The Impact of the Boris Kidrič Ironworks on the Urban Development and Spatial Identity of Nikšić Through Workers' Settlements and Infrastructure

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Introduction

Industrialization in the 20th century dramatically transformed urban environments across the globe, and cities in socialist Yugoslavia, among which Nikšić stands out, underwent significant changes under the influence of industrialization. Founded in 1950, the Boris Kidrič Ironworks[1] became one of the key factors in shaping not only the economic, but also the social and physical structure of Nikšić. It was not just an industrial complex; its existence had a profound impact on daily life, architecture, and urbanism, laying the foundations for the development of specific urban planning solutions that were in line with the ideology and needs of the socialist society.

This paper examines the spatial and social impact of the Boris Kidrič Ironworks on the post–World War II urban development of Nikšić, highlighting the role of industrialization in shaping the city's architectural and planning framework. As a major industrial and social force, the Ironworks influenced not only economic growth but also the transformation of urban space during the socialist period.

Focusing on selected case studies — including the workers' settlements of Humci[2] and Budo Tomović,[3] the city beach on Lake Krupac,[4] sports facilities, and the Institute of Ferrous Metallurgy[5] — this study explores how the Ironworks contributed to improving living standards and strengthening social infrastructure. These examples illustrate the broader processes of socialist urbanization and the central role of industry in defining the post-war urban identity of Nikšić. This research is based on a qualitative analysis of historical documents, urban planning records, architectural plans, and visual materials such as maps, drawings, and photographs that illustrate the transformation of Nikšić during the post-war socialist period. Archival research included technical and project documentation related to the Boris Kidrič Ironworks, as well as studies on workers' settlements and public infrastructure.

The methodological approach combines historiographical reconstruction with urban and spatial analysis, situating local developments within the broader theoretical framework of industrial urbanism and socialist urban planning in Yugoslavia. This enabled a comprehensive understanding

1 Boris Kidrič Ironworks [Željezara Boris Kidrič / Жељезара Борис Кидрич], a large socialist-era steel production complex that played a central role in the industrial and urban development of Nikšić.

2 Workers' Settlement Humci [Radničko naselje Humci / Радничко насеље Хумци], one of the first organized housing areas built for the Ironworks' workers during post-war urban expansion.

3 Workers' Settlement Budo Tomović [Radničko naselje Budo Tomović / Радничко насеље Будо Томовић], a housing complex developed in the 1960s for the growing workforce of Nikšić's industrial sector.

4 Artificial lakes near Nikšić: Krupac, Slano, Vrtac, Liverovići [Крупац, Слано, Вртац, Ливеровићи], man-made lakes created for industrial, energy, and recreational purposes during the socialist development of the region.

5 Institute of Ferrous Metallurgy [Institut za crnu metalurgiju / Институт за црну металургију], a scientific-research institution founded in collaboration with the Ironworks to support metallurgical innovation.

of how industrial production shaped both the physical and social fabric of the city.

This paper will contribute to the understanding of how industrialization, through architectural and urban processes, influences the physical and social shaping of urban environments. Furthermore, it will provide insights into the specific characteristics of urbanization in Nikšić as an industrial city, which throughout its history reflected both social changes and the challenges that industrial production brings to urban spaces.

It is important to note that while the Boris Kidrič Ironworks played a central role in Nikšić's post-war development, it was not the sole driver of the city's architectural and urban growth. Numerous other significant public buildings and residential complexes were constructed during the socialist period, contributing to the rich and diverse urban fabric of Nikšić. This paper aims to position the impact of the Ironworks within this broader context, assessing its scale, quality, and contribution relative to other developments. By doing so, it clarifies the specific consequences of industrialization on Nikšić's spatial development and urban identity during this transformative era.

Industrial urbanization, as a specific phenomenon of urban space development, emerged in the context of accelerated industrialization in the second half of the 19th and early 20th centuries. This process was not only economic but also deeply sociopolitical, as it shaped new social structures and living conditions in urban environments. In the case of Yugoslavia, industrialization became a key component of socialist construction, and its influences on cities like Nikšić are particularly evident in architecture, urbanism, and social organization. Theories of industrial urbanization raise questions about how industrial development reflects the physical and social appearance of cities. In the socialist context, industrial production was not only an economic engine but also an instrument of social and political transformation. Industrial cities often emerged in accordance with planned economies, with workers' neighborhoods and infrastructure being part of a broader ideological framework. According to some authors, industrial urbanization in socialism was focused on egalitarianism, reducing social disparities, and creating new communities through planned housing and public spaces.[6]

Workers' settlements were often positioned as "satellite units" within the broader urban environment, with specific infrastructural solutions and urban characteristics that met the needs of industrial production.[7] In socialist urbanism, workers' settlements were associated with the concept of social equality. Theories on workers' settlements suggest that these areas were designed as "satellite units" within the broader urban environment, with specific infrastructural solutions and urban characteristics tailored to the needs of industrial production.[8] Although the primary goal of these settlements was to improve the living conditions of workers, many studies suggest that workers' neighborhoods were subject to social segregation, where workers, despite improved housing conditions, remained in marginal parts of the city. These social divisions, which manifested both in the physical and the social space, were inherent to industrial urbanization in many countries during that period.[9]

Post-industrial urbanization, as a theoretical framework, deals with the analysis of cities in the context of the decline of industrial production and the shift towards services and high-tech sectors. Although Nikšić was not a typical post-industrial city, in the contemporary urban context we can observe how industrial spaces, including facilities such as the Ironworks, are subject to transformations for new purposes. Through the analysis of post-industrial urbanism, it is possible to examine how cities like Nikšić attempted to adapt to new economic circumstances by reducing their dependence on heavy industry.[10]

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6 Peter Hall, *Urban and Regional Planning* (London: Routledge, 2002), 112.

7 Raymond Williams, *The Country and the City* (London: Chatto and Windus, 1973), 45.

8 Harvey Molotch, "The City as a Growth Machine: Toward a Political Economy of Place," *American Journal of Sociology*, vol. 82, no. 2 (1976): 309–332 https://www.jstor.org/stable/2777096.

9 David Harvey, *Social Justice and the City* (Oxford: Basil Blackwell, 1973), 67.

10 Richard Sennett, *The Fall of Public Man* (New York: W.W. Norton, 1977), 100.

Historical Context of the Development of Nikšić After World War II

The post-war period in Yugoslavia was marked by rapid industrialization and modernization, driving urban planning efforts focused on population growth and the economic needs of the state. Influenced by socialist ideals of balanced development and space rationalization, urbanism aimed to improve living standards and job opportunities in cities. As a key industrial hub in Montenegro, Nikšić faced the challenge of keeping pace with industrial growth while providing adequate infrastructure and housing for workers and their families. Its urban plans reflected broader Yugoslav trends but were adapted to meet specific local needs.

