

transportation isn't just about machines; it's about the people who will imagine, design, and manage them—and I plan to be one of them.

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THE WHEELS OF A NATION: A HISTORY OF LAND TRANSPORT IN UKRAINE AND KHARKIV

A. Galytskiy, student,

Kharkiv National Automobile and Highway University

For millennia, the lands of modern-day Ukraine have served as a vast crossroads where empires, trade routes, and cultures intersect. The history of land transport here is a story of constant adaptation—from the earliest tracks carved by Bronze Age traders to the railway networks that stitched together vast imperial territories, and on to the modern highways and metro systems that define independent Ukraine. This journey is mirrored in the fate of Kharkiv, a city that rose from a frontier military outpost in the 17th century to become Ukraine's second-largest metropolis, its explosive growth fueled by successive transportation revolutions. This article traces that shared journey: the evolving arteries of movement that shaped a nation and the city that became one of its most vital transport hubs.

Ancient Routes and Medieval Highways The story of land transport in the region begins not with roads as we know them, but with a network of primitive trade routes

that emerged during the Bronze Age. By the 3rd to 2nd millennia BC, the Carpathian region was already integrated into a trans-European system of pathways connecting the Baltic Sea with the Black Sea and the Aegean world. It was on the fertile plains of what is now Ukraine that some scholars believe the wheel—arguably the most transformative mechanical invention in human history—was first developed by people of the Trypillia culture. Archaeological evidence suggests that wheels likely emerged around 4300 BCE, with significant evidence from Ukraine's Tripolye (Trypillia) culture, where molded clay wheels on toys represent some of the earliest known wheeled artifacts. This single innovation would make long-distance overland freight possible, laying the foundation for all future transport systems. In the 1st millennium BC, ancient Greek writers documented the main European roads, many of which traversed the Pontic steppe where Scythian nomads roamed. Centuries later, the legendary "Route from the Varangians to the Greeks" emerged as a vital artery of the early medieval world. Established in the late 8th and early 9th centuries by Varangian explorers, this route gained significant importance from the 10th until the first third of the 11th century, linking Scandinavia with Byzantium along the Dnipro River and its overland portages. This route played a pivotal role in the formation of Kyivan Rus, the powerful medieval state whose legacy both Ukraine and Russia claim.

During the medieval and early modern periods, the territory that would become Ukraine was divided between competing powers: the Polish-Lithuanian Commonwealth to the west, the Tsardom of Russia and later the Russian Empire to the east, and the Ottoman Empire and its Crimean vassals to the south. This fragmentation meant that land transport developed not as a unified national system but as a patchwork of local trails and imperial post roads serving the interests of distant metropolises. For centuries, the primary means of overland freight across the Ukrainian steppe was the iconic chumak wagon. The chumak trade, a commercial transport industry, emerged in the second half of the 16th century in the Dnieper region as a salt-trading enterprise, with salt brought from the Black Sea coast, Crimea, and Galicia. These large, ox-drawn vehicles, crewed by tough Cossack traders known as chumaky, hauled grain, salt, and fish along well-worn routes connecting the interior to Black Sea ports. Due to the threat

of Crimean Tatar attacks, until the end of the 18th century chumaky traveled in armed caravans of a hundred or more mazhy (wagons) led by an elected ataman (leader). The chumak wagon, known as a mazha, was not fundamentally different in design from a standard peasant cart, but its construction was notably more robust—larger and stronger to withstand the immense stress of long-distance journeys. The chumak trade, which persisted in some regions until the latter half of the 19th century, represented the most significant pre-industrial freight system on Ukrainian lands.

Kharkiv: A Bastion on the Frontier It was in this fluid, contested landscape that the city of Kharkiv was born. Founded around 1655 by Ukrainian Cossacks and peasants fleeing turmoil further west, it began as a military stronghold designed to protect Russia's southern borderlands from Crimean Tatar raids. Situated at the confluence of the Kharkiv, Lopan, and Udy rivers, it was part of the larger historical region known as Slobidska Ukraine (Slobozhanshchyna), a frontier zone that, while under the sovereignty of the Russian Tsar, enjoyed considerable Cossack-led autonomy. For its first century, Kharkiv's "transportation system" was simple: a handful of dirt tracks radiating from its wooden fortress into the surrounding countryside. A network of roads between the various Sloboda Regiments began to form in the early 18th century alongside the traditional routes carved by steppe nomads over centuries. The city's growth, while steady, was incremental; it became a seat of provincial government in 1732 and developed important trade and handicraft manufactures, but it remained a regional administrative and military center, its economic potential still constrained by the limits of ox-cart logistics.

