAR, A DIJELIČNO IZVAN GRADSKIH ZIDINA

tracks and the facilities outside the baroque fortress in the Karlin neighbourhood. The location of the station within the walls was not randomly chosen: the site was previously used as a garden (the inner city was spatially dense without open free spaces). The location can be seen as the contrast to Vienna, in which stations were located outside city walls.

In the case of Zagreb (Fig. 7) and Budapest, city walls as urban development limiting factors were absent (the defence line in Budapest did not withstand Ottoman conquests and has not been reconstructed since, and even if there are traces of the walls, these do not create physical barriers). The first railway line (1846, marked with A) was built in the northern part of the Pest side, followed by the main road leading to Vác from the terminal constructed at the border of the built-in area of the city. In the case of Zagreb, railway lines did not penetrate the built-up area of the city: they horizontally followed roads, but were placed far from the existing body of the city, in the fields. Urban development lines are clearly visible, following the horizontality, the railways and the existing roads. Actually, the Austro-Hungarian urban fabric (mostly the Lower Town area) was located between

the railway and the existing medieval settlements (Gradec and Kaptol). In contrast with the linear distribution of railway lines in Zagreb, it is mostly the radial distribution with connecting lines<sup>25</sup> that can be seen as the direction of development in other cities.

The urban tissue around railway stations was diverse, yet significant and peculiar to each city, according to the analysis of relevant<sup>26</sup> historical maps using the integrated method:

– Vienna: stations were located mostly outside city walls, far from built-up areas, the rare examples inside outer walls were placed in open spaces surrounded by an irregular

<sup>25</sup> The railway node was finished in 1882 in the city of Prague, also the main station and the Smíchov terminal were connected to the network, the Masaryk Station (formerly Prague Station) remained unconnected [KOHOUT, VANCURA, 1986: 97]. In the not yet unified Budapest, the first plan for connecting the railway was made in 1871. There were two versions of the plan, but both planned to go across unbuilt fields and meadows (less expensive fields). Only in 1877 was the connecting line finished, resulting in the construction of the Keleti Railway Station [SEEFELNER, 1877: 161-173, 224-240]. In Vienna the lack of connection of railway lines and stations enabled the creation of an appropriate network system. This gap was filled later on with the Stadtbahn (primary idea of Otto Wagner) in the inner/suburban areas and the Vienna connecting rail (1859) and Donauufer-Donauländebahn.

street network and geometrically irregular blocks (Franz Josefs, Hauptzollamt).

– Prague: the hybrid location of the Masaryk (formerly Prague) Station shows how a densely built urban structure with medieval roots was dealing with the requirement of new technological needs. The station was surrounded with mostly medieval structure, an irregular street network and blocks. The main railway station is located at the edge of former city walls, facing a large green area (park), but the facilities and the tracks are running on free (unbuilt) areas. Smíchov is a great example of a railway station located in an industrial area that remained of the same type for more than a century (it has a strong industrial character until the present day, even if it is in transition).

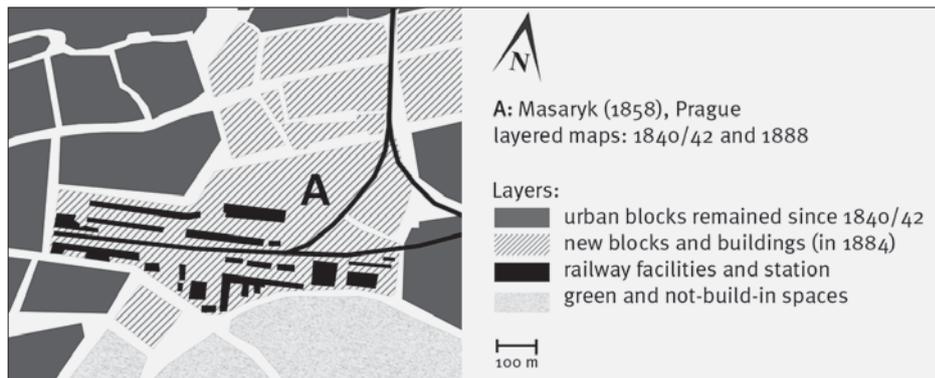
– Budapest: the main stations were located outside the built-up area, making it possible in the period of progressive urbanization of the Austro-Hungarian era to undergo intensive changes.