In the first half of the 20th century, Montenegro, initially as an independent state and later as part of the Kingdom of Yugoslavia, remained an area with a low level of development. The Balkan Wars followed by World War I severely impacted an already fragile economy based mainly on agriculture and crafts. Even the interwar period, which was a time of recovery in a broader context, did not bring significant economic progress to Montenegro. Due to poverty and significant population loss during the wars, the country remained underdeveloped and poorly urbanized.[11]

After the end of World War II, Montenegro became one of the constituent republics of the new Socialist Federal Republic of Yugoslavia. The change in political and social governance played a decisive role in the development of the republics, and consequently, of their cities. In this context, Nikšić stands out as an example of a city that recorded rapid development in economic, industrial, cultural, and social aspects. The physical manifestations of this development are particularly evident in the fields of architecture and urbanism.

One of the primary goals of socialist governance was to ensure uniform and balanced development across all Yugoslav republics. Considering that Montenegro was among the least developed regions, particular attention was given to its economic development. The city of Nikšić, the second largest city in Montenegro, due to its geographical location and natural resources, was chosen as the focal point of Montenegro's industrial development.

Natural Context and Characteristics of Nikšić as the Basis for Industrial Development After World War II

Nikšić, located in western Montenegro at about 630 meters above sea level, benefited from its geography, proximity to major transport routes, and abundant natural resources — such as iron ore, stone, and water — laying the foundation for its development as an important industrial center in the second half of the 20th century.

The climate, with moderate continental characteristics, allowed for relatively favorable living and working conditions, while the hydroelectric potential of nearby rivers and lakes, particularly the construction of the Krupac Hydroelectric plant, provided an energy base for heavy industry needs. These natural advantages were crucial factors in the decision to build the Boris Kidrič Ironworks in Nikšić, marking the beginning of one of the most significant periods of economic and social development in the city.

The topographic features of the Nikšić Field, its basin-like appearance, and its openness through passes and valleys that cut across the mountainous framework were of great importance for Nikšić's function as the central city of the surrounding area. The passes and valleys extend radially, enabling the development of transportation, making Nikšić a crossroads that connects the

11 Zdravko Ivanović, "Razvoj nekih urbanih naselja u SR Crnoj Gori" [Development of Certain Urban Settlements in the Socialist Republic of Montenegro], *Geographica Slovenica* 10, no. 1 (1979): 85.

mountainous, central, and coastal parts of Montenegro.[12] The geographical features that define Nikšić's location clearly indicate that this city plays a key role both in connecting different regions of Montenegro and linking Montenegro with neighboring Bosnia and Herzegovina and Croatia. Additionally, it should be noted that the Municipality of Nikšić is the largest administrative unit in Montenegro, covering an area of 2,065 km², which constitutes 14.95% of the country's territory. However, the municipality also includes a large amount of mostly uninhabited rural land, so its size does not directly reflect the size or urban character of the city proper.

Regarding water resources, there are both permanent springs and accumulations. Permanent springs are located in the northern part of the Nikšić Field and are used for supplying the population. The accumulations consist of several lakes used for industrial and recreational purposes, including: Krupac Lake (5.7 km²), Slano Lake (8.8 km²), Vrtac (13.4 km²), Liverovići (0.93 km²), and the Grahovo accumulation.[13]

Although the Municipality of Nikšić covers 14.95% of Montenegro's territory, with significant agricultural land and extensive forests (approximately 108,421 ha, of which 78.2% is forested), these natural resources have had limited direct impact on the industrial development concentrated in the urban area of Nikšić. Still, the surrounding rural and forested areas provide an important environmental and economic context for the city's overall development.[14] The Nikšić municipality is particularly rich in deposits of red and white bauxite. There are several bauxite deposits, with established reserves ranging from 962,000 tons to 9,518,000 tons. It is estimated that the total bauxite reserves in the Nikšić region amount to around 200 million tons.[15]

This brief overview of the natural resources available to the industrial city of Nikšić serves as an introduction to the review of the economic activities and companies established based on these resources, which significantly influenced the development and even the shaping of the city. The water resources contributed to the establishment of the company Gornja Zeta in 1951, with the aim of developing the electric power industry and energy potentials to ensure a constant supply for consumers and industrial plants. This company constructed the Perućica Hydroelectric power plant.[16][17]

The first agricultural company in Nikšić was the Brewery Trebjesa,[18] known for producing high-quality beer. At its peak, the Brewery employed around 1,000 workers. In 1967, an Agricultural-Food company was established in Nikšić, which over time evolved into a company employing approximately 1,500 workers. This company had its own chain of markets, bakeries, dairy processing facilities, and more. One of the companies that was developed based on the natural wealth of the forests was the Forestry-Industrial Company, which produced top-quality furniture, mainly for the foreign market, particularly Italy. This company employed around 800 workers. In 1971, the Textile industry factory Koni was opened in Nikšić, which employed

12 Branko Radojičić, *Opština Nikšić: priroda i društveni razvoj* [The Municipality of Nikšić: Nature and Social Development] (Nikšić: Filozofski fakultet, 2010).

13 Branko Radojičić, *Vode Crne Gore* [Waters of Montenegro] (Nikšić: Institut za geografiju, Filozofski fakultet, 2005).

14 *Lokalni ekološki plan (LEAP)* [Local Environmental Action Plan (LEAP)] (Nikšić: Opština Nikšić – Služba menadžera i Služba za zaštitu životne sredine, 2012).

15 Miodrag Gomilanović, *Mineralna proizvodnja i rudarske sirovine u Crnoj Gori* [Mineral Production and Mining Raw Materials in Montenegro] (Podgorica: Ministarstvo industrije, energetike i rudarstva Republike Crne Gore, 1999).

16 Perućica Hydroelectric Power Plant [Hidroelektrana Perućica / Хидроелектрана Перућица], one of the oldest and most significant hydroelectric plants in Montenegro, contributing to the region's energy infrastructure.

17 Biljana Mićković, "Analiza kretanja broja stanovnika Opštine Nikšić u periodu 1948–2011, korelacija sa procesima industrijalizacije i tranzicije" [Analysis of Population Trends in the Municipality of Nikšić from 1948 to 2011: Correlation with the Processes of Industrialization and Transition], *Tehnika* 69, no. 4 (2014).

18 Brewery Trebjesa [Pivara Trebjesa / Пивара Требјеса], a historic brewery in Nikšić that formed part of the city's industrial landscape and local identity.

about 360 workers. To explore and exploit the bauxite ore, the Bauxite Mines Company[19] was founded in Nikšić in 1948, which at its peak employed about 2,000 workers. After the Bauxite Mines, the first metal processing company in Montenegro, Metalac, was established, which would employ around 800 workers. For the purposes of the city's construction, the Construction Company Crna Gora was founded in 1947. It built almost all the important buildings in the city and in the republic. Following the major 1979 earthquake in Montenegro the company had as many as 3,000 workers. The companies mentioned were key to exploiting regional natural resources, spawning numerous related businesses in services, trade, and transport. Their economic impact led to rapid population growth in Nikšić, which necessitated new architectural and urban developments, shaping the city's physical form and cultural life.

