Interreg CENTRAL EUROPE

Co-funded by the European Union

OPTI-UP

DELIVERABLE D.2.1.2 – PILOT ACTION REPORT PAKS AND OSIJEK PROJECT AREAS

A report on implementation of PT network optimisation solution in the Paks and Osijek project areas with guidance for future actions for sustainability of the pilot action

Version 2.0

March 2026

COOPERATION IS CENTRAL

This publication has been developed within the OPTI-UP project, supported by the Interreg CENTRAL EUROPE Programme with co-financing from the European Union. Its content is the sole responsibility of the authors and the project partnership and does not necessarily reflect the views or positions of the Interreg CENTRAL EUROPE Programme, its programme bodies or the European Union. Neither the programme authorities nor the European Union can be held responsible for any use that may be made of the information contained herein.

Table of Contents

List of Figures

List of Tables

Abbreviations

AF	Application form
DRT	Demand-responsive transport
KPI	Key Performance Indicator
PA	Pilot action
PT	Public transport

1. Introduction

The OPTI-UP project (*Optimizing and greening Public Transport networks through Integration with Urban Planning and data-driven approaches*) aims to optimise PT in small and medium-sized cities in Central Europe through integration with urban planning and data-driven approaches. Tailored optimization solutions for PT have been tested on six pilot areas: Modena (Italy), Grosuplje (Slovenia), Osijek (Croatia), Paks (Hungary), Pécs (Hungary) and Český Krumlov (Czech Republic).

In the pilot areas have been implemented 6 pilot action optimization solutions in 3 thematic fields.

- **Demand-responsive transport (DRT)** thematic field focuses on providing a flexible PT to low-demand areas to improve bothe PT service accessibility and financial viability. Different DRT pilot actions were tested in two pilot areas: PA1 in Modena (Italy) and in PA 2 in Grosuplje (Slovenia).
- **PT network optimisation** thematic field deals with adjusting routes and schedules of the existing PT system. Pilot solutions were tested within two pilot areas: PA3 in Osijek (Croatia) and PA4 in Paks (Hungary).
- **Alternative fuel technologies** thematic field refers to testing impact using electric propulsion vehicles on energy efficiency and PT ridership through increased comfort levels, cleanness, both contributing to better sustainability. These solutions were tested in two pilot areas: PA5 in Pécs (Hungary) and PA6 in Český Krumlov (Czech Republic).

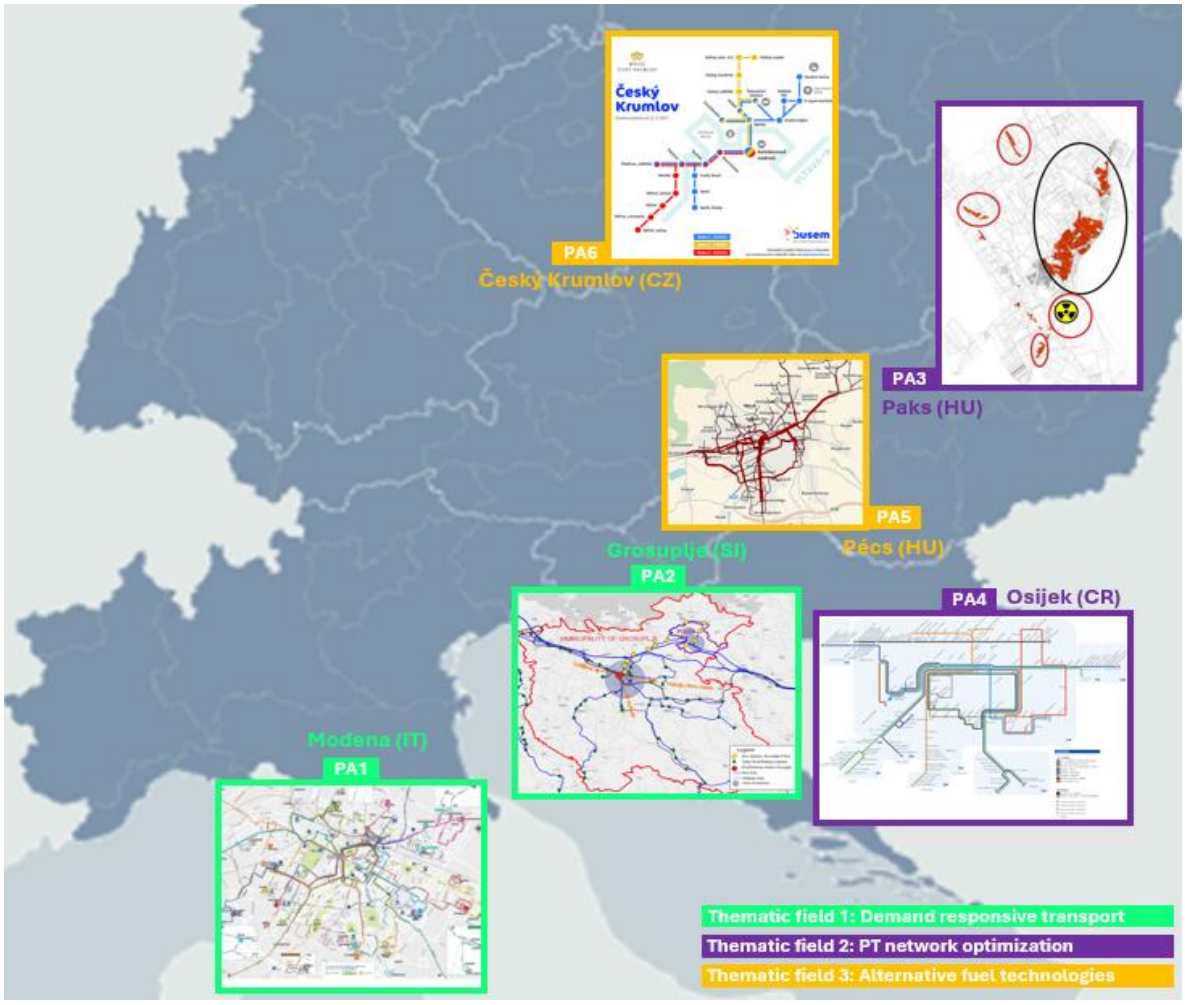


Figure 1: Locations of OPTI-UP pilot areas

This deliverable D.2.1.2 focuses on PT network optimisation field. It aggregates and compiles the outcomes of PT network optimisation pilot action implementation in Paks (Hungary) and Osijek (Croatia) and provides guidance for future actions to ensure sustainability of the implemented pilot solution. The outcomes and guidance for other two thematic fields are presented in separate deliverables:

- D.2.1.1: A report on implementation of the Demand-responsive transport (DRT) thematic field. It aggregates and compiles the outcomes of DRT pilot action implementation in Modena (Italy) and in Grosuplje (Slovenia) and provides guidance for future actions to ensure sustainability of the implemented pilot solution and
- D.2.1.3: A report on implementation of alternative fuel technology solution in the Pécs and Český Krumlov project areas with guidance for future actions for sustainability of the pilot action.

