

Road Safety Review of the Environment of Selected Schools in Szombathely

Viktória Ötvös^{1,2*}, Kinga Tóthné Temesi³, Erzsébet Hóz⁴

¹ Authority Support Project Centre, KTI Institute for Transport Sciences, Than Károly u. 3-5., H-1119 Budapest, Hungary

² Department of Transport Technology and Economics, Faculty of Transportation Engineering and Vehicle Engineering, Budapest University of Technology and Economics, Műegyetem rkp. 3., H-1119 Budapest, Hungary

³ Transport Organising Office, Northwestern Hungary, KTI Institute for Transport Sciences, Than Károly u. 3-5., H-1119 Budapest, Hungary

⁴ Road Safety Research Centre, KTI Institute for Transport Sciences, Than Károly u. 3-5., H-1119 Budapest, Hungary

* Corresponding author, e-mail: otvos.viktoria@kti.hu

Received: 29 April 2025, Accepted: 27 September 2025, Published online: 24 February 2026

Abstract

Szombathely is a typical cycling town with many educational institutions. Although cycling infrastructure development is at the heart of infrastructure development, it is increasingly being crowded out by car traffic in the city centre. There is critical congestion around schools in the morning and afternoon, with irregular stops and waiting times. The traffic volume on the city's roads has almost exceeded the level at which cyclists feel safe, so most children and pupils are transported by car by their parents.

In our study, we review traffic safety in each location – the surroundings of the selected schools – and develop proposals for concrete traffic engineering measures on the roads leading to and around the institutions to ensure safe pedestrian and cyclist traffic.

Keywords

road safety, children, child safety, active mobility

1 Introduction

As parents, our greatest treasure is our children. As responsible adults, we try to do everything we can to ensure the safety of our children, but we also unwittingly choose the solution that seems most obvious to us and most convenient for our comfort. In our car-centred society, the car has become almost a limb, and we use the convenience of private car transport for even the smallest distances (Renard et al., 2022). Meanwhile, the vehicle is not only comfortable and fast, but it is also perceived as the safest means of transport compared to any other. Parents can hold their child's hand from the garage to the school door, but in a school, where 6-800 children want to arrive at the same time for the morning 8.00 am classes, this is not possible for all 6-800 children at the same time. Instead, we are experiencing dozens of daily traffic jams, irregular manoeuvres and accident-prone situations, and we are causing conflicts and disruptions in traffic daily (Kizawi and Borsos, 2021). In addition, a lack of movement associated with our mobility, which is linked to our mobility and affects our health, is another problem of our

civilisation that needs to be solved, and which leaves ever more warning signs in our bodies from one generation to the next (Lin and Lou, 2022).

2 Trends in child accidents in Hungary

Most children are travelling to school or for leisure. Little is known about the modal distribution of children's travel, but research shows that traffic density and distance to educational institutions influence children's travel and mode choice (Krukowicz et al., 2021).

Between 2001 and 2023, 477 children died in road accidents in Hungary, and 42,643 children were involved in road traffic accidents. Looking at the trends in child accidents in Hungary, we can see that the safety of children in Hungary has improved significantly over the last two decades. While in 2001, 37 children died in road accidents, in 2023, only eight children were killed. The number of children killed and injured in road accidents has almost halved in 22 years (Fig. 1).

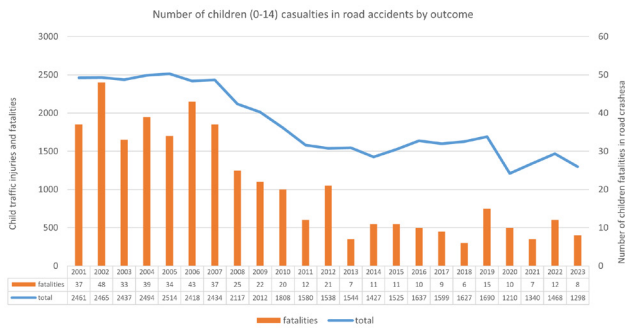


Fig. 1 Change in the number of children (0-14 years) killed or injured in road traffic accidents by outcome between 2001 and 2023 (Source: KTI, WEB-BAL)

Just as European trends show a decline in population and an ageing society, the same trend can be seen in Hungary, where the proportion of children in the population has fallen slightly: from 16.6% in 2001 to 14.6% in 2022, at the same time, the proportion of older people in our society has increased by more than 5% over the past two decades. In 2021, children injured or killed in road accidents accounted for just 0.09% of all children (Meesmann and Wardenier, 2023).