Demographic Changes and Urbanization of Nikšić After World War II

After the end of World War II, Nikšić transitioned from being a small town to a regional industrial center, leading to significant demographic changes and accelerated urbanization. A key point in this process was industrialization, which began with the opening of the Boris Kidrič Ironworks. This industrial complex became the main driver of the city's economic development, creating a demand for a large workforce. This, in turn, caused migration from rural areas to Nikšić, leading to an increase in the population.

Before World War II, Nikšić was a small town with just over 4,500 residents. Between 1921 and 1941, the population growth rate was only 20%, whereas between 1941 and 1961, the population grew by 338%, which was a 17-fold increase. This dramatic population growth directly impacted the urban transformation of the city.[20] The level of urbanization in Nikšić also grew significantly during this period. According to the data, this urbanization rate was 22.1% in 1953, 35.1% in 1961, and reached 49.5% in 1971.[21] The rapid growth can be attributed to the significant increase in the number of migrants coming to the city to work in the new industrial plants.

This process of industrialization and urbanization was not accidental but rather the result of strategic political and administrative decisions aimed at accelerating the city's development. A particularly important factor was industrial growth, which became the key sector of Nikšić's economical development. The percentage of the population employed in industry and mining in 1953 was only 6.07%, but by 1961 it had risen to 34%, and by 1971 it had increased to 44%.[22] This increase in industrial employment indicates that the socio-economic changes in the city were largely influenced by the newly established industrial facilities such as the Ironworks. At the end of the 1980s, just before the dissolution of Yugoslavia, Nikšić had about 56,000 inhabitants, while the municipality had a population of approximately 74,500. Around 22,000 people were employed in the industry, including 7,500 workers in the Ironworks, 1,500 in the Electric Power Company, 2,000 in the Bauxite Mines, 800 in the Brewery, 800 in the Metal Company, and 2,000 in the Agricultural Company. After the 1990s, Nikšić's population declined significantly due to multiple factors: the breakup of Yugoslavia, international sanctions (1992-2002), and an economic shift. Sanctions disrupted raw material imports and product exports, causing reduced production and layoffs in major industries like the Ironworks and Electric Power Company.[23]

19 Bauxite Mines Company [Rudnici boksita / Рудници боксита], a major mining enterprise in Nikšić, essential to the supply chain of the Ironworks and the broader economy.

20 Živko Bulajić, *Moderne osnove Nikšića* [Modern Foundations of Nikšić], (Zagreb: Grafički zavod Hrvatske, 1972).

21 Zdravko Ivanović, "Urbanizacija SR Crne Gore" [Urbanization of the Socialist Republic of Montenegro], *Geografski glasnik* 38, no. 3 (1976): 117.

22 Zdravko Ivanović, *Nikšić, urbano-geografska studija* [Nikšić, an Urban-Geographical Study] (Beograd: SANU, Geografski institut „Jovan Cvijić", 1979).

23 Electric Power Company [Elektroprivreda / Електропривреда], the state-owned energy provider responsi-

The poorly managed transition from socialism to capitalism, marked by politically driven privatizations, further led to production cuts, layoffs, and company bankruptcies.

Today, the number of industrial jobs has drastically declined. The population decline caused not only job losses but also a drop in the quality of life. Reduced industrial employment lowered family incomes, prompting migration within Montenegro and abroad. Corrupt and poorly managed privatization cut state investments and increased debt, worsening the economy. Despite ongoing challenges, some signs of recovery have emerged. Recent local investments in infrastructure, strategic industries, and the service sector — particularly tourism and energy — offer potential for economic growth. The return of major enterprises and economic diversification may support job creation and population stabilization.

Urban Development of Nikšić During the Post-War Industrialization Period

The post-war reconstruction and rapid development of Nikšić required the urgent and systematic implementation of urban planning. Immediately after the Second World War, the city lacked an institutional structure responsible for implementing urban plans or for controlled construction, which further complicated the process of planned urbanization. The organization of urban planning services developed gradually. Initially, the Urban Planning, Communal, and Housing Council was formed, and by 1955 it evolved into the independent Urban Planning Council. As a culmination of the institutionalization of urban planning activities, the Municipal Institute for Urbanism and Design was founded in December 1963, which led the unified policy of urban and architectural design of the city, covering everything from research studies and analyses to specific urban planning projects.

It is important to note that all the key post-war urban plans for Nikšić during this period were developed by planning teams and individuals from outside Montenegro. The second post-war urban plan for Nikšić was prepared by the Urban Planning Department of the Faculty of Architecture, Civil Engineering, and Geodesy in Zagreb, between 1954 and 1958. The author of the plan was the prominent architect and professor Josip Seissel and the development of the plan involved architects Dragan Boltar, Boris Magaš and Bruno Milić.

This urban plan was the first to clearly define the broader and narrower construction zones of the city, thereby providing a functional continuation and enhancement of the first regulatory plan from 1883, created by architect Josip Šilović Slade. This initial phase of Nikšić's urbanization established the fundamental framework of the city's spatial organization and urban identity, which holds particular significance in the Montenegrin context. The socialist planning phase thus had a solid foundation to further develop the cityscape and ensure continuity. Seissel's plan retained certain elements from Slade's concept, particularly regarding the central green belt, where public and social buildings were envisioned, as well as larger-scale buildings. The plan also foresaw the preservation of the central part of the city in its existing form, representing a confirmation of the value of Slade's original vision.[24]

The quality of the subsequent urban plan — the General Urban Plan from 1986 — lies in the consistent application of the fundamental principles of the previous urban solutions, which enabled continuity in the spatial development of Nikšić. Furthermore, the plan strategically positioned socially significant buildings along the zone adjacent to the historical core, thereby strengthening the connection between urban continuity and contemporary development. Additionally, it reinforced the industrial zones and areas designated for workers' settlements.[25] (Fig. 1)

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ble for electricity production and distribution in the region.

24 Vladimir Bojković, "The Meander Building by Architect Bruno Milić; The Beginning of Modernism in the City of Nikšić," *Prostor* 26, no. 1(55) (2018): 40-51, https://doi.org/10.31522/p.26.1(55).3

25 Vladimir Bojković, "Development of the City of Nikšić through the Planning Documentation of Croatian Architects," *Prostor* 32, no. 1 (2024): 156-67, https://doi.org/10.31522/p.32.1(67).13.