Deliverable D.2.1.2 is compiled from the pilot action implementation reports prepared by the responsible project partners PAKS (PP5: Paks) and GPP (PP9: Osijek). It is composed of:

- Reports on individual PT network optimisation pilot project, covering the implementation and outcomes of the two different PT network optimisation solutions tested in Paks (Hungary) and Osijek (Croatia). Each report is structured in seven sub-sections, covering:
    - Pilot action scope and objectives
    - Pilot action solution and end expected outcomes
    - Implementation of pilot action activities
    - Difficulties and deviations from the implementation plan
    - Analysis of pilot action implementation
    - Common conclusions
    - Guidance for future actions for pilot action sustainability.
- A comparison of the two pilot actions, which addresses common characteristics of the pilot activities, key differences between the implemented solutions, common findings, opportunities for improvements and conclusions.

2. Paks pilot project report

This chapter presents the report on PT network optimisation in Paks (Hungary), detailing the implementation and outcomes of the tested solutions, as well as guidance for future actions.

2.1. Pilot action scope and objective

Key information about the pilot area is presented, including the main public transport challenges addressed and the desired outcomes to be achieved through the pilot action.

2.1.1. Description of pilot project area

The description of the pilot project area provides an overview of its geographical, demographic, and transport-related characteristics. Key features of the area are illustrated with numerical data and supporting maps.

Location

The town of Paks is located in Tolna County and is the centre of the Paks district. With a population of nearly 17,700, it is the second most populous town in Tolna County after Szekszárd, and with an area of 15,408 acres, it is the largest administrative area in the county.

Figure 2: Maps of Paks

Area characteristics

Paks lies on the boundary of the Mezőföld plain and the Tolna hills, giving the town a mixed topography of flat lowlands along the Danube and gently hilly surroundings inland. This geographical position has shaped both the settlement structure and transport corridors, concentrating development along the river and north-south road axes.

The city is a significant employment centre, with a positive commuting balance according to the 2022 census data. The number of employees commuting to the city daily (6,344 people) exceeded the number of employees commuting from Paks to other settlements (1,232 people) by more than 5,000. The increase in

mobility needs within the region is indicated by the fact that, compared to the 2011 census, the number of people commuting to Paks has increased by almost 1.5 times, while the number of people commuting from the city has increased by 1.8 times. The number of employees living and working in Paks has decreased compared to 2011, with 54% of jobs in Paks currently filled by residents of the city.

The urban structure of Paks is elongated along the Danube, with a compact historical core, residential districts, and large-scale industrial zones in the south, where the nuclear power plant and industrial park are located. New residential and service developments are emerging to accommodate workers related to the Paks II (Nuclear plant) expansion, while central streets face growing congestion from local and through traffic.

Public transport is autobus-based, coordinated through a central station. Coverage is generally adequate, though some outlying neighbourhoods lack direct access. The local transport company (PP5 in CE OPTI-UP project) provides local transport services, while intercity routes are handled by national operator (MÁV Passenger Transport). Rail links exist through the 42 Pusztaszabolcs–Dunaújváros–Paks line, but passenger services have been suspended since 2009. The line remains strategically important for freight, particularly for the nuclear power plant and the port, and has recently been refurbished to support future logistics tied to the Paks II project.

Paks is located along the Rhine–Danube TEN-T corridor, with its port offering direct access to European inland waterway transport. The town is also connected to the motorway network via the M6, linking it northward to Budapest and southward to Croatia. Despite this, weak multimodal integration and limited rail passenger services hinder full exploitation of the TEN-T opportunities.

The extension of the M6 motorway to the national border will also improve the transport infrastructure of the Danube and Mohács regions. Furthermore, the development will enable safe and fast transit traffic between Northern and Southern Europe. After the completion of the final section of the M6, the Hungarian section of the TEN-T corridor connecting the Adriatic and Baltic Sea regions will be complete.

Although Paks has good transport links (the M6 motorway, connection to the Danube, public transport services), its administrative area is large and the outlying areas are difficult to access, with no public transport links at all.

Summary

Overall, Paks's transport system faces the dual challenge of accommodating growing local and regional traffic, while leveraging its strategic position on the TEN-T Rhine–Danube corridor. Improving multimodal connections between road, rail, river and sustainable urban mobility will be critical to ensuring both economic growth and liveability in the coming decades.

2.1.2. Key issues & objectives of pilot action

This section presents the main PT and accessibility challenges in the pilot area and the objectives set to address them through the pilot action.

Key public transport issue(s) addressed and main causes

Due to the expected growth in motorization, the number of people traveling by private car will continue to increase in the future, resulting in further traffic jams and congestion, which will lead to longer travel times for both private motorized and public transport, as well as soft modes of transport. As a result of this process, on the one hand, the proportion of residents dissatisfied with transport services will increase, and on the other hand, the large number of vehicles will lead to more frequent accidents.

- Serving the needs of a growing city

- Improving accessibility to outlying areas
- Coordinating local public transport with intercity bus services
- Improving operational efficiency

Key objectives (future outlook)

In the future, Paks is likely to experience continued pressure on its transport system as private car use keeps rising. If this trend remains unchecked, congestion, longer travel times, and accident risks will intensify, creating dissatisfaction among residents and further straining both public and private mobility. The growth of built-up areas and higher traffic demand could also reduce green and community spaces, worsening environmental conditions and undermining urban liveability. Climate-related impacts such as extreme weather events may place additional burdens on infrastructure, increasing costs and reducing resilience, meaning that without timely interventions, current problems are expected to persist or even worsen

At the same time, several alternative scenarios offer more positive outlooks. The expansion of local public transport, such as the new bus line introduced through the pilot project, can improve accessibility, reduce car dependency, and ease traffic congestion. If supported by further multimodal improvements, better integration of surrounding settlements, and the adoption of cleaner technologies, the city could move toward a more efficient and sustainable transport system. Success depends heavily on coordinated planning, infrastructure investments, and public willingness to shift travel habits. If these conditions are met, Paks could transform into a forward-looking mobility hub; if not, the city risks entrenching its car-dependent trajectory, limiting long-term economic, social, and environmental benefits.

Based on the above, the following objectives can be formulated:

- Serving the needs of a growing city
- Improving accessibility to outlying areas
- Coordinating local public transport with intercity bus services
- Improving operational efficiency

2.2. Pilot action solution and expected outcomes

This section provides an overview of the pilot action, covering its expected outcomes, the stakeholders engaged in the implementation, and the potential risks identified prior to the start of the project.

2.2.1. Description of Pilot action solution

The implemented pilot action solution is described with a focus on its operational features and its contribution to improving accessibility, connectivity and overall system efficiency.