The Iron Horse: Railways and the Transformation of an Empire The mid-19th century witnessed the single most transformative event in the history of land transport across Ukraine: the arrival of the railway. The construction of railways on Ukrainian lands was profoundly shaped by the political division of the territory between the Russian and Austrian Empires. The first line on Ukrainian territory was built in 1861 in the western region of Galicia, then part of the Austrian Empire. The Galizische Carl Ludwig-Bahn linked Kraków and Lviv via Przemyśl, firmly integrating Galicia into Central Europe's economic sphere. Just a few years later, in Russian-ruled Ukraine, the

first rails were laid to connect the port city of Odesa with Balta, a distance that was quickly extended to link the Black Sea coast with Kyiv, with the first train arriving in Kyiv on February 17, 1870. The impact was revolutionary. Railway construction, beginning in earnest in 1865, rapidly replaced the archaic chumak wagon as the primary mode of freight delivery. By the end of the 19th century, four main railway lines crisscrossed Ukraine, connecting the deep interior to the ports of the Black and Azov Seas and turning the region into a vital transport corridor between major economic centers like Warsaw, Moscow, and St. Petersburg.

No city was more dramatically reshaped by this iron revolution than Kharkiv. In the late 1860s, with the opening of the adjacent Donets Basin coalfield, the city's destiny was sealed. The railway reached Kharkiv in 1869, giving it a direct freight connection to the mines. In a remarkably short time, it became a crucial railway junction, linked by 1873 to Rostov-on-Don and Kyiv, and by 1875 to Sevastopol on the Black Sea. This nodal position ignited an industrial explosion. In that period, Kharkiv's own industries, especially engineering, grew rapidly. Factories producing machinery, steam engines, and agricultural equipment sprang up, cementing Kharkiv's role as a key engineering hub for the entire Russian Empire.

The First Urban Revolution: From Horse Cars to Electric Trams The city's staggering population growth created an urgent need for organized public transit. The city's first response came in 1882, when a concession to a private Belgian company inaugurated the konka—a horse-drawn railway. The initial line connected the main railway station to the city center, providing a vital link for commerce. By 1906, the konka had a powerful new rival: the electric tram. The first electric tram line in Kharkiv officially opened on July 3 of that year, with service provided by twelve German-made MAN trams—elegant vehicles with a wooden body mounted on a steel frame.

The introduction of the electric tram in 1906 immediately began to reshape the city's daily life. New routes, radiating from a central hub on Pavlivska Square, reached into every district, transforming Kharkiv into a modern metropolis where workers could commute from further afield. The tram became a public utility, a symbol of civic pride and modernity. Originally built as a metre-gauge system, the network underwent a

major technical upgrade between 1927 and 1930 when it was regauged to the wider "Russian standard" gauge of 1,524 mm, unifying it with the broader national rail system and enabling more efficient transit. The system grew rapidly; by the interwar period, a fleet of domestically produced "Kh" series trams (named after the city) began to arrive, with the first vehicles built in 1927. The "Kh" series cars could carry twice as many passengers as their predecessors. In addition to these successes, the first experiments with motorized buses began in 1910, though they initially failed to compete with the cheaper and more established tram services. An extensive network of horse-drawn cabs, numbering around 3,500 by 1915, continued to serve individual travel needs, illustrating a city in technological transition.

The Soviet period that began after the 1917 Revolution brought a new set of priorities: central planning, heavy industrialization, and military logistics. Transport infrastructure was now a tool of state policy. While railways, with their capacity for vast, coordinated movement, remained the favored child of the Soviet system, roads began to receive more systematic—if often strained—attention. The early Soviet years saw a focus on scientific road-building; Ukraine's first dedicated research institution in this area was founded in Kharkiv on April 15, 1926, as a Road Research Station under the Ukrainian Local Transport Administration, a clear sign of the city's strategic importance.