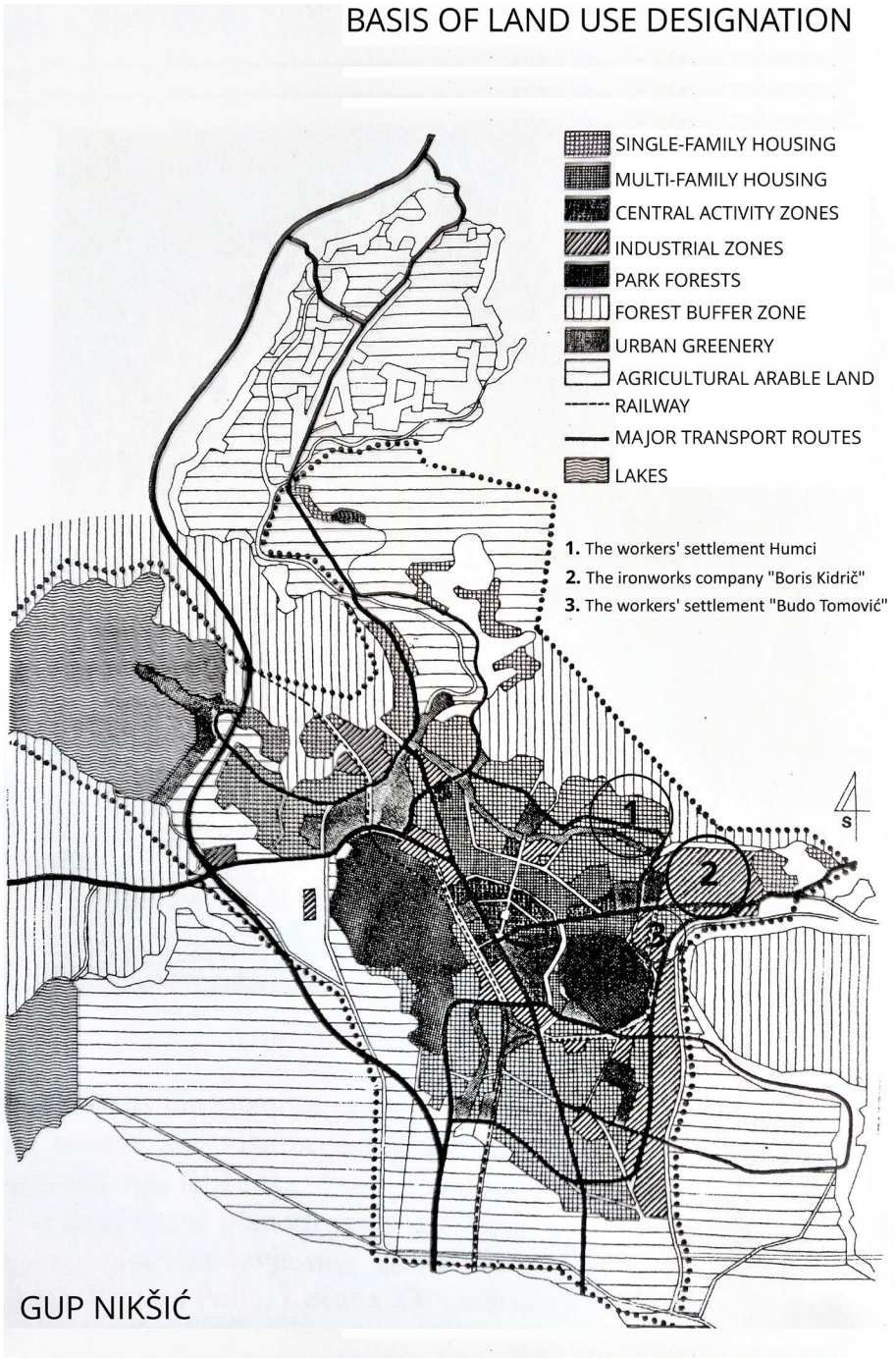


Fig. 1: General Urban Plan of Nikšić (1986): the positions of the workers' settlements and the steelworks zones are marked with numbers

The Impact of the Kidrič Ironwork on the Development and Urbanization of Nikšić

The Boris Kidrič Ironworks was founded in 1950, with its first production facilities commencing operations in 1956, and the planned construction of the factory being completed in 1961. The construction of the plant was overseen by engineer Rihard Merker. From its opening until the early 1990s, the Ironwork was one of the most important industrial facilities, not only in Montenegro but also in Yugoslavia. (Fig. 2)

This factory played a crucial role in the planned industrial development of Nikšić, which had previously been predominantly agrarian. The advantages provided by the proximity to water resources for electricity production, as well as the city's location near coastal ports that facilitated the transportation of raw materials, created ideal conditions for the establishment of such an industrial facility. Moreover, the fact that Nikšić could provide a large enough workforce was critical to the plant's operation.[26]

In the initial decades the Boris Kidrič Ironworks was an industrial giant, and its steel production had a significant impact on the economy of Nikšić and Yugoslavia. The factory was the cornerstone of industrial development, and its existence led to dramatic changes in the urban and social life of the city. The construction of the ironworks was in line with broader industrial plans, and the steel plant became a symbol of the modernization of Nikšić, which was transitioning from an agrarian to an industrial phase.[27] The spatial structure of the factory encompassed various functional zones. The main facilities of the steel plant included large production

26 Bulajić, *Moderne osnove Nikšića*.
27 Ibid.

Fig. 2: Construction of the steel mill

halls, blast furnaces, and steel melting plants, which occupied extensive areas. Additionally, the steel plant included logistical spaces for the storage of raw materials (such as ore and coal) and finished products, as well as technical facilities required for the operation of the plant, such as power stations, compressors, and water supply and sewage systems.[28]

Worker settlements, such as Humci and Budo Tomović, built in close proximity to the factory, had a great impact on the urbanization of the outskirts of Nikšić. The steel plant was not only a production center but also influenced the development of the city's infrastructure. The entire urbanization of Nikšić was directed towards the needs of the factory, which included the expansion of city boundaries and the creation of new settlements related to industrial production.[29]

However, at the beginning of the 1990s, the political and economic changes shattered the production and the survival of the factory. During this period, steel production at the plant declined, the number of employees was drastically reduced. The factory, which once had more than 7,000 workers, now only employs a few hundred.[30] Although the original production of the Boris Kidrič Ironworks has ceased , the facility still operates on a limited scale, currently producing structures for solar panels. Notwithstanding, the Ironworks have played a key role in the history and development of Nikšić, laying the foundations for the urban transformation of the city and contributing to the development of its industrial infrastructure. The spatial organization of the factory as well as its economic and social impact have left a deep mark on Nikšić, which is still reflected in its urban and social character today.

28 Ibid.

29 Ibid.

30 Agence France Presse, "List of International Sanctions Against Serbia" (2000), accessed May 15, 2020, https://www.globalpolicy.org/global-taxes/42528.html.