Paks Transportation llc will introduce the new local bus service (Pilot Action) on September 1, 2025, with the start date of the service aligned with the start of the school year. A new line will be introduced, which will be designated as line 5. Services on this line will transport passengers between the Gesztenyés utca stop and the newly included "PK telephely" stop in the Paks Transportation llc transport network. Between the two terminals, the transportation co. will serve the stops named Jedlik Ányos utca, Költségvetési üzem and Szőlőhegy in both directions.

The new line has been designed to take into account the objectives set out in the project preparation (AF):

- improving the efficiency of existing local transport;
- coordinating transport with settlements in the city's agglomeration;
- improving access to areas of the city that are not currently served by local public transport;
- the planning of PT needs to fit to the future approach of the dynamically expanding city.

The first stop on the new line provides access to an outer residential area that was previously inaccessible by public transport, and passengers coming from Nagydorog can transfer here if they are heading to the city's business centre. The terminus will serve a newly built residential complex and office building, where there will be significant additional demand for public transport services in the future.

In addition to all this, operational efficiency will improve (besides the number of kilometres travelled will stay on the same level), and there is no need to purchase additional buses, as the existing buses will be able to serve passengers on the new route.

Figure 3: Pilot line route

The travel time between the termini of the new line number 5 is 6 minutes. The timetable was designed taking into account the expected demand on school days, weekends and during the summer holidays.

Table 1: Pilot line timetable

Gesztenyés utca	PK telephely
x8:07	5:06
x8:37	x5:36
x8:37	i6:56
i10:45	z6:56

z10:45	t7:56
z11:34	z8:56
i12:36	i10:55
z14:06	i11:55
i14:45	x12:06
15:45	i12:36
x17:06	t12:41
x17:37	t13:36
z18:06	z13:40
i18:30	i13:51
x20:07	z14:06
20:45	z15:44
21:06	i15:56
23:06	z16:55
	x21:06
Traffic sign legend	
x	The bus runs on weekdays.
z	The bus service operates on weekends, holidays and public holidays.
i	The bus service operates on school performance days.
‡	The bus service runs every day during the school year (not during summer break).
Δ	The bus service runs every day during the summer school break.
t	The bus service operates every weekday during school breaks.
Unmarked bus services operate every day.	

Addressing key objectives

The primary objectives of the pilot action are to improve accessibility to previously underserved residential and development areas, enhance the efficiency of the existing local public transport network, and support sustainable mobility in a dynamically expanding city. The introduction of Line 5 directly addresses these objectives by providing a new connection between outer residential zones and emerging office and housing developments, while also enabling better coordination with intercity services.

The pilot line supports the strategic goal of reducing dependence on private cars by offering a reliable public transport alternative for daily commuting and essential trips. At the same time, it contributes to operational optimization by integrating the new service into the existing network without requiring additional vehicles, thereby improving coverage while maintaining cost efficiency. The pilot also serves as a practical test case for evaluating how targeted network extensions can respond to changing mobility needs associated with urban growth.

Expected outcomes/effects of Pilot Action

The pilot action is expected to increase public transport usage along the new corridor, particularly among residents of previously unserved areas and users accessing newly developed residential and office zones. Improved accessibility is anticipated to reduce car dependency for local trips, contributing to lower congestion and supporting more sustainable travel behaviour.

From an operational perspective, the pilot provides valuable data on passenger demand, service reliability, and timetable performance, enabling evidence-based adjustments to routes and schedules. The results will support future network optimization and inform long-term planning decisions by demonstrating how modest route extensions can improve service coverage without significant additional costs.

In the broader context, the pilot action is expected to strengthen cooperation between the municipality and the transport operator, increase public awareness of public transport opportunities, and establish a foundation for further integration of sustainable mobility solutions. The experience gained will contribute to refining planning practices and scaling similar interventions across other parts of the city where accessibility gaps remain.

2.2.2. Engagement of stakeholders

The table lists the key stakeholders involved in the pilot action, showing their roles, levels of involvement, importance, and influence during the preparation, implementation, and evaluation phases.

Table 2: List of stakeholders involved in pilot project implementation & impact assessment

Stakeholder	Type	Role	Importance	Influence
Municipality of Paks	Local public authority	COLLABORATE	HIGH	HIGH
Ministry of Construction and Transport	National public authority	COLLABORATE	HIGH	HIGH
Citizens	General public	CONSULT	HIGH	MEDIUM
Local organizations (Schools, SMEs, Social and Health Institutions)	Education/training centre and school; Hospitals and medical centres, SME	INFORM	LOW	LOW

2.2.3. Risk assessment

The table presents an assessment of potential risks related to the pilot action, showing their probability and impact, along with the measures identified to mitigate them.

Table 3: Identification of potential pilot action implementation risks

Risk	Probability	Impact	Countermeasure
Underutilization	LOW	LOW	In the event of underutilization of departures the schedule can be easily redesigned to meet actual demand.
Insufficient capacity	HIGH	HIGH	As expected, large numbers of residents and workers move into the new part of the city, the current bus capacity will be insufficient. (However, in the current situation, the service capacity is adequate to meet passenger needs.) The problem can be addressed by expanding the fleet, but this will also entail a significant financial burden.
Technical risk	LOW	HIGH	The company's bus fleet is young, and the risk of technical failures is currently minimal. Reducing service time will be the only solution in the event of a breakdown, and the company is working to improve this by developing its own repair workshop.
Financial risk	LOW	LOW	When planning the Pilot Action, we anticipated that revenues would increase. This increase will offset the minimal rise in operating costs. We do not expect a significant increase in fuel prices (electricity) in the medium term.

2.3. Pilot action implementation activities

The table presents the key activities carried out during the implementation of the pilot action, including a description of how each activity was carried out, along with timelines and monitoring arrangements before, during, and after the pilot period.

Table 4: PA monitoring table of implementation of activities and steps

PLAN				IMPLEMENTATION	
Pilot activity	**Brief description**	**Start**	**Deadline**	**When**	**Comment**
Activity 1	**Pilot action planning**	**April 2025**	**Aug 2025**	Apr – Aug 2025	In addition to planning, it was also necessary to obtain permits and consents.
Activity 2	**Promotion of the pilot before launch**	**Aug 2025**	**Aug 2025**	Aug 2025	More media appearances in local media.
Activity 3	**Launch and execution of pilot action (4 months: 01/07/25 – 31/10/25)**	**Sep 2025**	**Aug 2026**	Sep 2025 – Aug 2026	Since the new line also serves schoolchildren, the duration of the Pilot could not be shorter than one year.
Activity 4	**Monitoring of performance parameters & stakeholders' feedback**	**Sep 2025**	**Jan 2026**	Sep 2025 – Aug 2026	Continuous data provision
Activity 5	**Assessment of the pilot action implementation and report**	**Nov 2025**	**Feb 2026**	Nov 2025 – Feb 2026	Passenger traffic collection starts November 2025 KPI validation and analysis January 2026
Activity 6	**Promotion of results of implemented pilot actions**	**March 2026**	**April 2026**	2026 March	Right before or after school spring break.