– Zagreb: stations were built on open spaces surrounded by gardens, thus providing an opportunity for the urbanization of Austria-Hungary. The first station (marked A) was situated in an open field, later on military facilities were built in the neighbourhood of the station and the railway lines.

## THE CHARACTERISTICS OF THE URBAN PATTERN<sup>27</sup> AFTER THE CONSTRUCTION OF RAILWAY LINES AND STATIONS

### OBILJEŽJA URBANOG TKIVA NAKON IZGRADNJE ŽELJEZNICE I ŽELJEZNIČKIH STANICA

**1. Characteristics of urban fabric along the railways:** as a result of the construction of railway lines, changes in the construction dynamics (urban pattern) can be examined around railway stations and lines. When tracks were laid parallel to the direction of spatial urban development, efficient spatial communication of the split areas on each side of the tracks was made impossible. Track represented spatial and social divisions. Par-



allel lines can be found in Zagreb. Radial track division, later on with the connecting circles, moderated the effect, but in the case of Budapest the moderate effect was significant.<sup>28</sup> The loose urban structure dominated by single-family houses or rural environment, as well as the previously dominant undeveloped fields (cultivated or uncultivated land) were replaced by industrial sites and accompanying infrastructural buildings which can be considered as the consequence and the character of the industrialism period (Prague, Zagreb). In the vicinity of railway lines new settlements were built to meet housing needs of workers (typically regular, geometric structure/vertically and horizontally intersecting streets in Budapest, after the research period in Vienna).

Railway lines penetrated the existing urban tissue of the city only exceptionally<sup>29</sup>; usually they passed beside the built environment (the existing structure). According to this feature, the area along the railway lines in many cases did not undergo significant changes<sup>30</sup> (Vienna, Prague), especially if lines passed through an undeveloped territory (Budapest, Prague, Vienna).

Along the more centrally located railway lines the construction followed the dynamics of the incorporated central area, therefore in these areas multiple-story rental palaces are frequent, the building layouts, building types are more similar along the tracks than further away, in the inner city areas closer to the centre (Budapest).<sup>31</sup>

In the case of Budapest, the first third of the dualist era was the most important section in the railway construction, even though the economic recession (started in 1873) slowed down the development of the railway system as well as urban development. The urban development plan (1871) was followed by less intensive changes: only indispensable demolition and path widening were taken into account (Nagykőrút, Andrásy/Radial Road). The simple tissue (street network) of the undeveloped area was designed according to the radial-ring system practice with mostly

FIG. 4 PRAGUE, MASARYK (FORMERLY PRAGUE) RAILWAY STATION IN THE HISTORICAL URBAN STRUCTURE (COMPARISON OF MAPS: 1840/43 CADASTRAL MAP AND 1884 CITY MAP)

SL. 4. PRAG, ŽELJEZNIČKA STANICA MASARYK (PRIJE PRAŠKA) U POVIJESNOJ URBANOJ STRUKTURI (USPOREDBA KARATA: KATASTARSKI PLAN IZ 1840./43. I PLAN GRADA IZ 1884.)

<sup>26</sup> 1<sup>st</sup> period before Austria-Hungary (1838-1867).

