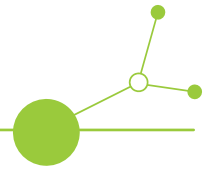


Deliverable D3.2.1

Report on pilot joint requirements,
preparation, implementation and
evaluation

**Pilot action: Demonstrate the feasibility
to re-use trolleybus switches in Szeged,
Hungary**



Version 2
03 2026





DELIVERABLE D3.2.1

Pilot action Szeged, Hungary

Project index number and acronym	CE0100250 CE4CE
Lead partner	LP LVB
Deliverable number and title	D3.2.1 Report on pilot joint requirements, preparation, implementation and evaluation
Responsible partner(s) (PP name and number)	PP4 SZKT
Contributed person	Dr. Zoltán Ádám Németh, Gábor Jéga-Szabó
Project website	https://www.interreg-central.eu/projects/ce4ce/
Delivery date	31.03.2026
Status	Final
Dissemination level	Project



Authors and log change of the document

Partner No.	Partner Acronym	Name of the author	Action	Version
LP	Rupprecht Consult on behalf of LVB	Ana-Maria Baston	Starting version of the document drafted	0
PP7	UM	Danijel Hojski	Template design for reporting	0
PP4	SZKT	Dr. Zoltán Ádám Németh	Provided input and data	1
PP4	SZKT	Gábor Jéga-Szabó	Provided input	2
PP4	SZKT	Dr. Zoltán Ádám Németh	Review and finalisation	2

Contents

1. Executive Summary	3
2. NUTS region(s) concerned by the pilot action (relevant NUTS level).....	3
3. Basic pilot concept	4
4. Key pilot development phases	5
5. Preparation and technical requirements	6
6. Implementation phase	6
7. Process evaluation	8
8. Testing and evaluation phase	8
9. Best practices	9
10. Risks and contingency approach	9
11. Pilot impact and sustainability	10
12. Transferability of the pilot action	10
13. Annexes.....	10
Annex 1: Procurement materials list (separate annex)	10
Annex 2: Media	10



1. Executive Summary

The CE4CE project empowers circular economy system thinking for actors in public transport from Central European countries to reduce waste and create value along new life cycles of infrastructure and rolling stock. To achieve this, CE4CE jointly develops solutions that enhance knowledge and capacities for the sector, reduce barriers and costs, and initiate the development of new services and skilled jobs. Additionally, the project focuses on strategies and action plans that support policy development, learning, and exchange at both regional and transnational levels.

One of key aspects of CE4CE's initiatives is the implementation of pilot actions that demonstrate and validate circular economy principles in public transport. By applying these principles in real-world settings, CE4CE aims to create new value chains, optimize resource efficiency, reduce costs, and foster innovation within the sector. These pilot initiatives serve as practical examples of how circular economy strategies can be integrated into public transport operations, ultimately contributing to a more sustainable and resource-efficient mobility system.

To achieve this, CE4CE pilots will test solutions that enhance knowledge and capacities for public transport stakeholders, address regulatory and financial barriers, and support the development of new services and job opportunities. The results of these pilots will contribute to shaping policies, guiding investments, and facilitating knowledge exchange at both regional and transnational levels.

Furthermore, CE4CE pilot actions will enable cooperation among key transport actors to co-develop and refine processes that integrate circular economy principles. This includes innovative procurement strategies, circular business models, extended life-cycle assessments, and cost-benefit methodologies.

2. NUTS region(s) concerned by the pilot action (relevant NUTS level)

Country (NUTS 0)	HU
Macroregion (NUTS 1)	HU3 - Great Plain and North
Region (NUTS 2)	HU33 - Southern Great Plain
Sub-region (NUTS 3)	HU333 - Csongrád-Csanád County



3. Basic pilot concept

Szeged Transport Company operates 37 km of trolleybus catenary in its system, with 45 electric switches. The trolleybus electric switches are key in trolleybus operation safety, could be a focal point of current collector derailing that could cause damage, but even if they don't work reliably, it can cause delays and unpleasantness in the regular service. These trolleybus overhead switches in Szeged were in different conditions, some are considered modern high-speed switches with radio control ("Elektroline switches"), but were installed 15-20 years ago. Some switches in the depot are considered old with outdated setting method (traction current setting, "K&M-like switches"). Both needed to be exchanged to a new overhead switch.