2.3.1. PA promotional campaign

The communication and promotional activities supporting the launch of the pilot action and its visibility among users and stakeholders are described.

Table 5: PA promotion campaign

Date	Purpose of publication	Publication location
21st August 2025	Passenger information about the schedule change and the introduction of the new line 5.	https://paksbusz.hu/uj-vonalat-vezetunk-be-szeptember-1-jen/
25th August 2025	English version of the previous news.	https://paksbusz.hu/en/new-line-to-be-introduced-on-september-1st/
29th August 2025	Informing passengers in Tolna County about the pilot action.	https://www.teol.hu/helyi-kozelet/2025/08/bovul-a-szolgaltatas-uj-buszutvonalat-vezetnek-be
29th August 2025	Informing the population of Paks about the pilot action.	https://www.telepaks.net/2025/08/29/uj-vonalat-vezet-be-a-pk-kft-szeptember-1-jen/

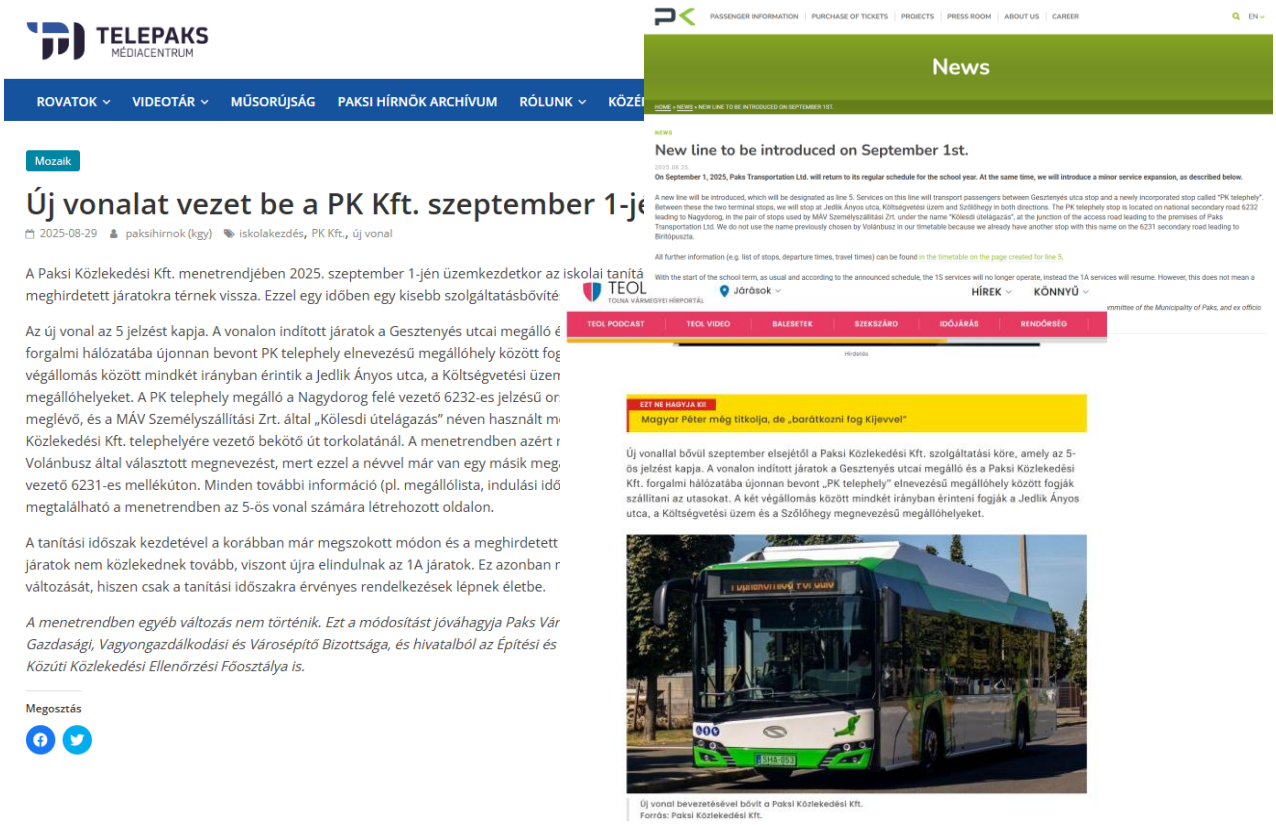


Figure 4: Communication and promotional materials

2.3.2. Promotion of Pilot action results

The results of the PT network optimisation Pilot action in Paks were presented by PP5 Paks Transportation llc at a stakeholder meeting held on 28th January 2026. The results of the stakeholder meeting were published in the OPTI-UP project news section of Paks Transportation llc's website.

Figure 5: Stakeholders meeting

2.4. Difficulties and deviations from the plan

Difficulties and deviations encountered during the implementation of the pilot action are summarised in the list below.

Table 6: List of difficulties/deviations in implementation of the PA plan

Date	Brief description	Reason	Management/solution	Impact rating
September 2025	There were problems with connecting departures. In the case of departures operating during peak periods, the departure time could not always be met due to delays in the connecting departures.	operation lack of buses (-10%)	We have revised the scheduled departure times.	low
January 2026	In the case of intercity connecting departures, the January weather caused difficulties due to the unusually significant amount of snow.	operation	We maintained constant contact with the dispatch service of the operator providing intercity public transport services.	moderate

2.5. SWOT analysis of implementation

Key internal and external factors influencing the implementation of the pilot action are summarised through a SWOT analysis, highlighting strengths, weaknesses, opportunities and threats.

Table 7: SWOT analysis of pilot action implementation

Strengths	Weaknesses
Existing local public transport network that can be extended without major infrastructure investments. Pilot line implemented using existing vehicles, avoiding immediate capital costs. Strong cooperation between municipality and transport operator during implementation. New line improves accessibility to previously unserved residential and office areas. Clear pilot objectives aligned with city development and mobility needs. Ability to adjust schedules and routing based on observed demand.	Limited financial resources for fleet expansion and long-term service development. Insufficient capacity planning for electric vehicles in relation to potential future demand growth. Dependence on a small vehicle fleet increases vulnerability to technical failures. Limited flexibility in reallocating vehicles during peak periods. Partial lack of advanced passenger information systems and modern ticketing solutions. Public transport still perceived as less attractive compared to private car use.
Opportunities	**Threats**
Growing mobility demand linked to urban expansion and new residential and business developments. Strong political support at local and national levels for improving public transport accessibility. Potential integration with regional and intercity services to strengthen multimodal connectivity. Use of pilot results to support long-term network optimization and future funding applications. Further development of sustainable mobility solutions (electric fleets, smart mobility tools). Opportunity to promote behavioural change through targeted communication and employer engagement.	Rising operational costs (energy, maintenance, labour). Continued increase in private car ownership leading to reduced PT competitiveness. Public scepticism toward changes in service types or vehicle comfort (e.g. smaller vehicles). Economic downturns that could limit public budgets for transport services. Delays in complementary infrastructure development may reduce effectiveness of the new line. Low initial ridership could weaken political and institutional commitment if not properly addressed.