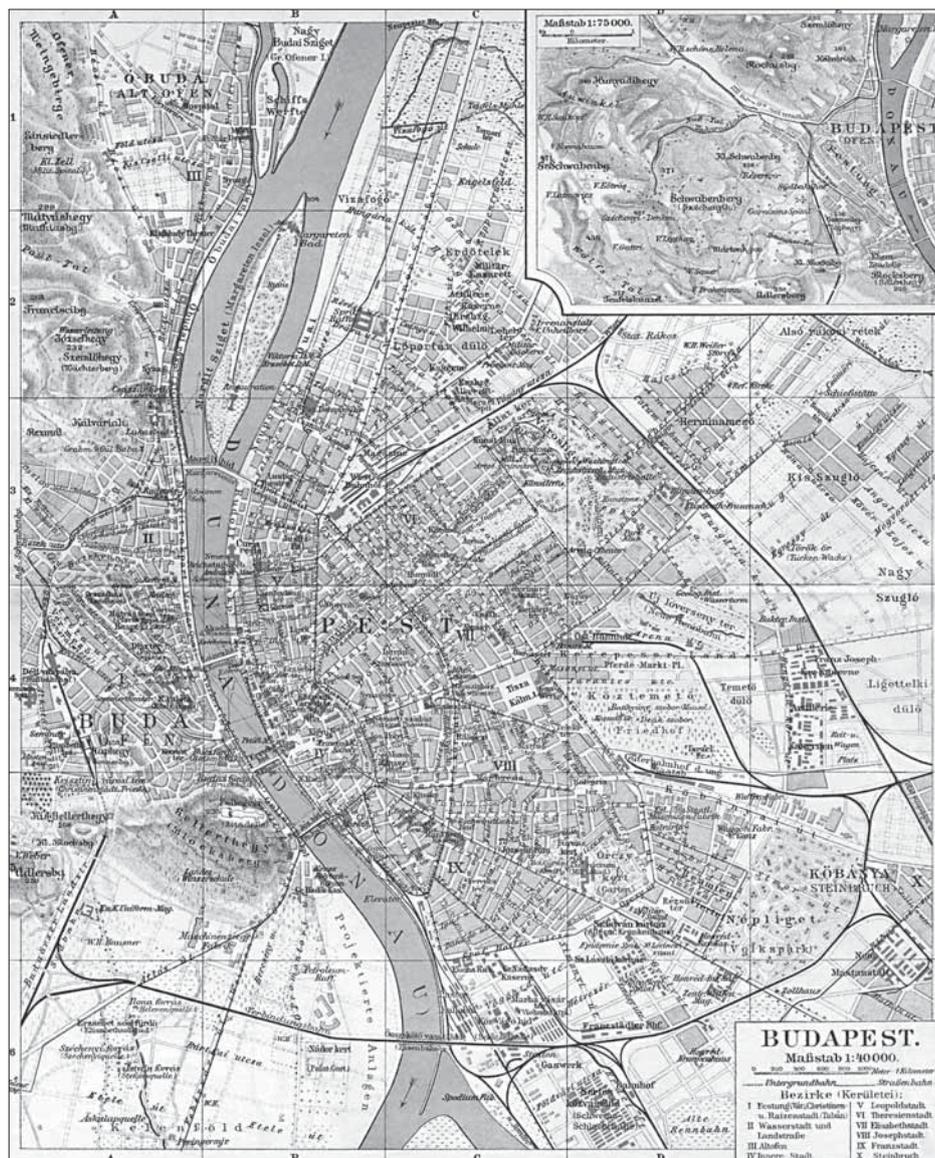
<sup>27</sup> According to the results of the integrated urban morphology method.

<sup>28</sup> It encouraged the railways owner before the MÁV to propose a plan in 1872 to build under- and overpasses to connect city parts divided by railway lines [VADAS, 2005: 148].

<sup>29</sup> The case of Vienna and Prague, but stations and tracks were constructed in unbuilt areas without demolishing the original urban tissue.

<sup>30</sup> Changes: demolition of the existing urban structure.

<sup>31</sup> Based on the studied archival maps of the 2<sup>nd</sup> [mid Austria-Hungary period, CS No 2, 3, 8, 9, 13, 14, 18] and 3<sup>rd</sup> [late Austria-Hungary period till 1918, CS No 4, 5, 10, 11, 15, 16, 19, 20].