The number of accidents caused by children has also fallen significantly over the last 20 years: while in 2001, 775 road accidents were caused by children, in 2021, 232 children were involved in less than a third of all road accidents. Let us compare the number of accidents caused by children to the total number of accidents involving children. The proportion of accidents involving children fell from 30% in 2010 to 13.8% in 2023 (Fig. 2).

In terms of fatal accident rates involving children, since 2011, more than 60% of children have been involved in road accidents as passengers, while less than 30% have been pedestrians and just under 10% have been cyclists (Fig. 3).

When looking at the proportion of serious injuries, this proportion changes somewhat, with the proportion

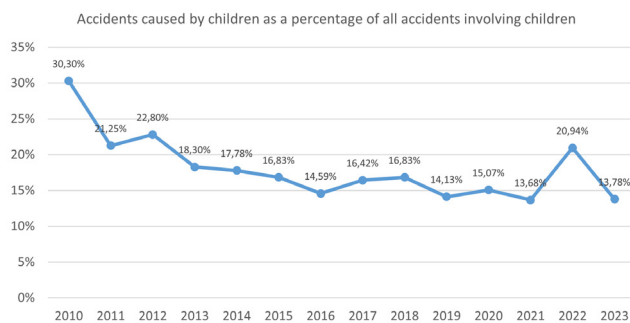


Fig. 2 Change in the rate of accidents caused by children between 2010 and 2023 in terms of total accidents involving children (Source: KTI, WEB-BAL)

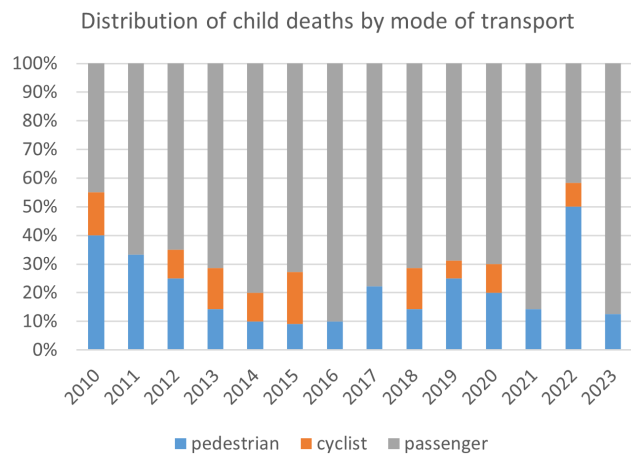


Fig. 3 Distribution of child deaths by mode of transport 2010-2023 (Source: KTI, WEB-BAL)

of children seriously injured as passengers hovering around 50%, children seriously injured as pedestrians around 30% and children seriously injured as cyclists around 20% on average. A more detailed analysis of child fatalities also confirms that the causes of accidents are mainly attributable to driver error (Fig. 4), according to Ötvös and Krizsik (2023).

3 Investigating children's mobility

Mobility is an essential prerequisite for children's development. Mobility helps children explore the world, but it also exposes them to risks. It would be wrong, however, to restrict children's independent mobility in order to reduce the risk of accidental death in children (European Road Safety Observatory, 2018).

What other solutions are there to protect children? Let us look at the trend in our current 'car-centric' world (see Fig. 5).

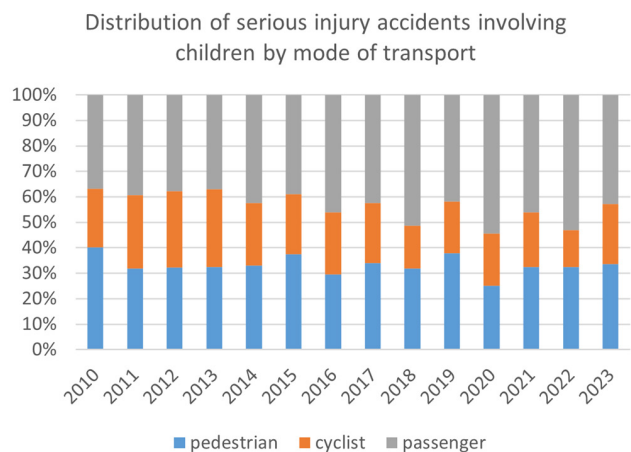


Fig. 4 Distribution of serious injury accidents involving children by mode of transport 2010-2023 (Source: KTI, WEB-BAL)