Using the principles of circular economy the aim of the pilot project was to exchange four older high-speed switches in the Szeged trolleybus traffic network, and re-using these "Elektroline switches" at four other places in the trolleybus depot exchanging the even more outdated "K&M-like switches". Thus we can achieve improvement at 8 locations. Depot switches are significantly less used, thus older, less reliable equipment still suitable, while in the network the operation obtain new and more reliable equipment.

SZKT trolleybus operation used Elektroline high-speed trolleybus overhead switches with automatic radio control everywhere since 2015. In the trolleybus depot, however there were some older K&M-like type switches in use with traction current operation. These older ones are very unreliable, can cause lots of derailing of the current collector, and there is no more spare part supply. However, while the switches in the network could be used 200-300 times / day, the depot switches are significantly less used, only 20-30 times / day. Thus, building in new switches in this pilot project was performed at four locations in the network (switch No. 502, 510, 904, 1004), and these four switches, which were originally built in between 2005-14, were used to replace two older K&M-like type switches in the depot (switch No. T06, T07, T08, T11). This idea is coming from using the circular economy principles „reuse”, reduces waste and saves investment money, and can be extended to all kinds of infrastructure elements (e.g. tram rails, switches), where there is a significantly different usage on the main network and the depot.





4. Key pilot development phases

Main milestones of the pilot project	Description	Duration of the stage	Calendar term	Responsible partner
Pilot Design	The project definition was put together during the application for the CE4CE project.	1 month	2022.02-04	SZKT
Stakeholders Engagement and joint development	Preparations were mainly internal within SZKT, since the pilot is action is mainly concerning different departments of SZKT	6 months	2023.07-12	SZKT
Feasibility Study and Preparation	Internal preparation (SZKT traffic operation, infrastructure maintenance departments)	6 months	2023.07-12	SZKT
Procurement Process(es)	Preparation of the material list: 2024. I-II. quarter	5 months	2024. I-II. quarter	SZKT
	Public procurement: Contract date: 30 September 2024.	3 months	2024.06-09	
	Delivery of the materials: 24. November 2024.	2 months	2024.09-11	
Pilot Implementation	Implementation is done by the SZKT overhead maintenance crew. The timeline was determined by the availability of the crew, since it has also performed its regular maintenance job.	8 months	2025.02-09	SZKT
Operational Launch	The last switches in the depot were installed in September 2025	8 months	2025. sept	SZKT
Monitoring and Evaluation	Regular switch operation is continuous since the instalments. Monitoring is done using the regular maintenance operation processes.	ongoing	2025.02-	SZKT



Reporting and Documentation	Data collection and analysis is done through the reporting,	4 months	2025.09-2026.02	SZKT
-----------------------------	---	----------	-----------------	------

5. Preparation and technical requirements

The pilot action (trolleybus electric switch replacement) does not require authorization; it could be performed under the authority of the public transport company. The procurement process and the execution was done by the responsible departments of Szeged Transport Company (logistics, catenary maintenance). During the execution the trolleybus traffic had to be replaced with the organization of SZKT traffic department, and the road authority was involved regarding the works done on the road for about 18 hours.

6. Implementation phase

The selection of the 4+4 switches in the network and the depot was done through the discussion of the infrastructure department and the traffic operation department of SZKT, as well as the chief of railway safety involved. The quality requirements were determined by the standard prescriptions of SZKT trolleybus catenary.

Authorization was not required for this activity according to Hungarian law.

Once the switches were selected, the overhead maintenance crew listed the material requirement for public procurement, with SZKT logistics involved. SZKT logistics determined the required public procurement process involving external legal office.

After the materials were delivered, SZKT overhead maintenance crew planned the instalment with the involvement of SZKT traffic department (organizing trolleybus replacement service) and road authority was contacted regarding space for installing works. For the depot installation SZKT technical department was also involved due to work organization during the voltage shutdown required during installation.

Implementation was done in regards to the regular schedule of the overhead maintenance crew.

After installing the switches in the network, a temporary operation period was necessary with manual radio control since the VETRA system was only installed a few weeks later.





