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HISTORY OF KHARKIV CITY ELECTRIC TRANSPORT

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Kharkiv's urban electric transport system is a living chronicle of the city's turbulent journey through the 20th and 21st centuries—from imperial modernization and Soviet industrialization to post-independence struggle and wartime resilience. Its story begins not with electric power but with horses, whose rhythm on iron rails first taught the city the discipline of fixed-route transit.

The Horse-Drawn Prelude: Konka (1882–1919) Kharkiv's public transport era began on 24 September 1882, when the first horse-drawn railway—the konka—commenced operations. This initial single-track line connected the Azov-Kursk Railway Station (now Kharkiv-Passenger Station) along Alexandrovskaya Street (now Poltavsky Shlyakh) to the Stock Exchange on Nikolaevskaya Square (now Constitution Square). The Belgian firm of Clément Bonnet and Édouard Otlet held the 42-year

concession, having successfully petitioned the Kharkiv City Duma on 2 March 1881.

The network expanded steadily: by 1884, the line reached the Horse Market (Konny Rynok), and a second route from Moskaliovka to the city centre opened in 1885. A third route connecting Zaikivka appeared in 1896. The first depot was built on Horse Square in 1885. By 1914, two konka routes served the city.

The konka era ended amid revolution and civil war. The City Duma voted to terminate the concession on 16 September 1917, and the system finally ceased operation on 23 March 1919. Electrification of the former konka tracks followed rapidly, completed by October 1923.

The Electric Tram: A City Transformed (1906–Present) Kharkiv's electric tram age dawned on 3 July 1906, when twelve German-built MAN motor cars inaugurated service. The first line was a metre-gauge (1,000 mm) single-track route with eight passing loops, running 3.8 kilometres from Pavlovskaya Square (now Rosa Luxemburg Square) to Balashovsky Station. Unlike the privately held konka, the electric tram was municipally owned from the outset.

The city's population of roughly 270,000 at the time was served by approximately 5,000 private cab drivers, and the tram's arrival significantly reduced their numbers. The network expanded rapidly. The Petinska line opened on 3 June 1906, followed by the Klochkivska line on 17 December 1909. A particularly popular route along Pushkinskaya Street was inaugurated in 1910.

A major technical transformation occurred between 1927 and 1930, when the entire network was regauged from metre-gauge to the "Russian Standard" gauge of 1,524 mm—the same width used by mainline railways. The last narrow-gauge tram ran in May 1930. Domestic tram production also began during this period: the first "Kh" series trams (named after Kharkiv) were built in 1927, and by 1933 the fleet counted over 226 motor cars.

The network's scale grew substantially during the Soviet period. In the 1960s, a dedicated line was built to serve the newly constructed Saltivka residential district, Kharkiv's largest housing estate. By the eve of the full-scale invasion in 2022, the Kharkiv tram system was—and remains—the largest in Ukraine, with more than 230

kilometres of track. Today the system operates 11 routes covering 217.6 kilometres of network length.

The Trolleybus: A New Era of Trackless Electric Transport (1939–Present) Kharkiv's trolleybus system—the sixth in the Soviet Union—was inaugurated on 1 May 1939. The city received ten YaTB-4 trolleybuses as a gift from the Soviet government. These vehicles, manufactured at the Yaroslavl Automobile Plant, featured wooden bodies and a maximum speed of 55 kilometres per hour.

The first route stretched 6.6 kilometres from the former Red Army House near Universytetska Hill, along Universytetska Street, Spartakovsky Lane, Tevelev Square (now Constitution Square), and Karl Liebknecht Street (now Sumska Street) to Gorky Park. Regular service began on 5 May 1939. The first trolleybus depot was a modest open-air facility located at the current site of the "Mirror Stream" fountain near the Opera House. By 1940, the line had been extended to the Southern Railway Station, and the fleet had grown to 27 vehicles.

The German invasion of 1941 devastated the young system. In October 1941, during the Wehrmacht's advance on the city, trolleybuses were used as barricades in the city centre, and the infrastructure sustained heavy damage. Service was not restored until May 1944, following the city's liberation.