2.6. Pilot Action conclusions

During the implementation of the pilot action in Paks, continuous communication with stakeholders and monitoring of passenger demand were carried out to assess the performance of the newly introduced bus line.

The pilot was implemented following standard planning and consultation procedures, including engagement with local stakeholders and dissemination of information about the new service. Passenger numbers were continuously monitored throughout the pilot period.

Although the initially planned ridership targets were not fully achieved, this was partly influenced by external factors, particularly delays in planned residential developments in the service area. As a result, the expected demand base did not fully materialise during the pilot period.

Despite this, the pilot confirmed that the introduction of the new line generated new passenger demand and revealed previously unmet mobility needs. The service also demonstrated stable operational performance and provided a basis for further development.

Based on the results and stakeholder feedback, the City of Paks decided to continue and extend the pilot service. The planned extension of the route will connect additional residential areas, increasing the number of potential users and improving overall service coverage.

The planned changes include:

- extension of the route to newly developed residential areas,
- construction of additional bus stops, and
- adjustment of the timetable to improve coordination with other lines and ensure better service integration.

These measures are expected to increase ridership and improve the long-term sustainability of the service, while enhancing the overall quality of public transport in the area.

2.7. Guidance for future actions for pilot action sustainability

The table below provides guidance for future actions to support the long-term sustainability of the pilot solution, based on the lessons learned and highlighting key steps for continuation and potential scaling.

Table 8: List of activities for achieving sustainability of the implemented pilot solution

Action	Providers	Inputs/resources	Hints
Public service contract (preferably long-term as permitted by law)	State or municipality	Contractual data	Long-term maintenance is worth considering as a consideration during the design phase, as this ensures the possibility of later correction, but does not endanger the premature termination of the development (due to a decision made in the absence of results).

Promotion of the new mobility service/optimized networks	Affected employers, public institutions, educational institutions	Number of marketing campaigns, number of active outreaches among the target audience	Informing passengers and institutions is crucial, as without this, service use may decrease, even though public transport will become more efficient for passengers.
Regular monitoring of service	PT Operator	Operational and financial data, passenger traffic	The method of preliminary delimitation of data is very important in order to be able to separately examine the effectiveness of a given service.

3. Osijek pilot project report

This chapter presents the report on PT network optimisation in Osijek (Croatia), detailing the implementation and outcomes of the tested solutions, as well as guidance for future actions.

3.1. Pilot action scope and objective

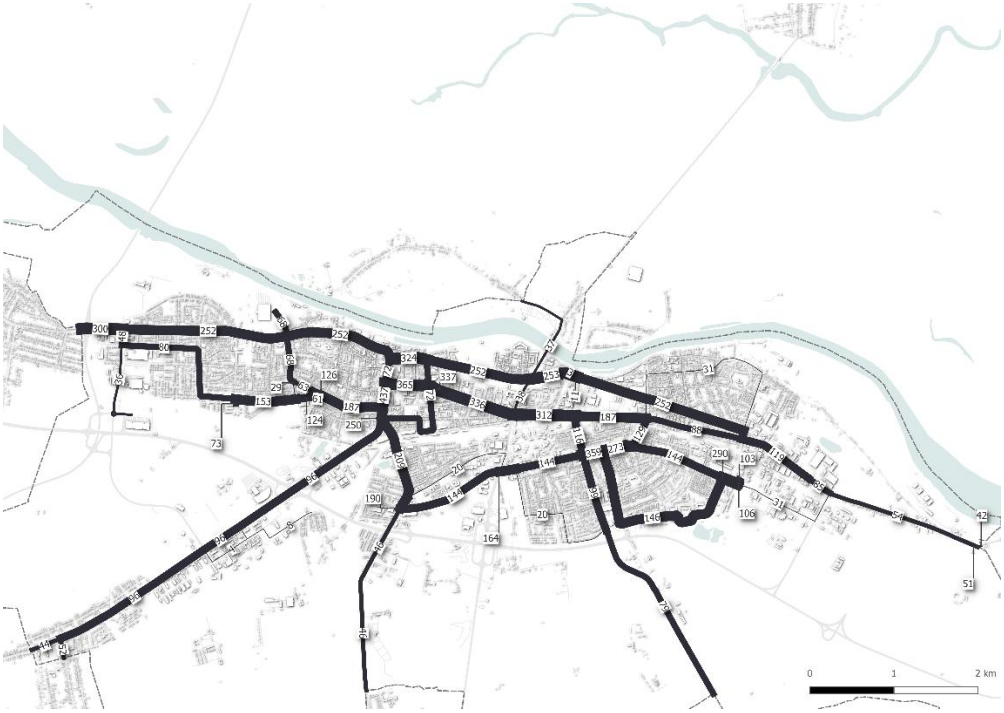
Key information about the pilot area is presented, including the main public transport challenges addressed and the desired outcomes to be achieved through the pilot action.

3.1.1. General information on pilot project area

The description of the pilot project area provides an overview of its geographical, demographic, and transport-related characteristics. Key features of the area are illustrated with numerical data and supporting maps.

Location

City of Osijek


0
1
2 km


Obrazovna ustanova
Trgovina
Stambena zona unutar 200 m od obrazovne ustanove ili trgovine
Stambena zona unutar 500 m od obrazovne ustanove ili trgovine
Stambena zona unutar 1000 m od obrazovne ustanove ili trgovine
Grad Osijek
0
2
4 km

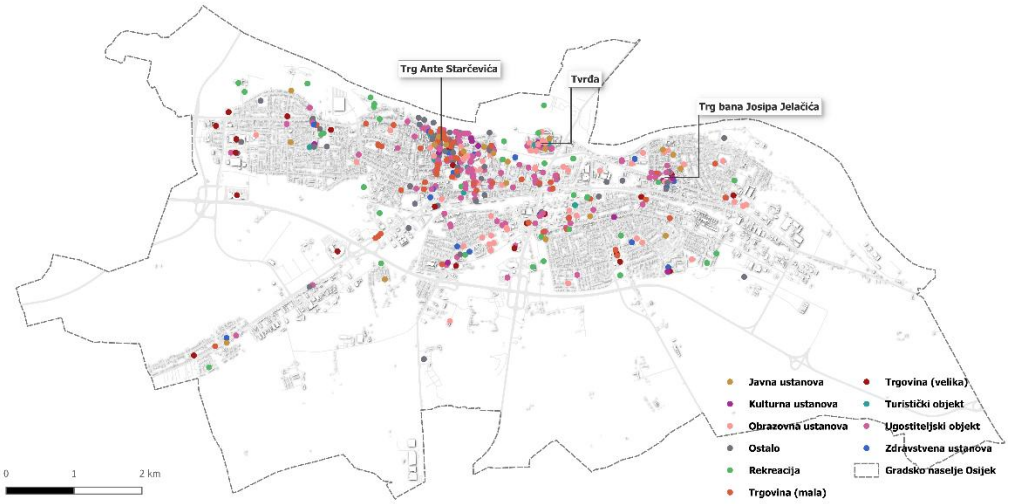


Figure 6: Maps of Osijek

Area characteristics

Osijek is characterized by predominantly lowland terrain and is located on the very right bank of the Drava River. The population in Osijek has exhibited a decline, with recorded figures of 129,792 in 1991, 114,616 in 2001, 108,048 in 2011, and 96,313 in 2021.