FIG. 5 BUDAPEST IN 1905  
SL. 5. BUDIMPEŠTA, 1905.

monotonous grid street networks, where only fractures of traversing streets brought some variety. The period of the new Nyugati railway station construction (1877, Eiffel Office) and the first period (started in 1872) of the Nagykörút (outer ring road) construction overlapped, and one of the most significant buildings of the ring road became the Nyugati station (Fig. 6). According to the stations, a diverse urban development scenario can be seen after the construction: extreme urban development (privileged area: Main Station / Zagreb/) and suburban: Southern Station / Zagreb/); modest/progressive urban transformation (Budapest and Prague /Smíchov/); in the case of Vienna and Prague (Main Station and Masaryk) just minor urban changes can be witnessed.

In Budapest (Fig. 5) and Zagreb the 2<sup>nd</sup> development period saw the most intensive urbanisation (discussed in the urban typology context), while the 3<sup>rd</sup> period can be seen as a sequel of previous works. Although the main urban transformation in Prague took place after the First World War and in Vienna in the 1st and the beginning of the 2<sup>nd</sup> period, these examples act as counterpoints in the com-

**32** The railway line could act like a fringe belt that is taken separately in the analysis, although the railway station itself is part of the townscape and city structure, but taken as a counterbalance point in urban typology.

**33** The significant factors of urban typology identification are chosen according to previous research by Éva Lovra, regarding the most important components of urban environment in the research period.



parison and emphasize the importance of the railway in further development.

## THE URBAN TYPOLOGY CONTEXT

### KONTEKST URBANE TIPOLOGIJE

The aim of the study was not to create a historical/spatial comparison of the four cities but to use the comparison to explain and prove the importance of railways and railway stations in the process of urban typology. The comparison of maps from the three periods shows the direction of urban evolution and the dynamics and location of railway development.<sup>32</sup> In the 2<sup>nd</sup> development period the majority of railway stations were built in the wider territory of each city, giving the further direction of the expansion.

The analysis of urban typology is based on the integrated urban morphology method. Significant factors of urban typology identification<sup>33</sup>: 1. placement of railway lines, railway stations; 2. their relations with the surrounding urban tissue and the historic (central) core; 3. other urban type defining factors (green areas and natural water surfaces).

The most relevant stations for urban typology are chosen according to Table I, as it can be considered as the outcome of the Heritage Urbanism methodology. Table I is graphically guiding, but without considering the focused classification of stations and identification of the urban tissue from the Austro-Hungarian period, no relevant surroundings can be chosen. In our case the most relevant stations are located in Budapest (A, F) and Zagreb (A, B), and to give a wider context in Vienna<sup>34</sup>,

<sup>34</sup> The Gründerzeit (Founder's period) between 1857 and 1914 is a more complex and intensive period [PARSONS, 2008], even though the period partly overlaps with the urbanization of the Austro-Hungarian era, it cannot be compared, since it differs from it. According to that, the relevance of the Viennese structures are important, but it can be seen in the affirmation of the importance of the railway in urban typology analyses.

since the most intensive urban tissue transformation can be seen in Budapest and Zagreb (Fig. 6 and 8) according to the comparison of the four cities, whereas urban tissue transformation of Vienna is less intensive, yet visible (Fig. 2).

– **Street network structural changes** were prompted by the evolving transportation in the industrial period and the narrow streets that made communication within cities impossible. A special type of roads was constructed towards railway stations to connect stations (mostly placed on the outskirts) directly with the city centre. This type of streets can be found in Budapest (Keleti), but it was never established in Vienna or Prague. Keleti faces a large square and a radial road, structurally similar to the location of the Main Station in Zagreb (Fig. 8) where the station faces a large square and a green area/park, but the function is similar (next to the park, that is part of the Green Horseshoe, streets are wide enough for transport).