The 1960s and 1970s were the golden age of Kharkiv trolleybus expansion. The number of routes grew from 8 in 1967 to 38 by 1981, and the contact network almost tripled in length. Depots No. 2 and No. 3 were built during this period and continue operating today. In the 1970s, Kharkiv introduced its first imported vehicles—Czechoslovak Škoda trolleybuses. By the 1980s, the Soviet ZiU-9 (produced at the Uritsky plant in Engels, Russia) dominated the fleet, and Kharkiv became one of the largest operators of this model in Ukraine.

After decades of post-Soviet decline, a significant renewal began in 2019 when the city acquired over 130 modern trolleybuses, including vehicles with autonomous battery-powered capability for off-wire operation. Kharkiv now leads Ukraine in both the number of autonomous trolleybuses and the number of routes they serve.

The Metro: Engineering a Deep-Level Solution (1975–Present) By the mid-

1960s, Kharkiv's population had surpassed one million, and its surface electric transport could no longer cope with demand. A resolution was passed to construct an underground rapid transit system. Work began on 15 July 1968 with the excavation of the first shaft.

Construction proceeded over seven years through challenging geological conditions beneath a densely built city. The first section of the Kholodnohirsko-Zavodska Line opened on 22–23 August 1975 with eight stations along 9.8 kilometres of track. The Kharkiv Metro was the second in Ukraine (after Kyiv) and the sixth in the Soviet Union. Stations on this inaugural segment included Kholodna Hora, Vokzalna, Tsentralnyi Rynok, Maidan Konstytutsii, Levada, Sportyvna, Zavodska, and Turboatom—several of which were later renamed during Ukraine's decommunization process. Public enthusiasm was extraordinary: the system carried 413,000 passengers on its second day of operation, 23 August 1975.

The network expanded in two subsequent phases. The Saltivska Line began construction in 1981, with its first segment opening in 1984 and the final stations reaching the Saltivka neighbourhood on 24 October 1986. The Oleksiivska Line commenced operations in 1995 and was extended to Peremoha station in 2016. Today, the Kharkiv Metro comprises three lines spanning 38.7 kilometres and serving 30 stations, with a daily ridership of approximately 350,000 passengers.

Post-Soviet Decline and Renewal The dissolution of the USSR in 1991 inaugurated a prolonged crisis for Kharkiv's electric transport. Chronic underfunding across Ukrainian municipalities meant new vehicles were purchased rarely and in small numbers. Tram and trolleybus networks contracted as routes were abandoned and infrastructure deteriorated.

A partial recovery began in 2006–2007 when growing municipal budgets and targeted state programmes allowed for rolling stock renewal. By the late 2010s, Kharkiv's trolleybus fleet was undergoing its most significant modernization since the Soviet era, with low-floor and autonomous vehicles entering service. However, the city's tram network—despite remaining the country's largest—continued to rely heavily on aging Czechoslovak Tatra T3 and T6A5 vehicles, many dating from the 1970s and

1980s.

Conclusion The history of Kharkiv's electric transport is more than a technical chronicle. It maps the city's growth from a provincial capital of the Russian Empire into a Soviet industrial metropolis and, ultimately, into an independent Ukrainian city fighting to preserve its infrastructure under bombardment. From the Belgian-built horse tram of 1882 to the metro tunnels that sheltered families in 2022, each generation of Kharkiv's electric transport has served a dual purpose: moving people and embodying resilience. As the city contemplates reconstruction—including plans for new metro stations and continued fleet modernization—the enduring lesson of its past is that mobility, once established, proves remarkably difficult to extinguish.

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LOGISTICS

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Logistics as an integrated management of material and information flows within a system should be based on the following principles:

· Considering the movement of material resources from the primary source to the final consumer as a single material flow, which involves performing processes such as transportation, loading, unloading, moving, warehousing, and storing materials.

· Implementing organizational and managerial mechanisms to coordinate the actions of specialists from various departments involved in material flow management.

· The result depends on how successfully it is possible to link into a system the implementation of a complex of measures regarding the rationalization of packaging, unification of cargo units, improvement of warehousing, optimization of order sizes and inventory levels, selection of the most profitable routes for moving materials, etc.

Material flow is understood as a collection of raw materials, supplies, and semi-finished products that come from suppliers in the form of objects of labor to production units and, transforming there into finished products of labor, reach consumers through