Osijek is divided into several key urban areas, each with distinct characteristics:

Gornji Grad (Upper Town): The historic core, featuring Baroque architecture, the Parish Church of St. Peter and Paul, and Tvrđa, an 18th-century fortified complex with museums, galleries, and vibrant nightlife. It's a cultural and tourist hub.

Donji Grad (Lower Town): A residential and commercial area with modern amenities, schools, and shopping centres. It's more suburban, with green spaces like King Tomislav Park.

Novi Grad (New Town): A newer residential zone with apartment blocks, sports facilities, and the large Portanova shopping mall. It's popular among families and younger residents.

Retfala: A quieter, primarily residential area west of the city centre, known for its mix of older homes and newer developments, with parks and local markets.

Jug II: A densely populated residential area in the south, featuring high-rise apartment buildings and proximity to industrial zones, with good public transport links.

Tvrđa: Often considered part of Gornji Grad but distinct for its historical significance as a fortified old town. It's a UNESCO candidate, with cobblestone streets, the Museum of Slavonia, and lively bars.

Sjenjak: A central residential neighbourhood with a mix of mid-20th-century housing and green areas, close to the Drava River and city amenities.

Industrijska Četvrt (Industrial Quarter): Located near the city's eastern edge, this area hosts industrial facilities, warehouses, and some worker housing, less focused on residential life.

These areas reflect Osijek's blend of historical, residential, and modern urban zones, centred around the Drava River.

Today, the city of Osijek has approximately 30 km of tram tracks on which two lines operate. On the other hand, buses operate on 8 lines with various sub-variants. There are plans for the construction of a new depot, following the initiation of a project to modernize 9.5 km of tram tracks.

Although it is not located directly on any of the TEN-T corridors, Osijek is situated very close to the important Danube port - the Port of Vukovar. The Port of Vukovar is positioned on the Rhine-Danube corridor as well as on the Western Balkans - Eastern Mediterranean route.

3.1.2. Key issues & objectives of pilot action

This section presents the main PT and accessibility challenges in the pilot area and the objectives set to address them through the pilot action.

Key public transport issue(s) addressed and main causes

1. Complicated Network Structure
   - Description: The public transport network is complex, with many lines featuring multiple route or schedule variations throughout the day, making it challenging for passengers to navigate.
2. Inadequate Information System
   - Description: The information system lacks real-time schedules and transfer details, leaving passengers without easy access to accurate, up-to-date transit information.
3. Low Population-to-Bus/Tram Kilometres Ratio
   - Description: The study area has the lowest ratio of population to daily bus and tram kilometres, indicating underutilized or inefficiently allocated public transport resources.
4. Low Public Transport Capacity Utilization
   - Description: The daily static public transport capacity utilization is only 2,5, suggesting that buses and trams are significantly underused, with low passenger numbers relative to available capacity.
5. Low Average Public Transport Trips per Inhabitant
   - Description: The average number of public transport trips per inhabitant is only 0,18, indicating very low usage of the system by the population, possibly due to inconvenience or lack of accessibility.
6. High Operational Cost per Bus/Tram Kilometre
   - Description: The operational cost, excluding amortization, is 2,56 EUR per bus/tram kilometre, with an average cost of 1,36 EUR per passenger, indicating high expenses relative to the low passenger utilization.

Key objectives (future outlook)

The "Local plan for the City of Osijek" aims to overhaul the public transport system by introducing a simplified, user-friendly network. Key expectations include:

- **Simplified Network**: The plan will streamline the complex network of bus lines, reducing route variations and making the system easier to navigate for passengers.
- **Improved Transfers**: The new network will facilitate easier transfers between lines, enhancing connectivity and convenience.
- **Increased Efficiency**: The redesigned network is expected to optimize resource allocation, improving the population-to-bus/tram kilometres ratio and overall system efficiency.

Adaptation Period: Current users may need time to adjust to the new system, as changes to routes and schedules could initially cause confusion.

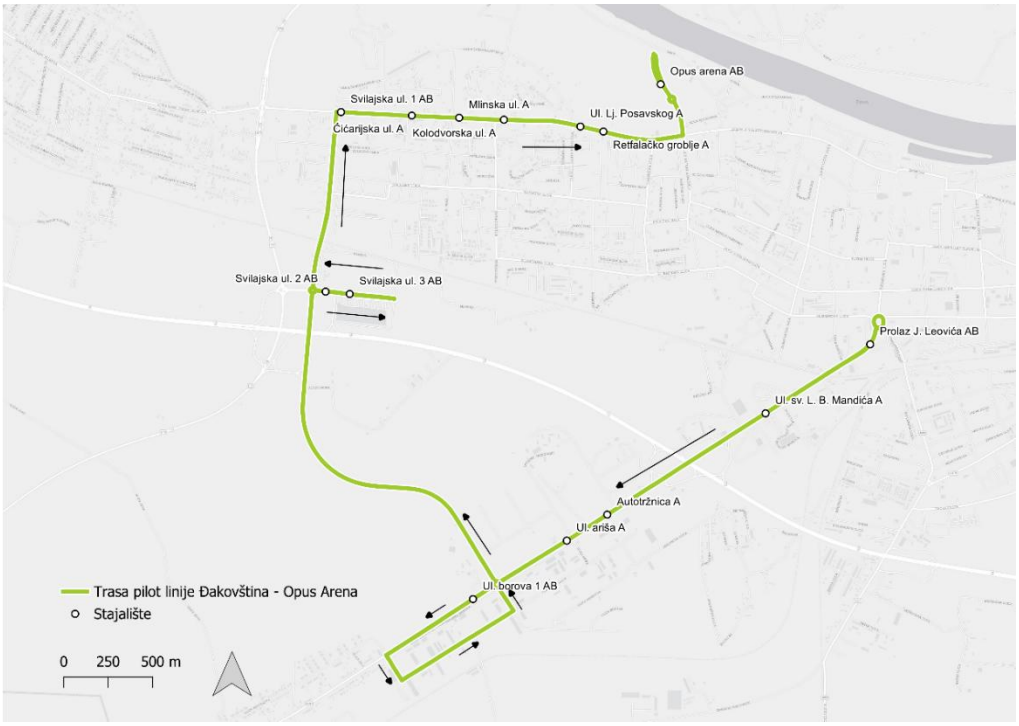
3.2. Pilot action solution and expected outcomes

This section provides an overview of the pilot action, covering its expected outcomes, the stakeholders engaged in the implementation, and the potential risks identified prior to the start of the project.