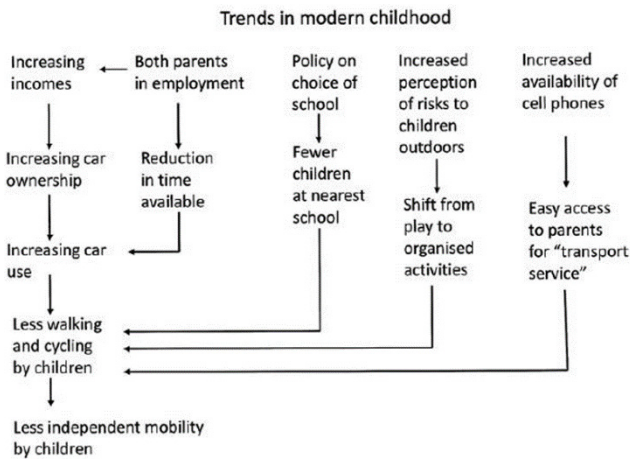


Fig. 5 Social trends influencing children's mobility (Source: European Road Safety Observatory, 2018)

Travel to school and children's mobility habits are common themes in mobility studies. According to one of the final studies of the ETSC LEARN! Project, improving road safety and promoting active and sustainable mobility are two themes that often go hand in hand. Actual and perceived safety has a significant influence on the choice of transport modes, especially the most sustainable modes of transport - walking and cycling, and the possibility of accessing public transport. It is essential to recognise that safer roads also mean more sustainable roads. If users do not feel safe, they may switch to other, less sustainable modes (Frank and de Dobbeleer, 2023).

For example, reviewing recent articles, Huertas-Delgado et al. (2017) present a case study of parents' perceived barriers to active mode use in Spain; Helbich (2016) examines the relationship between urban structure and mode choice in the Netherlands; Queiroz et al. (2020) analyse the factors influencing the use of public transport in a household survey in Portugal; Noonan et al. (2017) study the different health status of active and passive mode users in Liverpool.

The choice of transport mode for a child is strongly defined by the parents and other carers. In most countries, the main transport modes children are using are: 'being a passenger in a car', cycle, walk or public transport. Children travel more often as pedestrians or cyclists (vulnerable road users) compared with other age groups (Dijkstra, 2021). Unfortunately, no comparable data is available on the mobility (exposure) of children in the EU, which makes it impossible to calculate relative risk across the EU (which is the number of deaths and injuries per km or time spent). Nor is it possible to assess whether changes in transport modes might be the underlying factor

in the decrease in fatalities among children (Meesmann and Wardenier, 2023). Data from a Belgian study on the mobility behaviour of children (6-14 years old) show that most of the trips by children are made by car (46%), followed by bicycle (25%) and on foot (19%). Data from other (European) countries show generally the same pattern: children and older adults walk most, whereas teenagers cycle most (Meesmann and Wardenier, 2023).

Although transport policy objectives have been formulated in recent years about travel and travel by children, there is little recent history in Hungary specifically on the travel behaviour of children (Dijkstra, 2021).

Audrey and Batista-Ferrer (2015) conclude in their study that "improving road safety is one of the most important factors in increasing active commuting among children".

Several factors have contributed to a higher number of people choosing private cars as their default mode of travel to school, including:

- urban sprawl,
- monofunctional developments,
- increased convenience and perceived safety concerns.

This results in a traffic peak in the vicinity of schools for 15-30 minutes at the start and end of the school day, which creates unsafe access and egress conditions for pupils and contributes to congestion that negatively impacts others in the community.

Furthermore, car trips to school also contribute negatively in other ways, such as (Köllinger, 2024):

- Increased air and noise pollution,
- low levels of physical activity,
- and lower sustainable mobility behaviour patterns.

4 Mobility characteristics of Szombathely, current situation

Szombathely is a typical cycling city with many educational institutions. Although cycling infrastructure development is at the heart of infrastructure development, it is increasingly being crowded by car traffic in the city centre, critical congestion around the schools in the morning and afternoon, and irregular stops and waiting times. The traffic volume on the city's roads has almost exceeded the level at which cyclists feel safe, so most children and pupils are transported by car by their parents.