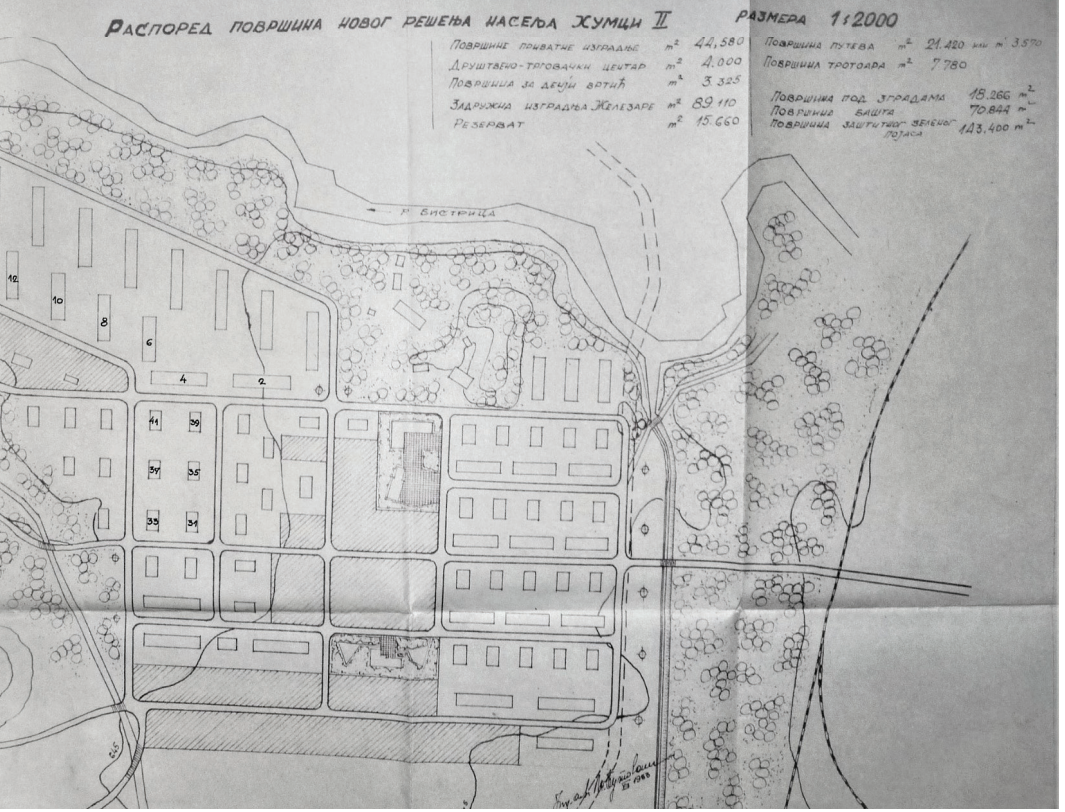
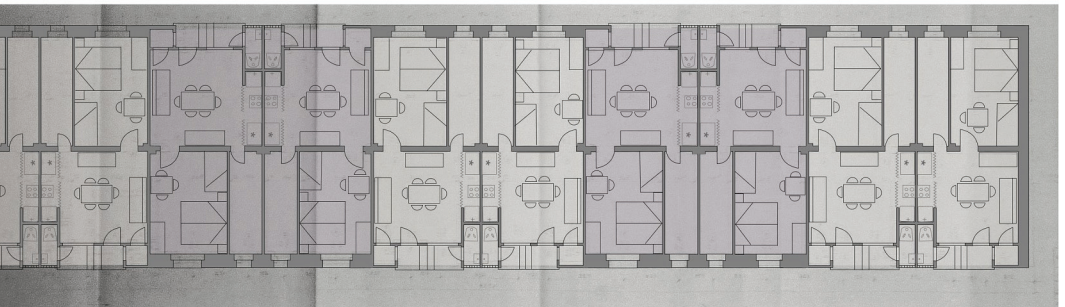


Fig. 3: Workers' settlement Humci: plan, aerial view of the settlement, typical building plan and facades



Workers' Settlements Humci and Budo Tomović in Nikšić: A New Urban and Architectural Typology

Among the numerous industrial enterprises that shaped the development of the city of Nikšić, the Boris Kidrič Ironworks played a key role specifically in shaping the housing infrastructure for workers and the surrounding urban environment. This paper focuses on examining how the Ironworks influenced the spatial and social development of workers' settlements and related infrastructure in Nikšić. Statistical data from 1954 show that the city had 1,780 housing units with a total area of 84,376 m².[31] 1,371 residential buildings were constructed between 1954 and 1961, with a total housing area of 73,624 m². In the following decade, from 1961 to 1971, the number of new housing units increased to 3,256, bringing the total residential area to 138,965 m², which was double the size of the previous period.[32]

Between 1961 and 1971, Nikšić underwent rapid urbanization driven by the expansion of its industrial base, with the Ironworks at the center of economic growth. The population grew significantly, mostly due to an influx of workers, creating an urgent need for organized housing. For the first time urban planning included the construction of multi-family and collective housing, which also spurred the development of broader social infrastructure — such as roads, schools, kindergartens, markets, and service facilities. In this context, the workers' settlements of Humci and Budo Tomović became key elements of the city's evolving urban fabric.

Workers' settlement Humci

Architect Vsevolod Butovski, one of the architects who influenced the urban development of Nikšić after World War II, and an engineer employed at the Ironworks, was responsible for the development of the urban plan on the basis of which the Humci settlement was constructed. The plan proposed by Butovski focused on the creation of a settlement for several thousand workers and their families, located in close proximity to the Ironworks, with the goal of providing temporary housing for the factory workers. Initially, workers' families stayed in the settlement until they secured larger apartments in the city, after which new workers would move into the accommodations. This system lasted for only a few years, after which the residents of Humci became permanent inhabitants of their housing units. (Fig. 3)

The settlement consists of two types of residential buildings: single-story and multi-story buildings. The single-story buildings are located in the western part of the settlement and consist of units with one- and two-room apartments. The buildings are arranged in two parallel rows, with the two-room apartments located closer to the main street, while the one-room apartments are positioned somewhat to the north. The apartments are oriented so that the dominant axis is east-west, while the shorter sides of the buildings face south and north, providing adequate protection from strong northern winds, as well as ensuring good airflow within the urban block.[33]

The single-story buildings with one-room apartments typically contain 10 apartments, four have entrances facing west, and six facing east. A typical one-room apartment has around 40 m², with a multifunctional living area that includes living room, dining area, and kitchen. Although the space was initially inadequate for four-member families, over time, the residents of the apartments often expanded the living area or changed the function of the rooms (e.g., converting storage rooms into children's bedrooms), which led to deviations from the original plan and alterations to the building facades. While these interventions were practical, they did not significantly contribute to improving the quality of the space. The most common adapta-

31 *Statistički godišnjak NR Crne Gore* [Statistical Yearbook of the People's Republic of Montenegro] (Titograd, 1955).

32 Ivanović, *Nikšić*.

33 Vladimir Bojković, "Workers' Settlements in the Former Industrial City of Nikšić, Montenegro," *Periodica Polytechnica Architecture* 51, no. 2 (2020): 189-95, https://doi.org/10.3311/PPar.15275.