Kharkiv's elevated status was enshrined when it became the first capital of the newly formed Ukrainian Soviet Socialist Republic (Ukrainian SSR) from 1920 to 1934. This period, though brief, had a lasting impact on its infrastructure. The devastation of World War II brought a catastrophic halt to progress. As a key transport junction on the Eastern Front, Kharkiv was bitterly contested and changed hands several times, suffering immense destruction. Across all of Ukraine, the post-war period was an era of massive reconstruction and expansion. The Soviet model prioritized rail for freight and public transport, leading to a massive electrification program for the main rail arteries from the 1960s to the 1980s. Simultaneously, the 1960s and 1970s were a golden age for road construction in Ukraine. By 1940, the Ukrainian SSR had only 270,700 km of roads, a mere 10.8% of which had a paved surface. In response, the state

invested heavily. The construction of the Moscow-Simferopol highway through Ukraine, carried out in 1948–1949 as part of the program of logistical system development of Southern Ukraine and Crimea, was a landmark project. Between 1959 and 1965 alone, 24,800 kilometers of hard-surfaced roads were built in the republic. By the time of the Soviet Union's dissolution, the vast majority of the road network existing in present-day Ukraine had been constructed.

As Kharkiv's population swelled past one million in the post-war decades, its tram and bus networks could no longer cope alone. The solution was a high-speed off-street system: the metro. Construction began on July 15, 1968. The project was a herculean engineering undertaking that involved boring deep tunnels underneath a major city. The first section of the Kholodnohirsko-Zavodska Line opened on August 23, 1975, with eight new stations and nearly 10 kilometers of track. The Kharkiv Metro was the second in Ukraine (after Kyiv) and the sixth in the USSR, a final, monumental achievement of the Soviet era that offered a vision of a modern, efficient future for an industrial giant.

The Independent Era: Challenges of Transition With the dissolution of the USSR in 1991, Ukraine inherited a vast and technically sophisticated transport network. Established upon the breakup of the Soviet Union, its railway system was the 13th longest in the world, with over 22,000 km of track. The nation also possessed the most extensive tram and trolleybus network of any former Soviet republic. However, maintaining and modernizing this legacy has been one of the defining struggles of the independence era. Economic disintegration as a result of the dissolution of the Soviet Union constituted a serious problem for tram and trolleybus companies, as existing economic ties were severed not only between Central and Eastern European countries but also between ex-Soviet republics. The post-Soviet period saw a well-documented regression in urban electric transport across most Ukrainian cities, with the sharpest decline occurring in the industrial east of the country, including Kharkiv. While some systems stabilized or slightly improved after the initial post-Soviet collapse, many suffered from chronic underfunding, forcing them to rely on an aging fleet. Municipal tram and trolleybus companies generated financial losses and higher indebtedness each

year, with new vehicles bought rarely and in small numbers. The road network also faced a severe crisis, with crumbling Soviet-era highways deteriorating under the pressure of increased car usage and poorly managed federal resources.

Nevertheless, the post-Soviet period was not a story of only decline. The state's policy evolved through stages of modernization and reform, increasingly seeking integration with European transport systems and slowly focusing on safety, environmental sustainability, and digitalization. Before the full-scale Russian invasion in 2022, there was a concerted effort to rehabilitate and expand the country's trunk highway network, including major routes connecting Kyiv with Kharkiv. In urban areas, Ukraine became a vibrant, if chaotic, museum of mobility where ancient, Soviet, and modern technologies coexisted.

Conclusion From the ox-cart to the metro, the history of land transport in Ukraine is a powerful testament to the nation's deep-rooted role as a dynamic Eurasian crossroads. For centuries, its overland routes were not its own but tools of distant empires, built to extract resources and project military power. Yet, these very arteries also fostered explosive economic growth and created deep integration with both European and Eurasian spheres. In Kharkiv, this history is etched into the urban landscape. A frontier fort was forged into a sprawling industrial metropolis by the railway, then layered with a complex nervous system of trams and a deep-bored metro. The war that began in 2022 targets this precise infrastructure, seeking not just to conquer territory but to sever the ligaments of a state. The fight to preserve and rebuild these connections is a fight for movement itself—for the ability of an independent Ukraine to connect its people, its economy, and its future to the world.

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HISTORY OF KHARKIV CITY ELECTRIC TRANSPORT

A. Krasilnikov, student,

Kharkiv National Automobile and Highway University

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