Szombathely's population of just over 78,000 people makes an average of 2.6 daily transfers per person. This translates into almost 190,000 daily transfers

within the city. The car is the dominant mode of transport within Szombathely. Almost half of all trips are made by car, which is a high proportion. Those who drive mostly commute to work, with lower car use for other reasons. By contrast, the share of local public transport is very low, even compared to other cities in the country, and did not reach 10% in 2021. This is somewhat offset by the fact that the overall share of active modes of transport - cycling and walking - in the modal split is very positive. The overly car-oriented nature of the city makes it necessary for Szombathely's Sustainable Urban Mobility Plan to place even greater emphasis on the development of sustainable transport modes, pedestrian, cycling and public transport, than in the past (TRENECON, 2022).

Car traffic (both stationary and moving) is starting to crowd out public spaces (roads and green spaces) to the extent that even in areas with detached houses, the streets are saturated with parked cars. It is not uncommon to see 2-3 cars per household.

Szombathely's local public transport has improved dramatically since 1 January 2022, with the introduction of BLAGUSS, a new service provider with new air-conditioned, low-floor buses that can adapt to the timetable, and the LIME community e-scooter, which is becoming increasingly popular with young people.

5 Road safety audit of school environments in the city of Szombathely

In our study, we will develop proposals for specific traffic engineering measures on the roads leading to and around the institutions for the safe pedestrian and cyclist traffic movement through a complex traffic safety review of the selected school environments.

The regional school district centres determine the admission districts of primary schools, but given that Act CXC of 2011 on National Public Education allows free school choice in Hungary, it is up to the parents to decide which primary school their child will attend. Transport accessibility is not typically the most critical consideration when choosing a school.

In this article, we conducted a road safety review of three selected school environments. Based on this, we have made traffic engineering recommendations that are likely to be typical for other schools in similar environments.

The schools under study were selected according to their different urban structure.

In developing our recommendations, the following objectives were formulated:

- At a minimum, there should be a protected, safe route to the school for pupils on foot, by bicycle, scooter and local bus service.
- For children arriving by car, the access road should allow for safe, conflict-free, 'quick' access and egress, with designated and secure drop-off and pick-up points.

5.1 Szombathely, Zrínyi Ilona Primary School

5.1.1 Current situation

The Zrínyi Ilona Elementary School in Szombathely is in a "school street" in the city centre of Szombathely. Its legal predecessor, the Civil School for Boys, was founded in 1886. The institution operates on two sites. The number of pupils is stable at 671 (2014), despite the decreasing number of children in the city. Students from the school's district represent 29% of the total. 59% are from outside the district, and 12% from other municipalities. Its favourable geographical location and proximity to the city centre strongly influence parents' school choice.

Both schools are located on busy municipal roads.

A local bus stop within 300 m of both schools has a continuous, well-developed sidewalk connection.

In Zrínyi Ilona Street, there is a pay parking zone. On the school side of both streets, waiting is allowed in traffic lanes and parallel parking spaces, but the lack of parking in the city centre means that parked cars take up all possible green space on the opposite side. There is no dedicated parking for the school.

The school has no cycling infrastructure, and cycling traffic flows with vehicular traffic.

5.1.2 Problem

Most children arrive by car:

- This puts significant pressure on the streets and junctions on the routes to school.
- Parents want to drop their children off at the school entrance, which is not only a simple drop-off, but often involves taking other luggage out of the boot, resulting in a longer wait.
- The bus stop is located in front of the school entrance, so parents use the designated bus stop as a K+R parking area, despite the prohibition in the Highway Code, and prevent the local bus from entering the

bus stop in an orderly manner, thus endangering the boarding and alighting of passengers, including school children.

- Cars parked illegally on the 2×1 lane road obstruct regular local bus services, causing significant delays during the morning rush hour.
- Due to the high traffic mix, the high proportion of motor vehicles on the routes to school makes cycling and scooter use a high risk to road safety.

5.1.3 Proposals to improve road safety

Construction of traffic lights at the intersections of Rákóczi Ferenc Street – Szent Flórián Blvd. and Rákóczi Ferenc Street – Szent Gellért Street.

One-way traffic on Rákóczi Ferenc Street from Szent Gellért Street to Zrínyi Ilona Street, and a two-way cycle lane in the opposite direction.