– **Urban tissue patterns around relevant stations:**

1<sup>st</sup> type in the neighbourhood of the selected railway stations in Budapest and the Main Station in Zagreb show some similarities: the pattern is dense and shows spatial organization by an unbroken row of rental palaces, mainly rectangular and less often polygonal plot series with some corner sub-series, generally more regular with fine grain.

2<sup>nd</sup> type is based on the first, but looser with large green areas that broke the dynamics of the unbroken row of rental palaces. Multiple isolated buildings with similar layouts show the direction of the development of the plot series (Nyugati).

3<sup>rd</sup> type is shown in the Southern Railway Station in Zagreb, the placement is less favourable, the location during the research period was more suburban, with such special characteristics as the proximity of military facilities (Rudolf Barracks 1888/1889). The surrounding of the station is characterized by

FIG. 6 BUDAPEST, NYUGATI RAILWAY STATION AND TRACKS (SPATIAL CHANGES IN THE LAST QUARTER OF THE 19<sup>TH</sup> AND THE BEGINNING OF THE 20<sup>TH</sup> CENTURY)

SL. 6. BUDIMPEŠTA, ŽELJEZNIČKA STANICA NYUGATI I TRAJNICE (PROSTORNE PROMJENE U ZADNJOJ ČETVRTINI 19. ST. I POČETKOM 20. ST.)



FIG. 7 ZAGREB 1864: A – SOUTHERN RAILWAY STATION  
 SL. 7. ZAGREB 1864.: A – JUŽNA ŽELJEZNIČKA STANICA

large open areas and "randomly" placed (facility/industrial) buildings. According to the 1910/13 (1915) cadastral map<sup>25</sup> the urban tissue is loose with industrial characteristics, the station faces an open area, but the military buildings in the neighbourhood changed the pattern (not the urban distribution, but the land use is unique). In urban typology land use is less important, but since this urban tissue cannot be considered as homogeneous by the use, just by the pattern. The predominantly whole block plots and multiple isolated buildings with similar layouts should be considered as an important factor that has impact on the urban pattern of neighbourhood areas: creating an alien-like tissue surrounded by an unbroken row of buildings defined tissues.

**Square** as a pattern is present in all of the mentioned stations, but its distribution is widely different. Nyugati faces an outer ring road, with a square on the side of the station, but urban pattern analyses do not have a tissue changing role (open space, unbuilt space), they are not part of the simple tissue.

**Urban tissues** are diverse around the station, since the surrounding was in rapid development, the nearly permanent state is considered: large unbuilt areas and densely built urban tissue (closed, rectangular construction pattern with inner yards and a nearly geometric plot division, plot series repeating themselves and the building layouts are similar, showing homogeneous construction dynamics). The role of the tracks and the station in the urban typology is multifold: it should be considered not just in the context of the surrounding tissues, but also at the simple tissue determination as well. The already mentioned situation of Keleti and the Main Station has to be discussed, since these two stations act as gates to their respective cities, although rental palaces are less notable around Keleti than around the Main Station in Zagreb. Tissue distribution is similar, but with different building layouts and there are some differences in the simple tissue. Both of them act as gates and follow lines towards the city centre. In Zagreb the green area (series of squares) with the station has a double

effect in urban typology, since these should be taken as a single ensemble, not as unique elements.

Zagreb has an important role in urban typology, with its inner urban tissue and "counter-points" (railway, parks, Sava River) relations and the fact that the entire new urban territory was established during the Austro-Hungarian period with a strict, grid-like simple tissue that could act as one of urban basic types of urban typology in Austria-Hungary.