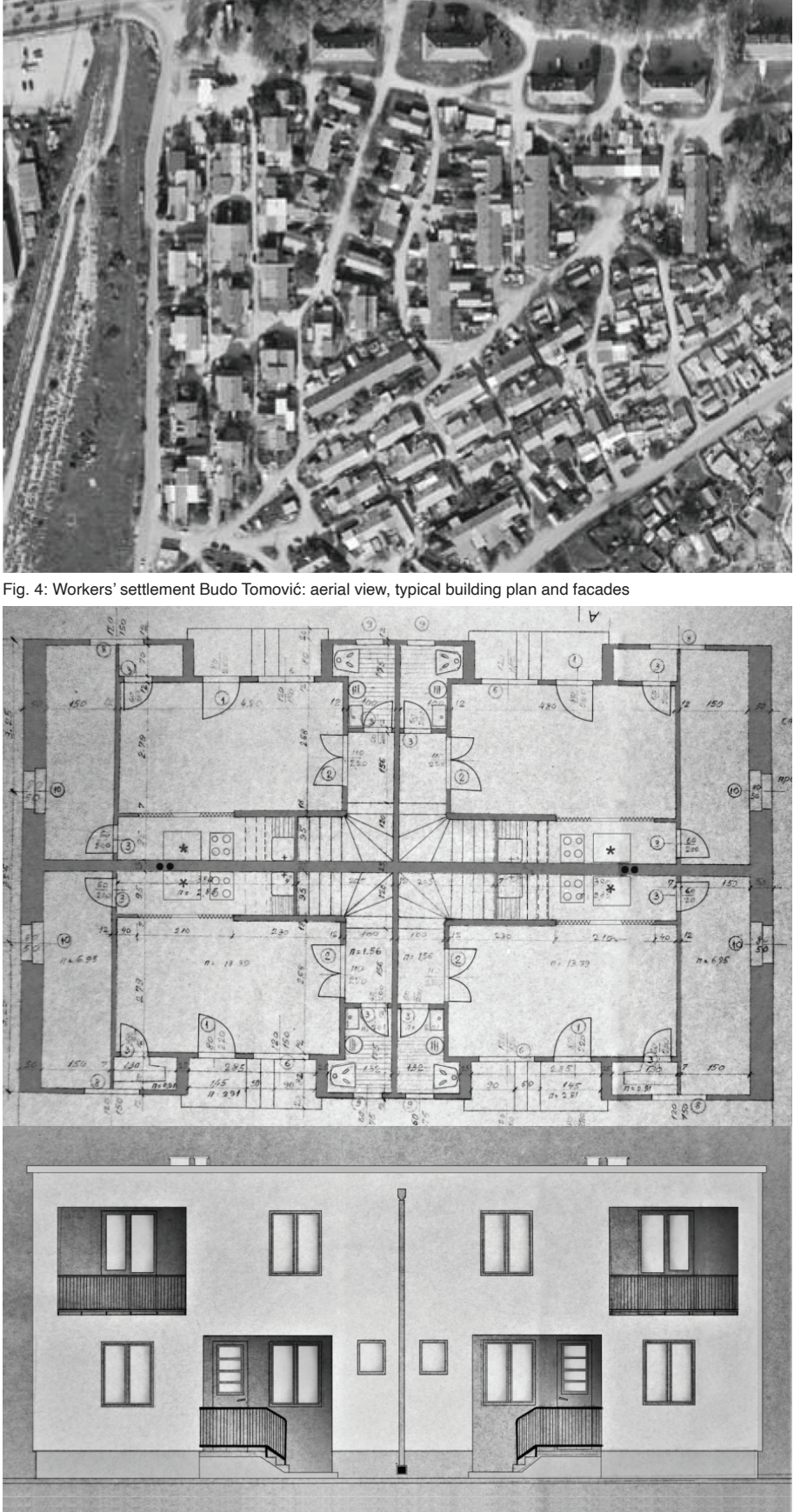


Fig. 4: Workers' settlement Budo Tomović: aerial view, typical building plan and facades

tions included expanding the living room, which often resulted in a loss of direct natural light. Another type of adaptation was the construction of a bedroom in the attic, with wooden stairs built in the storage room.

The settlement was organized so that each apartment had two courtyards: one in front of the entrance and another in front of the bedroom window. While this arrangement provided more privacy in the courtyards, practice showed that neighbors often exchanged courtyards in order to create larger and more functional spaces for gardening. The single-story buildings, located in the eastern part of the settlement closer to the Ironworks, are characterized by gabled roofs, clearly marked entrances, and loggias. These buildings, which include various apartment types (one-bedroom, two-bedroom, and three-bedroom), provided greater functionality and quality of life, as they were assigned to larger families. Furthermore, their layout within the urban block can be considered optimal, as the buildings are spaced at adequate distances to ensure good sunlight, ventilation, and room for parking.

The Humci settlement is also distinguished by a significant number of facilities that support everyday life, such as stores and craft workshops, but the most notable building is the Sunce Kindergarten, designed by architect Pavle Popović in 1975. For this building Popović received the Republican Borba award.[34] The kindergarten was designed in an almost archetypal house shape, with a hipped roof and skylight, and was constructed using concrete and brick. The urban plan of architect Butovski also foresaw the construction of a large park around the settlement, which would further improve living conditions; however, socio-economic factors led to unplanned construction and partial devastation of the area. Although the settlement has undergone certain changes over the years, particularly in terms of apartment extensions, Humci remains one of the most significant examples of a workers' settlement in Nikšić that has managed to preserve its characteristic urban and architectural integrity.

Workers' settlement Budo Tomović

The workers' settlement Budo Tomović is located in close proximity to the Ironworks and was designed to accommodate several hundred workers and their families. The urban planning for this settlement was developed by architect Vsevolod Butovski, who had also been responsible for the development of other parts of the city. The settlement is organized in the form of parallel streets, with residential buildings arranged in "cluster" configurations, where each building has a double rectangular layout. (Fig. 4)

In terms of typology, the Budo Tomović settlement presents a new approach to housing organization, as the buildings were designed to house four families, each occupying one corner of the rectangular foundation of the building, both on the ground floor and the upper floor. These buildings were among the first in Nikšić to feature duplex apartments, where the living area (kitchen, dining room, living room, and toilet) is located on the ground floor, while the two bedrooms with a loggia are on the upper floor. Although the spatial organization was innovative, the main drawbacks were related to the small size of the living area. The room combining kitchen, dining room, and living room was often insufficient for the everyday life of the families. An additional problem was the large pantry space, and over time residents adjusted the internal layout of the apartments, frequently expanding or modifying the living area. These changes, however, were not only internal but also affected the exterior appearance of the buildings, which led to the loss of their original architectural expression.

Interestingly, these buildings were among the first in Nikšić to feature flat roofs, which at the time represented an architectural innovation. Unfortunately, today the workers' settlement Budo Tomović has been largely devastated, with many buildings neglected, partially demolished, or altered through unsanctioned extensions and modifications, which have compromised both its spatial integrity and original architectural features.

34 Republican Borba Award [Republička nagrada Borba / Републичка награда Борба], a prestigious Yugoslav award granted for achievements in architecture, urbanism, and social contribution.

Based on the analysis of the workers' settlements in Nikšić, it can be concluded that these buildings had a significant impact on the urban and architectural development of the city. In terms of housing typology, the settlements enabled the development of the urban structure in a rational manner, but due to functional deficiencies many of the buildings underwent important alterations. The Humci and Budo Tomović settlements today serve as monuments to the time when the Boris Kidrič Ironworks was a key factor in the development of Nikšić, and the workers' settlements became the beginning of the city's urban expansion.