One-way traffic on Zrínyi Ilona Street from Rákóczi Ferenc Street to Hunyadi János Street, two-way cycle path in the opposite lane.

Construction of a parking lot for P+R in Rákóczi Ferenc Street in front of the bus stop in the section in front of the school.

5.2 Neumann János Primary School in Szombathely

5.2.1 Current situation

The Neumann János Primary School in Szombathely is located north of the city centre, next to one of the busiest four-lane national roads leading out of the city to the north (Huszár Street 11). As a corner plot, it is bordered to the south by the busy Bocskai Blvd., which is owned by the municipality, and the low-traffic, one-way Losonc Street.

A local bus stop within 300 meters is connected to the school by a continuous, well-developed sidewalk.

The roundabout at Huszár Street 11 – Vörösmarty Street – Bocskai Blvd. effectively distributes traffic from the connecting roads. It also has a separate cycle path.

5.2.2 Problem

The current bicycle infrastructure only partially ensures that children can get to school safely. There is no bicycle connection to the north, and the roundabout is primarily designed to divert motor vehicle traffic, with the existing infrastructure merely tolerating vulnerable road users.

5.2.3 Proposals to improve traffic safety

Change the priority rules for the bike path around the roundabout, prioritising the bike path.

Redesign of the intersection of Huszár Street 11, creating a two-way bicycle lane separated from motor vehicle traffic on the section between Bocskai Blvd. and Lipp Vilmos Street, maintaining 2×1 traffic lanes and ensuring lanes at intersections.

5.3 Sándor Reményik Lutheran Primary School and Elementary School of Arts

5.3.1 Current situation

The Reményik Sándor Evangelical Primary School is in the heart of Szombathely, in the so-called university quarter, bordered by Dózsa György Street, Gagarin Street, Jókai Mór Street and Kálvária Street. Szent László király Street, which provides access to the school, is a two-way municipal road.

A local bus stop within 300 meters is connected to the sidewalk, but the school's students do not typically use it. The school has its own parking lot.

5.3.2 Problem

During morning and afternoon rush hours, disorderly parking and picking up and dropping off passengers obstruct traffic in front of the school.

5.3.3 Proposals to improve traffic safety

Make Szent László király Street one-way from Géfin Gyula Street to Kálvária Street.

A paved parking lot inside the school grounds will be constructed, and the connection will be widened to allow two-way traffic and ensure pedestrian space.

Creation of a K+R parking lot in front of the school for drop-off and pick-up.

6 Conclusion

Our proposals for improving traffic safety require new thinking and a change in attitude. It is worth considering whether it is right that in a city the size of Szombathely, we get into our cars to travel a mile and a half.

Public spaces should serve the public interest, and roads serve three functions: carrying traffic, connecting different parts of the city, and serving mobility needs. Parking private cars in public spaces is the most expensive form of parking, depriving the road of its other functions. If more people cycle, the proportion of motor vehicle traffic and the demand for parking will also decrease.

Our proposals will undoubtedly provoke opposition from both professional and civil circles at first, so they can only be successfully implemented through extensive consultation

with the affected population, with a detailed exploration of actual needs using the methodology identified in the above-mentioned international and domestic research.