## CONCLUSION

### ZAKLJUČAK

In the former Austria-Hungary regional transport was part of the deliberate development policy, but influence over urban territories was site-specific with some similarities. The railway and the increasing intensity of urban development in the second half of the 19<sup>th</sup> century changed the scale and urban tissue of urban areas. Intensive modernization took place during the industrial period and one of the accompanying events was the realignment and modernization of transport, routes, street networks. The railway brought new construction dynamics (new simple tissue and urban pattern) to the surrounding areas. New urban forms, such as the widened radial street, square, park or other green areas in front of the railway station, and new building layouts resulted, and urban tissue typology was changed corresponding to the period when the station was built. In the studied cities, as some mutual characteristics can be

seen, the first railway lines were placed in unbuilt areas, outside city walls (Prague, Vienna), just at the border of the built area (Budapest) and far from the built environment (Zagreb). The Masaryk (formerly Prague) Station was placed partly beyond the city walls and only the Franz Joseph Station (Vienna) penetrated the built environment, these two terminals being the only exceptions. Modern urban infrastructure exerted complex effects in settlements. Train stations incorporated into the urban tissue indicated the establishment of new sub-centres presenting a different, more grid-like spatial plan. The increasing number of regional railway lines impacted the improvement of certain parts of the city: new sub-centres were created, outskirts and the centre were connected. The results of the analysed period not only gave answers to the question of urban transformation of modernizing towns, but also showed the direction of development in the past. The most intensive urban transformation can be witnessed in Budapest and Zagreb, since the direction of urban development was identified in the four cities, the urban typology context was closely studied and explained in the case of railway stations of these two cities. Different urban contexts of the stations made it possible to study and determine the importance of the position and the relations between the surrounding urban tissue types and railway lines and railway stations in urban typology of the Austro-Hungarian cities.

[Proofreading: ANITA HARKAI, BA;  
Final proofreading:  
ZDENKA IVKOVČIĆ, "Interalia"]

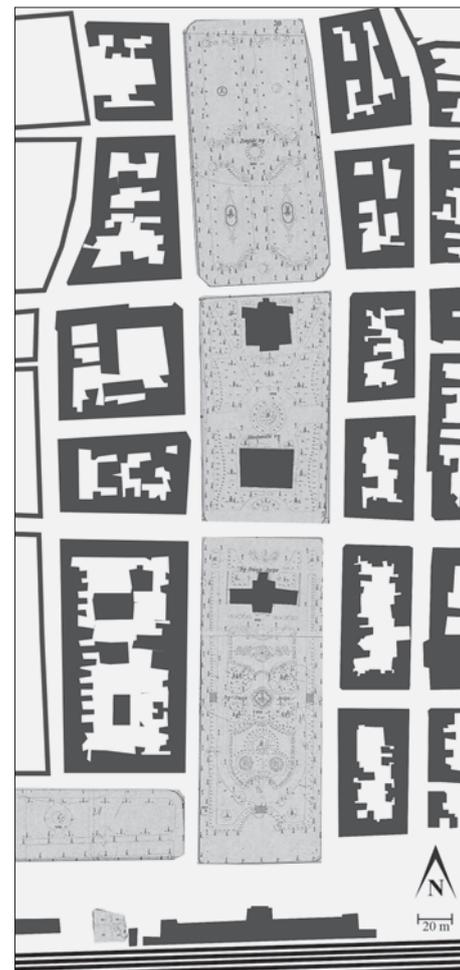


FIG. 8 URBAN TISSUE IN FRONT OF THE MAIN RAILWAY STATION, ZAGREB AROUND 1913  
SL. 8. URBANO TKIVO ISPRED GLAVNOGA ŽELJEZNIČKOG KOLODVORA, ZAGREB OKO 1913.

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## ILLUSTRATIONS AND TABLE SOURCES

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- FIG. 1 CS 4
- FIG. 2 Drawing: Éva Lovra, layering based on CS 12 and 22
- FIG. 3 CS 7
- FIG. 4 Drawing: Éva Lovra, layering based on CS 6 and 8
- FIG. 5 CS 4
- FIG. 6 Drawing: Éva Lovra, layering based on CS 2 and 3
- FIG. 7 CS 17
- FIG. 8 Drawing: Éva Lovra, based on CS 21
- TABLE I Drawing: Éva Lovra, The following maps were used from the CS: 1, 4, 5, 7 and 9-20.
- TABLE II Data from Literature under numbers: 7-10 and 17.