The Impact of the Boris Kidrič Ironworks on the Infrastructure and Urban Development of Nikšić

The industrialization of Nikšić, especially after the founding of the Boris Kidrič Ironworks, marked a turning point in the city's development. Beyond its economic role, the Ironworks influenced urban planning, infrastructure, and public life — contributing to transportation systems, communal services, and sports facilities. Its impact extended beyond production, becoming a central factor in shaping the city's modern identity.

The Ironworks directly participated in the construction of the municipal infrastructure of Nikšić, using its own financial resources to improve the city. Among the most important interventions were the construction of the sewer system and water supply networks, the installation of underground telephone and electric cables, and the asphalting of numerous streets in the city center. These interventions were crucial in raising the technical standard of the city and creating conditions for its further urban development. The Ironworks thus assumed the role of not just an industrial entity, but also an active participant in the modernization of public infrastructure.

The management of the Ironworks paid special attention to environmental protection and the creation of a sustainable relationship between industry and nature. The factory itself was built approximately 3 kilometers away from the city center, physically and visually separating it from the suburban settlements. A green belt was formed between the industrial complex and the city, intended for air filtration and purification, with the goal of mitigating the negative ecological effects of industrial production.

Furthermore, the Ironworks established its own horticultural service, staffed by engineers and responsible for the landscaping within the factory grounds. However, its contributions were not limited solely to the factory complex – important funds were also invested in the development and maintenance of green spaces throughout the city. The results of these efforts are visible in the statistical data: the area of urban greenery per capita in the city was 3.90 m² in 1964, and by 1973, it had increased to 6.10 m².[35]

One of the most striking examples of the Ironworks' impact on improving the quality of life was the construction of the city beach at Krupac Lake. This complex was built in 1973, largely funded by the Ironworks. The urban design was created by architect Slobodan Vukajlović, and among its most notable structures are the beach restaurant, designed by architect Duško Dude Popović, and the restaurant building designed by architect Ljubo Vojvodić. This complex not only contributed to the recreational and tourist capacities of the city, but also gave Nikšić a distinctive visual identity.[36] (Fig. 5) In addition to recreational facilities, the Ironworks demonstrated a high awareness of the importance of sports for the workforce and the wider community. An example of this is the project for the Recreational-Sports Center Čelik,[37] which was fully financed

35 Milorad Mrvošević, *Značaj željezare „Boris Kidrič"za Nikšić* [The Importance of the "Boris Kidrič" Ironworks for Nikšić], diplomski rad (Novi Sad: PMF, 1975).

36 Vladimir Bojković, "Željezara 'Boris Kidrič' i urbanizacija grada Nikšića" [The "Boris Kidrič" Ironworks and the Urbanization of the City of Nikšić], *Pogled* no. 40.

37 Čelik Recreational-Sports Center [Rekreativno-sportski centar Čelik / Рекреативно-спортски центар Челик], a partially realized urban project envisioned as a multifunctional leisure and sports facility for workers.

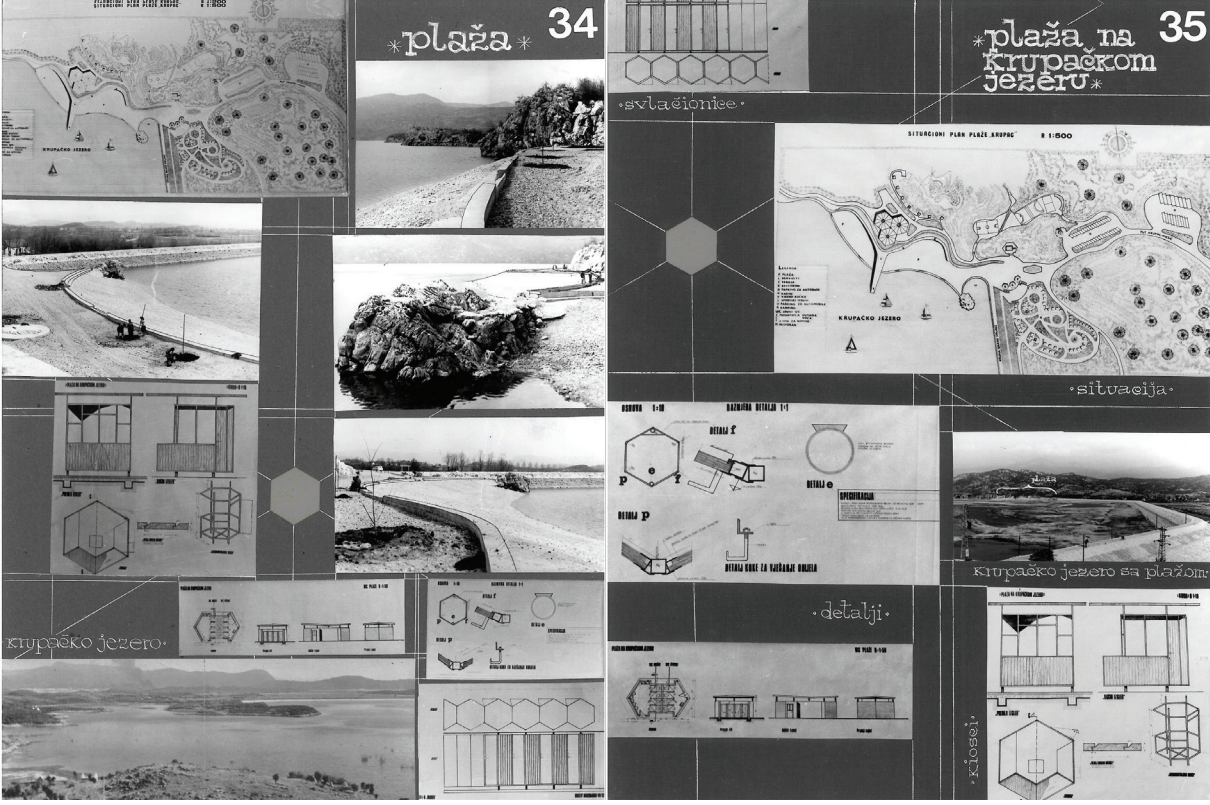


Fig. 5: Original drawings of the project for the city beach at Lake Krupac, architect Slobodan Vukajlović

Fig. 6: Recreational and Sports Center Čelik, architect Kosta Popović, Nikšić, 1962

(1) Throwing area for javelin, discus, and hammer. (2) Volleyball court. (3) Basketball court. (4) Footabll (soccer) field. (5) Athletic equipment. (6) Athletics track. (7) Shot put throwing area. (8). Exercise field. (9) Archery range. (10) Handball court. (11) Mini football (futsal) court. (12) Children's playground. (13) Changing rooms. (14) Water surfaces. (15) Recreational area. (16) Entrance

by the ironworks. The project was developed in 1962 by the Belgrade design company Sportprojekt, under the leadership of architect Kosta Popović, the author of the project for the Crvena zvezda stadium in Belgrade. Although the construction of the complex did not occur to the extent initially planned, the designed concept reflects the ambition to create a modern, multifunctional sports center, intended not only for the steelworks' workers but also for their families and the citizens of Nikšić. The complex was envisioned on a surface of about 8 hectares, with rich amenities: a social building, a summer garden, a bowling alley, an athletics track, numerous sports fields, a shooting range, a children's playground, and a park on the elevation. The planned capacity allowed for simultaneous use by 500 individuals, with a daily capacity of up to 1,500 users. The center was designed to meet the needs of workers' sports games, regular training, children's activities, and various forms of recreation and entertainment. (Fig. 6)

Through investments in infrastructure, urban planning, sports, ecology, and communal facilities, the Ironworks became a key factor not only in the industrial but also in the social and spatial development of Nikšić. Its actions can be viewed as an example of the integration of industry into the broader social system — where economic development serves as a lever for improving urban life and building a modern city.

