

BUDAPEST BREATHES

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As cities face the dual challenge of improving air quality and decarbonising transport, **Budapest** is leading the way with innovative solutions. From traffic optimisation to AI-driven data analysis, explore how the city is addressing emissions and shaping a more sustainable future under the new EU air quality regulations.

In cities like Budapest, improving air quality and reducing road transport emissions are pressing challenges. The transport sector is a major source of pollution, leading to high levels of particulate matter levels and negatively impacting public health.

In response to stricter air quality standards set by new European Union directives, Budapest has joined the EU's Climate Neutral Cities Mission, signalling its commitment to cleaner air and a more sustainable urban environment. But what exactly is Budapest doing to achieve these goals?

The Danube quay during the summer when it is closed for motorised traffic
City of Budapest



Illustration from the test run to the geometry Gyor3 with a mesh of ca. 1M cells. NOx concentrations at ground level are plotted in AQD-standardized colours and wind velocity by black arrows

City of Gyr



An air quality dilemma Planning (and executing) strategies for cleaner air

Budapest, the ninth largest city in Europe, faces considerable air pollution challenges, with road transport being a substantial contributor. According to the city's Sustainable Energy and Climate Action Plan (SECAP, 2021), nearly 40% of the city's PM10 emissions come from road traffic, with some areas exceeding 50%. With daily traffic involving around 600,000 private vehicle passengers and 350,000 public transport users, the strain on the city's infrastructure is evident. Freight transport, which accounts for 20-30% of urban traffic, disproportionately to emissions, further complicating efforts to decarbonise the city.

Despite a temporary drop in vehicle numbers during the COVID-19 pandemic, road traffic quickly returned to pre-pandemic levels, underscoring the city's reliance on road transport. Although public transport makes up about 35% of the city's modal split, road transport remains a significant obstacle to reducing emissions.

As part of the EU's 100 Climate Neutral Cities Mission, Budapest aims to cut emissions from both transport and domestic heating.

The city has also joined the 'LIFE IP HungAIRy' project to develop a high-resolution air quality model and emission databases, aimed at reducing the number of polluting vehicles. These initiatives align with the EU's stricter air quality standards and push for more aggressive measures to curb road transport emissions.

Budapest's strategy for improving air quality combines both regulation and innovation. While the city adheres to EU directives, it faces challenges due to fragmented responsibilities among various authorities.

In 2023, a collaborative effort involving the Municipality of Budapest (MB), the Centre for Budapest Transport (BKK), and the Hungarian Public Roads (HPR) marked a new chapter in addressing these challenges.

Budapest is placing great emphasis on the regeneration of its public spaces, with Blaha Lujza Square being a prime example. Previously used largely as a surface car park, this major transport hub underwent a complete redevelopment in 2023, with more green spaces and increased priority for pedestrians and cyclists.

Also in 2023, the iconic Chain Bridge, Budapest's first permanent crossing over the Danube, reopened after extensive renovations. Along with its historical restoration, traffic patterns were changed: private cars are no longer allowed on the bridge, making it faster for buses and bicycles, and more pleasant for pedestrians. This decision was made with the support of residents, and traffic data is being continuously monitored.

Transformation and renovation

One of the key projects for the coming years is the transformation of the lower quay of Pest, which will bring the city closer to the Danube. The design phase is well underway, and the section between Parliament and Liberty Bridge is regularly opened to active transport modes, with the impact on traffic being closely monitored.

The renovation of Budapest's M3 metro line is one of the city's largest recent investments in public transport, focusing on making stations barrier-free. Alongside metro improvements, tram expansion is also a priority, with 51 new low-floor CAF trams set to arrive by 2026. New tram lines, including one along Bajcsy-Zsilinszky Road, will be part of the Újbuda-Újpest axis, and extensions of lines 3 and 42 to the southwest will offer faster and more comfortable travel for residents.

Budapest's trolleybus fleet has also expanded with 48 new vehicles, and an additional 160 are planned. This will replace all high-floor trolleys and allow for the creation of new wireless lines. Over 300 low-floor buses were introduced, reducing the average fleet age to under ten years by 2023.

Another key development is the modernisation of the city's ticketing system. The BudapestGo app supports digital ticketing, pass validation, and real-time route planning. A pilot project, Pay&Go, was introduced on the M1 metro and the airport express line and has seen 500,000 users in its first year. Further enhancements to BudapestGo aim to enhance customer experience through data-driven decision-making.