## SUMMARY

## SAŽETAK

## PREOBRAZBE URBANE STRUKTURE

## ULOGA ŽELJEZNICE U OBLIKOVANJU URBANOGA TKIVA U GRADOVIMA AUSTRO-UGARSKE MONARHIJE (1867.-1918.)

Ustavno spajanje dviju država - Austrijskog Carstva i Kraljevine Mađarske, nakon čega slijedi Austro-ugarska nagodba (1867.) te Ugarsko-hrvatska nagodba (1868.), omogućilo je jedinstvenu državnu strukturu i politiku razvoja. Urbani razvoj dvojne države krenuo je u novome smjeru, dijelom zbog urbanoga razvoja koji je bio reguliran od strane države (u slučaju glavnih gradova, Beča i Budimpešte), ali i zbog ekonomskog razvoja koji je imao snažan utjecaj na proces urbanizacije. Četiri grada – Beč, Prag, Budimpešta i Zagreb – odabrani su gradovi za analizu i istraživanje prikazani u ovom članku.

S motrišta urbanoga tkiva željeznički kolodvori mogu se smatrati simbolom modernizacije druge polovice 19. stoljeća. Položaj i odnos kolodvora i trasa željezničke pruge prema okolnome urbanom tkivu, kao i njihov utjecaj na urbanu strukturu, uočljivi su u austrougarskim gradovima, posebice s gledišta urbane tipologije.

Istraživanje prikazano u ovom radu bavi se preobrazbom urbane strukture i urbanim odnosima zbog izgradnje željeznice i kolodvora. Cilj je istraživanja bio utvrditi čimbenike utjecaja na urbano tkivo uzrokovano uvođenjem željezničkog sustava te utvrditi karakter urbanoga tkiva nastalog kao rezultat izgradnje željeznice i kolodvora, i to s motrišta urbane tipologije. Istraživanje se sastavlja, a u ovom radu iznose se prvi rezultati i zaključci. Rezultati i metodologija istraživanja mogu biti primjenjivi u projektima urbane revitalizacije (obnove i unaprjeđenja povijesnih dijelova grada). Metodologija istraživanja temelji se na dvama pristupima – integriranoj urbanoj morfoloskoj metodi i na polazištima znanstvenog projekta *Urbanizam naslijeđa* [Heritage Urbanism – HERU] koji se provodi na Arhitektonskom fakultetu Sveučilišta u Zagrebu. Integrirana urbana morfoloska metoda temelji se na praksi talijanske [Caniggia, Muratori] i engleske [Conzen] urbane morfološke škole, koju je za ovo istraživanje razvila Éva Lovra.

Urbani tipološki oblici u razdoblju Austro-Ugarske Monarhije (1867.-1918.) mogu se prepoznati u matricama tlocrtnih oblika gradskoga tkiva nastalih

zbog utjecaja željezničke pruge i kolodvora kao novih građevina i novih funkcija unesenih u grad tijekom druge polovice 19. stoljeća.

Istraživanje je usmjereno na tipološke oblike urbanoga tkiva i željezničke pruge te pokazuje ulogu željeznice na smjer urbanoga razvoja i važnost željeznice za urbanu tipologiju. Značajni čimbenici u postupku prepoznavanja urbane tipologije jesu: 1. položaj željezničkih pruga i željezničkih kolodvora; 2. njihovi odnosi s okolnim gradskim tkivom i povijesnom jezgrom grada; 3. ostali čimbenici od važnosti za tipološku prepoznatljivost gradskoga tkiva (primjerice: perivoji, perivojni trgovi, parkovi, vodene površine i dr.).