3.2.1. Description of Pilot action solution

The implemented pilot action solution is described with a focus on its operational features and its contribution to improving accessibility, connectivity and overall system efficiency.

Pilot solution will be introduction of new bus line between Opus Arena and Đakovština. Currently, there is no such line and this pilot line will connect densely populated area (Retfala) with big industrial zone Jablan.



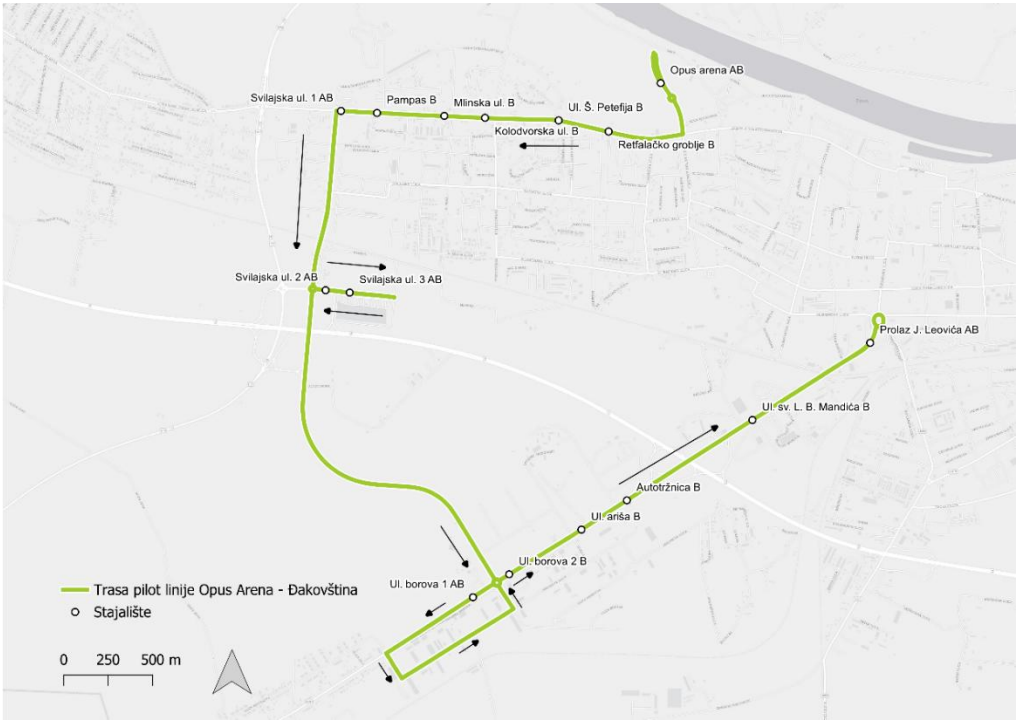


Figure 7: Pilot line route

Table 9: Pilot line timetable

Opus Arena	Đakovština
5:30	6:00
6:30	7:00
7:30	8:00
8:30	9:00
9:30	10:00
10:30	11:00
11:30	12:00
12:30	13:00
13:30	14:00
14:30	15:00
15:30	16:00
16:30	17:00
17:30	18:00
18:30	

The pilot action was designed in a way that relied exclusively on existing operational staff, without causing any negative impacts on regular operations. Likewise, a bus from the existing fleet was used, ensuring that the pilot implementation did not adversely affect ongoing services.

A new-generation MAN Lion's City 12C diesel bus was deployed for the pilot operation. The vehicle is equipped with a 265 kW diesel engine and an automated transmission, fully compliant with all applicable active and passive safety standards. The bus has a total capacity of 97 passengers, including 29 seated places, making it suitable for high-demand urban services.

As the pilot route terminated at Opus Arena, passengers were provided with convenient transfer options. These included the possibility to transfer to tram line 1, which turns around in the immediate vicinity at Podgrađe, as well as to bus line 1, which also terminates at Opus Arena. No timetable adjustments were made to other existing lines, while the pilot line itself operated according to a predefined regular headway (clock-face) timetable.

Addressing key objectives

Goal of the pilot action is to enhance public transport network and improve and provide public transport connectivity between densely populated area and industrial zone. Currently, connections between these two parts of the city are complicated and include transfers to and from different lines. Pilot action will also help determine correlation between modelled and real benefits.

Expected outcomes/effects of Pilot Action

This pilot solution was chosen as it provides smooth connection for densely populated area and industrial zone. It is expected that pilot line will be attractive to passengers with its 1-hour frequency. It also connects shopping malls on the route so it will be interesting to analyse how many trips will be made for non-obligatory trips. It will also give answer on how users will react to introduction of new line before applying big changes to the whole network. It will also help identify correlation between modelled data and real demand.

3.2.2. Engagement of stakeholders

The table lists the key stakeholders involved in the pilot action, showing their roles, levels of involvement, importance, and influence during the preparation, implementation, and evaluation phases.

Table 10: List of stakeholders involved in pilot project implementation & impact assessment

Stakeholder	Type	Role	Importance	Influence
City of Osijek	Local Authority	Provider of resources, impact on implementation of PT development actions	Very important	High
GPP	Public transport operator	Operator of city transport	Very important	High
HŽPP	Railway public transport operator	Operator of national, regional and sub-urban railway transport to the city;	Low	Low
Ministry of the Sea, Transport and Infrastructure	National ministry	Strategic/long-term planning of public transport, financial investments	Very important	High

3.2.3. Risk assessment

The table presents an assessment of potential risks related to the pilot action, showing their probability and impact, along with the measures identified to mitigate them.

Table 11: Identification of potential pilot action implementation risks

Risk	Probability	Impact	Countermeasure
Delay in implementation of temporary stops	Medium	High	Regular communication between City of Osijek and PTO
Late conclusion and agreements withing GPP departments, late issue of permit for new public transport service	Low	High	Regular communication and proactivity withing PTO departments
Lack of buses needed	Low	High	Check the operational conditions and capacities with PTO.
Difficulties to properly promote the new service to the potential users	Medium	Medium	Collaborate with PTO to promote the service via their channels within desired timeframe
Lack of drivers	Low	High	Check the personnel capacity with PTO and take measures on time.
Risk that the pilot may not operate as planned due to potential operational issues (e.g., prolonged travel/turnaround times caused by network congestion, route blockages, or similar constraints).	Low	High	Pre-pilot route validation and operational stress-testing, combined with flexible routing and timetable buffers to accommodate congestion and temporary route constraints.