Institute of Ferrous Metallurgy: The Strength of an Era

The Institute of Ferrous Metallurgy was one of the most important facilities for the industrial development of the city. Also known as the Information and Development Center, it is located on the northeastern foothill of Trebjesa Hill, on a plot of almost 40,000 square meters. Despite its impressive dimensions, its position and the spacious plot make it unobtrusive in the broader context of the city's urban space. The building is physically separated from the central urban areas and borders the industrial track to the east, while to the west it is neighbored by residential blocks. It is surrounded by an abundance of green spaces, including high evergreen and deciduous trees, which allows for a harmonious integration with the natural surroundings of Trebjesa Hill. The architectural composition of the Institute, although large in size, is characterized by a harmonious and simple design with an emphasis on the horizontal distribution of mass, which enables it to blend well with both the natural and urban environment.

Foundation and development of the institute

The Institute of Ferrous Metallurgy in Nikšić was established through collaboration between the Boris Kidrič Ironworks and the Faculty of Mechanical Engineering, Metallurgy, and Electrical Engineering from Titograd (now Podgorica). Although the agreement was signed in November 1978 and construction began shortly after, the Ironworks officially approved the project at the end of 1979. The process was coordinated within the Ironworks, with the Central Workers' Council playing a decision-making role. The Institute was founded to support the practical needs of the Ironworks through applied research in ferrous metallurgy. Its main goals included improving steel production, enhancing product quality, introducing new processes, and developing testing methods. By researching new materials and technologies, the Institute contributed significantly to Nikšić's industrial development. (Fig. 7)

The main architectural project of the Institute was designed by the firm Unioninvest from Sarajevo. According to the archival documentation of the Institute, the main project was carried out by the Institute for Architecture and Urbanism at the Architectural and Urban Planning Faculty from Sarajevo. The authors of the architectural design were the architects Izet Galičić and Mehmed Hrasnica, with the collaboration of architect Šefkija Dreca. This project, with its functional and aesthetic qualities, represented a symbol of industrial strength and scientific progress of that era.[38]

38 Vladimir Bojković, "Institut crne metalurgije, snaga jednog vremena" [Institute of Ferrous Metallurgy, the Power of an Era], *Pogled* no. 34.

Fig. 7: Institute of Ferrous Metallurgy

Spatial analysis of the institute of ferrous metallurgy building

The design of the Institute of Ferrous Metallurgy in Nikšić is characterized by two fundamental elements: the volume of the building, or the dynamic mass, and the resolved façade, which results from functional design. These elements arise from the basic functional foundation of the project, and the most accurate way to analyze the building is through structuralism, which treats the volume as a system made up of solid, orthogonally positioned elements.

The larger rectangular volume, whose base is the ground floor, represents the central part of the building. The sides of this rectangle are oriented east-west, and within it, a double system of offices is arranged on the northern and southern sides. In relation to the main volume, three smaller rectangular blocks are placed perpendicularly. Two blocks on the southern side are connected to the production halls, while the smaller block on the northern side houses the laboratory spaces. This arrangement creates a pleasant atrium space, which functionally and visually connects all parts of the building.

The façade of the building is shaped with aluminum windows and metal cladding made of corten steel. Due to its corrosion, corten steel creates a specific color and texture that symbolizes the metallurgical character of the institute. The horizontal distribution of mass is achieved through window strips and parapet cladding, while the vertical division of the façade is expressed in secondary details. The relief on the façade, resulting from the recession of the window strips, creates a contrast between transparent and opaque surfaces, thus achieving a dynamic visual effect.[39]

The entrance façade of the Institute of Ferrous Metallurgy is the most visually striking and architecturally vigorous aspect of the building. The main entrance stands out with its monumental forms, created as an indented reinforced concrete block, symbolizing a gateway or boundary between different spaces and functions. This entrance design serves as the primary access point and also sets the tone for the rest of the building's spatial organization.

On either side of the entrance, there are piazzas with birch plantings and an amphitheater, emphasizing the connection between nature and human activity within the context of research. This intentional design highlights the synergy between the institute's industrial function and its natural environment, reinforcing the idea of balance between human progress and ecological responsibility. The façade solution, with its glass surfaces and simple geometric shapes, contributes to the overall harmony between the natural surroundings and the architectural elements. The area around the entrance and the atrium integrates core principles — functionality, modernism, and ecological awareness — which serve as the foundation for the design of the Institute of Ferrous Metallurgy.

Conclusion

This paper offers the first comprehensive analysis of Nikšić's urban and architectural development through the lens of its industrial growth, focusing on the workers' neighborhoods and related infrastructure linked to the Boris Kidrič Ironworks. It demonstrates how these elements collectively shaped the city's spatial and social identity during the 20th century.

The development of worker settlements such as Humci and Budo Tomović illustrates a deliberate urban strategy that combined functional housing solutions with social infrastructure, reflecting the ideological and practical imperatives of the socialist era. While some buildings have retained their original design and purpose, others experienced functional adaptations that affected their architectural integrity.

39 Ibid.

Beyond residential areas, the Ironworks' influence extended to significant public and scientific infrastructure, including the Institute of Ferrous Metallurgy and ambitious urban projects like the Krupac Lake beach and Čelik Recreational and Sports Center. These reflect a broader vision of urban growth aimed at integrating industrial production with cultural, recreational, and social needs.

As a major industrial and social actor, the Boris Kidrič Ironworks played a central role in shaping Nikšić's modernization, going far beyond production to impact urban planning, education, and community life. This study contributes to the preservation and reinterpretation of Nikšić's industrial heritage by documenting key spatial and social entities and highlighting their importance for sustainable urban regeneration.

By recognizing the legacy of the Ironworks, this paper underscores the critical role of industrial heritage in forming the city's urban identity and offers a foundation for future studies and initiatives that promote heritage preservation and sustainable development in post-industrial cities.

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Fig. 2: Photo collection of Miloš Zvicer.

Fig. 3, 4, 7: Private archive of the author.

Fig. 5: Private archive of David Delibašić.

Fig. 6: *Arhitektura i Urbanizam* no. 15, III (1962): 45.