Izgradnja željezničke pruge, kao i potreba preobrazbe ulične mreže zbog razvoja industrije i nemogućnosti prometovanja u gradovima, pojačala je dinamiku izgradnje grada uokolo pruge i kolodvora. U gradovima se grade ulice koje vode prema kolodvorima, koji su najčešće na rubu povijesnoga središta, pa te ulice izravno povezuju središte grada sa željezničkim kolodvorima. Istraživanje je pokazalo tri vrste/tipa urbanoga tkiva uokolo kolodvora:

1. Urbano tkivo visoke gustoće s prostornom organizacijom neprekinutoga niza zgrada za iznajmljivanje, parcele su uglavnom pravokutnog i rjeđe poligonalnog oblika (na uglovima blokova);
2. Urbano tkivo sličnih obilježja kao prethodni tip, ali s velikim perivojnim površinama koje prekidaju monotoniju niza zgrada za najam;
3. Pretežito cijeli blok sastoji se od jedne parcele s brojnim izoliranim zgradama sa sličnim tlocrtima. Usporedbom četiriju gradova (Beča, Praga, Budimpešte i Zagreba) utvrđena su sljedeća osnovna obilježja.

Beč – Željeznički kolodvori nalaze se najčešće izvan gradskih zidina, podalje od izgrađenih predjela grada. Rijetki primjeri unutar vanjskih gradskih zidova postavljeni su na neizgrađenom prostoru okruženom nepravilnom uličnom mrežom ulica i geometrijski nepravilnih blokova (Franz Josefs, Hauptzollamt).

Prag – Položaj Masarykova kolodvora pokazuje kako se gusto izgrađena srednjovjekovna urbana struktura nosi sa zahtjevima novih tehnoloških potreba. Kolodvor je djelomično okružen srednjovjekovnim gradskim tkivom, nepravilnom mrežom ulica i blokova unutar zidina, a djelomično je postavljen izvan zidina. Glavni željeznički kolodvor nalazi se na dodiru s nekadašnjim gradskim zidom, s velikim perivojem ispred njega, ali željezničke građevine i pruga podižu se na neizgrađenim površinama. Smíchov je primjer željeznice kolodvora što se nalazi u industrijskom predjelu, a koji je ostao na istome mjestu više od jednog stoljeća (do danas ima snažan industrijski karakter, premda u tranziciji).

Budimpešta – Željeznički kolodvori i pruge nalaze se izvan izgrađenoga tkiva grada, dajući tako priliku razvoju novih urbanističkih koncepata u nadolazećem razdoblju intenzivne urbanizacije na prijelomu 19. i 20. stoljeća.

Zagreb – Kolodvori su podignuti na neizgrađenim prostorima, tada okruženi vrtovima, voćnjacima i poljima. Prvi (danasnji Zapadni kolodvor) smjesten je u blizini vojarnje, što je gradskom tkivu zapadnoga dijela grada dalo prepoznatljiva i jedinstvena obilježja. Položaj kolodvora na neizgrađenim terenima potaknuo je i omogućio prepoznatljivu urbanističku zamisao današnjega Donjega grada, koji je zamišljen i većim dijelom izveden u doba Austro-Ugarske Monarhije.

Nedvojbena je uloga željeznice i kolodvora u usmjeravanju i uobličavanju tipoloških obilježja urbanoga tkiva. Posebice je to razvidno kada se kolodvori smjestaju izvan gradskih zidova, odnosno podalje od tadašnjega grada i izgrađenoga gradskoga tkiva. Oni tada postaju pokretači i usmjerivači urbanističkog razvoja i prepoznatljive urbanističke zamisli. Početni rezultati istraživanja, prikazani u ovom radu, ukazali su na urbane preobrazbe na primjerima četiriju srednjoeuropskih gradova, ali i na smjer razvoja gradogradnje između 1867. i 1918. na teritoriju tadašnje Austro-Ugarske Monarhije.

## BIOGRAPHIES

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