7. Process evaluation

As the result of the pilot action Szeged Transport Company exchanged and upgraded 4+4 trolleybus switches in the network and the depot, both significantly increasing the safety aspect of the trolleybus operation. In the network these switches act more reliably in the long run, and in the depot the outdated switches, which cause many dewiring was replaces by a radio control switches. Introducing this pilot action to the public transport professional community we wanted to draw attention to a careful safety analysis of different infrastructure elements (e.g. tram switches, trolleybus switches, rails), that require significantly less reliability in the depots, as the speed and usage frequency is much lower than on the revenue network. Thus using second hand materials in the depots, less used sidings, etc... is a natural choice in line with circularity principles.

8. Testing and evaluation phase

The KPI's of our pilot project are long term, and can only be produced after years of operation, so it is sill ongoing.

Category	Indicator	Unit
Operation	current collector derailment (revenue operation)	pcs.
Operation	current collector derailment (depot)	pcs.
Operation	false switch setting (revenue operation)	pcs.
Operation	false switch setting (depot)	pcs.
Infrastructure	Switch damage	pcs.



9. Best practices

Electric public transport networks - trolleybus systems upgrade

<https://www.interregeurope.eu/good-practices/electric-public-transport-networks-trolleybus-systems-upgrade>

This best practice use case builds on existing trolleybus infrastructure for electric transport. The use case provided 26 new trolleybuses for the city of Brasov, Romania. These trolleybuses can run 5 km without wire. There is no recharging infrastructure needed, since it is done from existing overhead wires, thus extending the usage of existing infrastructure (fulfilling circularity goals).

Modernization of the fleet of trolley buses in Prešov

<https://www.interregeurope.eu/good-practices/modernization-of-the-fleet-of-trolley-buses-in-presov>

This use case is about rather than abandoning trolley bus networks in favour of diesel-powered buses it makes sense to invest in the existing or previously existing infrastructure (fulfilling circularity goals).

Project initiative for a dynamic-charged electro-bus

<https://www.interregeurope.eu/good-practices/project-initiative-for-a-dynamic-charged-electro-bus>

In Prague (Czech Republic), as in many European cities, sustainable and efficient mobility is an ongoing challenge. The dynamic-charged electro-bus is an innovative project to test electric buses on a bus route while taking advantage of existing synergies with other mobility infrastructures, namely tram and underground train networks (fulfilling circularity principles).

10. Risks and contingency approach

The project was relatively low risk, since it focused mainly internal SZKT departments and infrastructure. There was always risk in implementation as the switches had to be installed newly in an existing infrastructure, which have different elements (catenary, masts, mast foundations) in different stages of life cycle (for example, the masts spanning the switches were built between 1979-2010). Some masts are common street light masts. Mitigation of risks were done through the regular operation of the overhead maintenance crew, although nothing unexpected came up, if it would, the infrastructure department's troubleshooting processes would have been put into effect.



11. Pilot impact and sustainability

Impact: the safety and reliability of the switches are key operation safety of trolleybus operation in Szeged, which boasts 35.000 daily users and 5500 daily vehicle km (approx. 30 % of public transport volume of Szeged). Reliable electric public transport is key to sustainability in the environmental sense and in the traffic management sense (i.e. reliable alternative to the ever-increasing car traffic).

Sustainability: the built in switches are under the normal maintenance regime of SZKT's trolleybus overhead, which is part of the railway system of SZKT, and regulated through Railway Safety Protocols, which have a section about tram- and trolleybus catenary (BIE-07 - Maintenance and supervision of SZKT catenary). These protocols ensure the long-term operation of the newly built in materials.

12. Transferability of the pilot action

In case of any railway or trolleybus operation, the infrastructure can everywhere be sorted by two tears: a heavily used revenue network, and a service network. Service networks (i.e. depots, vehicle storage areas, sidings, workshops) are usually less used, requires lower safety level as there is no passenger service there. Therefore, it is a natural target of reusing second hand material where it is possible. Such possibility are trolleybus switches, but at tram depots rails, switches, masts are also possible second-hand materials that reduces the environmental impact of an investment, as well as cost saving possibility.

13. Annexes

Annex 1: Procurement materials list (separate annex)

Annex 2: Media

Press event and reports about the overhead trolleybus switches pilot action:

<https://szkt.hu/sajtomegjelenesek-2025-04-29>