References

- Audrey, S., Batista-Ferrer, H. (2015) "Healthy urban environments for children and young people: A systematic review of intervention studies", *Health & Place*, 36, pp. 97–117.
<https://doi.org/10.1016/j.healthplace.2015.09.004>
- Dijkstra, A. (2021) "Road safety thematic report - Pedestrians", European Road Safety Observatory, European Commission, Directorate General for Transport, Brussels, Belgium. [pdf] Available at: https://road-safety.transport.ec.europa.eu/document/download/137ed1d7-e03e-444d-ba08-da1908fc450f_en?filename=road_safety_thematic_report_pedestrians_tc_final.pdf [Accessed: 29 March 2025]
- European Road Safety Observatory (2018) "Children 2018", European Commission, Directorate General for Transport, Brussels, Belgium. [pdf] Available at: https://road-safety.transport.ec.europa.eu/document/download/be30d118-1a0d-46d1-a5cb-6c1ee6cf6e65_en?filename=ersosynthesis2018-children.pdf [Accessed: 29 March 2025]
- Frank, M., de Dobbeleer, W. (2023) "LEARN Flash 3 – Linking Education on Sustainable Mobility with Traffic Safety", European Transport Safety Council, Brussels, Belgium. [pdf] Available at: <https://etsc.eu/wp-content/uploads/LEARN-Flash-3-Linking-Education-on-Sustainable-Mobility-with-Traffic-Safety.pdf> [Accessed: 29 March 2025]
- Helbich, M. (2016) "Children's school commuting in the Netherlands: does it matter how urban form is incorporated in mode choice models?", *International Journal of Sustainable Transportation*, 11(7), pp. 507–517.
<https://doi.org/10.1080/15568318.2016.1275892>
- Huertas-Delgado, F. J., Herrador-Colmenero, F. J. H-D. M., Villa-González, E., Aranda-Balboa, M. J., Cáceres, M. V., Mandic, S., Chillón, P. (2017) "Parental perceptions of barriers to active commuting to school in Spanish children and adolescents", *European Journal of Public Health*, 27(3), pp. 416–421.
<https://doi.org/10.1093/eurpub/ckw249>
- Kizawi, A., Borsos, A. (2021) "A Literature review on the conflict analysis of vehicle-pedestrian interactions", *Acta Technica Jaurinensis*, 14(4), pp. 599–611.
<https://doi.org/10.14513/actatechjaur.00601>
- Köllinger, C. (2024) "School Streets for Safe and Sustainable School Trips", European Road Safety Observatory, European Commission, Brussels, Belgium. [online] Available at: https://urban-mobility-observatory.transport.ec.europa.eu/resources/case-studies/school-streets-safe-and-sustainable-school-trips_en [Accessed: 29 March 2025]
- Krukowicz, T., Firląg, K., Sobota, A., Kołodziej, T., Novačko, L. (2021) "The relationship between bicycle traffic and the development of bicycle infrastructure on the example of Warsaw", *Archives of Transport*, 60(4), pp. 187–203.
<https://doi.org/10.5604/01.3001.0015.6930>
- Lin, A., Lou, J. (2022) "Pedestrians' and Cyclists' Preferences for Street Greenscape Designs", *Promet - Traffic&Transportation*, 34(3), pp. 367–380.
<https://doi.org/10.7307/ptt.v34i3.3879>
- Meesmann, U., Wardenier, N. (2023) "Road Safety Thematic Report – Children", European Road Safety Observatory, European Commission, Directorate General for Transport, Brussels, Belgium. [pdf] Available at: https://road-safety.transport.ec.europa.eu/document/download/7ef71902-930a-428d-a59f-ca89793ef9bd_en?filename=Road_Safety_Thematic_Report_Children_2023.pdf [Accessed: 29 March 2025]
- Noonan, R. J., Boddy, L. M., Knowles, Z. R., Fairclough, S. J. (2017) "Fitness, fatness and active school commuting among Liverpool schoolchildren", *International Journal of Environmental Research and Public Health*, 14(9), 995.
<https://doi.org/10.3390/ijerph14090995>
- Ötvös, V., Krizsik, N. (2023) "Hazai gyermekbalesetek elemzése" (Analysis of domestic child accidents), In: XIII. International Conference on Transport Sciences, Győr: Multimodality and sustainability; Győr, Hungary, pp. 551–560. ISBN 9786156443175 (in Hungarian)
- Queiroz, M., Celeste, P., Moura F. (2020) "School commuting: the influence of soft and hard factors to shift to public transport", *Transportation Research Procedia*, 47, pp. 625–632.
<https://doi.org/10.1016/j.trpro.2020.03.140>
- Renard, A., Novačko, L., Babojelić, K., Kožul, N. (2022) "Analysis of child traffic safety near primary school areas using UAV technology", *Sustainability*, 14(3), 1144.
<https://doi.org/10.3390/su14031144>
- TRENECON (2022) "Szombathely Fenntartható Városi Mobilitási Terve (SUMP)" (Sustainable Urban Mobility Plan for Szombathely), TRENECON Tanácsadó és Tervező Kft., Budapest, Hungary. [pdf] Available at: <https://szombathely.hu/downloads/784> [Accessed: 29 March 2025] (in Hungarian)

Acknowledgments

"Project no. KDP-IKT-2023-900-I1-00000957/0000003 has been implemented with the support provided by the Ministry of Culture and Innovation of Hungary from the National Research, Development and Innovation Fund, financed under the KDP-2023 funding scheme."