Active and new mobility, front and centre

To promote sustainable transport, Budapest is developing a safer and higher-quality cycling network— which is why bollard-protected cycle lanes have been introduced on major roads like Váci and Üllői roads.

Bicycles, motorbikes, and e-scooters from various shared mobility providers are increasingly popular. The city's bike-sharing service, MOL Bubi, continues to grow in success, with more users each year. BKK, Budapest's mobility manager, is expanding the number of stations and the coverage of service areas. With the launch of 'Bubi 3.0,' the fleet will double, and electric bicycles will be available alongside traditional ones. Additionally, the Mobi-Point (micromobility point) network, which has 900 locations, is recognised as a global best practice for shared scooter parking.



Pedestrian crossing the newly refurbished Chain Bridge

City of Budapest

Collaborative efforts beyond Budapest

The Municipality of Budapest, along with its road operator (Budapest Közút), mobility manager BKK, and the National Road Operator (Magyar Közút), have recognised that meaningful results cannot be achieved through isolated, small-scale efforts—solutions must be applicable both regionally and nationwide.

The HiDALGO project aimed to develop innovative methods, algorithms, and software for High-Performance Computing (HPC) and High-Performance Data Analytics (HPDA) to accurately model and simulate complex processes related to major global challenges. Through data-driven analysis and simulation, the project demonstrated how traffic flow impacts emissions and how emissions can be reduced by changing traffic patterns.

The Hungarian Cooperative Intelligent Transport System (C-ITS) includes 130 fixed roadside units installed along major motorways and traffic lights in Zalaegerszeg and Győr, as well as 28 vehicles equipped with mobile units.

Hungary was one of the first in Europe to implement such a pilot system, which initially formed the longest C-ITS route.

Measurements confirm that the system achieves a 3% reduction in fuel consumption, a 5% reduction in CO emissions, and a 2% reduction in both hydrocarbon (HC) and nitrogen oxide (NOx) emissions.

The GLOSA, Green Light Optimal Speed Advisory services, improve traffic flow by minimising stops and reducing braking and acceleration, resulting in environmental benefits.

A path forward

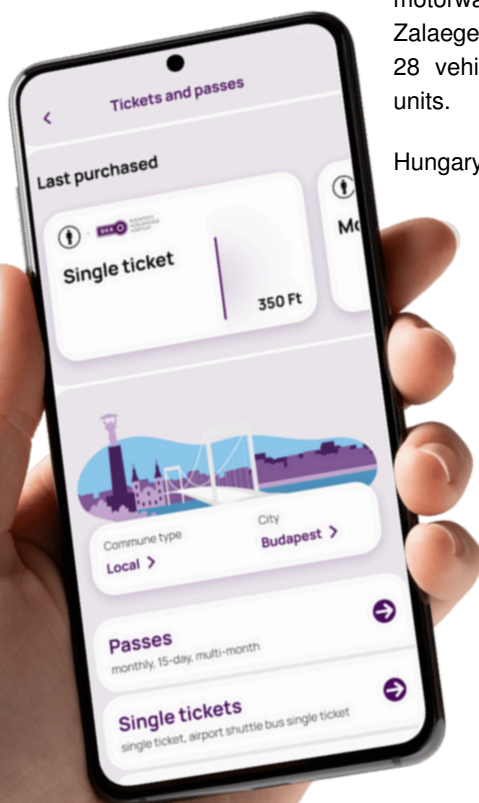
Budapest's efforts to improve air quality and reduce transport emissions highlight the importance of collaboration and technology. By partnering with municipal and national authorities and employing data-driven decision-making, the city is making strides towards meeting EU air quality standards.

In 2024, Budapest and its partners launched a joint pilot research project to assess transport flows to and from the city's functional agglomeration using various methods. Preliminary outcomes from this unique initiative are promising, offering insights that could lead to practical actions for improving air quality in both urban and peri-urban areas.

By prioritising public transport, reimagining public spaces, and leveraging innovative technology and collaborative methods, Budapest is setting a strong example for other European cities. While achieving climate and air quality goals remains a challenge, Budapest's comprehensive approach demonstrates that success is possible when stakeholders work together, no matter what happens.

BudapestGO smartphone application

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