3.3. Pilot action implementation activities

The table presents the key activities carried out during the implementation of the pilot action, including a description of how each activity was carried out, along with timelines and monitoring arrangements before, during, and after the pilot period.

Table 12: PA monitoring table of implementation of activities and steps

PLAN				IMPLEMENTATION	
Pilot activity	**Brief description**	**Start**	**Deadline**	**When**	**Comment**
Activity 1	**Pilot action planning**	**Jan 2025**	**Aug 2025**	Jan 2025 - Aug 2025	According to tasks 1.1-1.7
Task 1.1	Planning of different pilot line routes	Jan 2025	Aug 2025	Jan 2025 - Aug 2025	Used PTV Lines, tested more than 10 possible variants
Task 1.2	Timetable calculation	Jan 2025	Aug 2025	Jun 2025 - Aug 2025	PTV Lines calculation
Task 1.3	Turnaround feasibility assessment	Jan 2025	Aug 2025	Jul 2025 - Aug 2025	Based on Timetable and runtime
Task 1.4	Stop verification	Jan 2025	Aug 2025	Jul 2025 - Aug 2025	Discussed possibility to introduce additional stops
Task 1.5	Selection of the optimal variant	Jan 2025	Aug 2025	Aug 2025	Based on operational indicators
Task 1.6	Preparation of drivers and vehicles for the pilot line	Jan 2025	Aug 2025	Aug 2025	Similar to preparation for regular service
Task 1.7	Final adjustments before launching the pilot action	Jan 2025	Aug 2025	Aug 2025	Small tweaks to adjust timetable, connections, etc.
Activity 2	**Promotion of the pilot before launch**	**June 2025**	**Aug 2025**	Aug 2025	According to tasks 2.1-2.2
Task 2.1	GPP social networks and webpage	Jul 2025	Aug 2025	Aug 2025	Created post describing pilot
Task 2.2	Local media	Jul 2025	Aug 2025	Aug 2025	Shared to all local media
Activity 3	**Launch and execution of pilot action**	**Sept 2025**	**Nov 2025**	Sep 2025 - Nov 2025	According to task 3.1

PLAN				IMPLEMENTATION	
Pilot activity	**Brief description**	**Start**	**Deadline**	**When**	**Comment**
Task 3.1	Daily service regular running	Sep 2025	Nov 2025	Sep 2025 - Nov 2025	Running pilot action line as a line complementing regular service
Activity 4	**Monitoring of performance parameters & stakeholders' feedback**	**July 2025**	**Feb 2026**	Jul 2025 - Feb 2026	According to tasks 4.1-4.4
Task 4.1	Definition of KPIs	Jul 2025	Sep 2025	Jul 2025 - Sep 2025	Defined all SMART KPIs
Task 4.2	Data collection	Sep 2025	Nov 2025	Sep 2025 - Nov 2025	Collection of data during pilot line operation
Task 4.3	Survey activity	Sep 2025	Nov 2025	Sep 2025 - Nov 2025	Surveys among operational staff and passengers
Task 4.4	Data analysis	Nov 2025	Dec 2025	Nov 2025 - Dec 2025	Analysis of collected data
Activity 5	**Assessment of the pilot action implementation and report**	**Oct 2025**	**Feb 2026**	Oct 2025 - Feb 2026	According to task 5.1
Task 5.1	Pilot action assessment	Oct 2025	Feb 2026	Oct 2025 - Feb 2026	Based on collected data and surveys
Activity 6	**Promotion of results of implemented pilot actions**	**March 2026**	**April 2026**	Mar 2026- Apr 2026	To be decided.

3.3.1. PA promotional campaign

The table lists the communication and promotional activities implemented to support the pilot action and raise awareness among users and stakeholders.

Table 13: PA promotion campaign

Date	Purpose of publication	Publication location
29.08.2025.	Public information / service announcement	https://web.gpp-osijek.com/nova-autobusna-linija-pilot-u-sklopu-eu-projekta-opti-up/
29.08.2025.	Public information / service announcement	https://www.glas-slavonije.hr/osijek/2025/08/29/testna-autobusna-linija-od-1-rujna-od-opus-arene-do-s-ceste-i-dakovstine-715380/
29.08.2025.	Public information / service announcement	https://radio.hrt.hr/radio-osijek/obavijesti/nova-autobusna-linija-dakovstina-opus-arena-12310625
30.08.2025.	Public information / service announcement	https://031portal.hr/nova-autobusna-linija-pilot-u-sklopu-eu-projekta-opti-up/
30.08.2025.	Public information / service announcement	https://www.facebook.com/gpp.osijek/photos/-evo-kuda-vozi-nova-autobusna-linija-%EF%B8%8F-opus-arena-strossmayerova-portanova-s-ces/1230807122418889/
04.09.2025.	Public information / service announcement	https://www.facebook.com/photo/?fbid=1234972982002303&set=-evo-kuda-vozi-nova-autobusna-linija-%EF%B8%8F-opus-arena-strossmayerova-portanova-s-ces
14.09.2025.	Public information / service announcement	https://www.facebook.com/photo/?fbid=1240516991447902&set=-stiže-nova-autobusna-linija-od-1-rujna-kreće-pilot-linija-eu-projekta-opti-up-k

Figure 8: Communication and promotional materials

3.3.2. Promotion of Pilot action results

The results of the pilot action results in Osijek were presented to the City of Osijek at a stakeholder meeting held on 4 February 2025. In addition, a follow-up meeting for the wider City of Osijek administration is

planned to take place in the second half of March. Furthermore, it is planned to present and promote the pilot action results to the general public at a conference scheduled for October.

3.4. Difficulties and deviations from the implementation plan

Overall, the pilot was implemented without major difficulties or deviations, and operations remained stable throughout the entire period. No changes to the planned route were required, and all scheduled departures were carried out as planned.

A few minor observations were noted during implementation. At times, passengers experienced some initial confusion due to the pilot line departing from the same terminal as Line 1, indicating that passenger information could have been further improved. Additionally, certain sections of the existing road infrastructure, including the overpass above the bypass road and the condition of the S road, had a minor impact on ride comfort. Finally, as some stops were not constructed according to the original plan, the effective coverage of the line was slightly below the ideal scenario.

These observations did not critically affect service reliability or overall pilot performance.

3.5. SWOT analysis of implementation

Key internal and external factors influencing the implementation of the pilot action are summarised through a SWOT analysis, highlighting strengths, weaknesses, opportunities and threats.

Table 14: SWOT analysis of pilot action implementation

Strengths

Existing tram and bus network system for PT.

Significant recent investments in fleet modernization.

Existing infrastructure that may be sufficient for most transport organisation needs.

Good road infrastructure that forms the basis for PT services.

Compact urban layout in the centre makes public transport routes more efficient.

Weaknesses

Limited financial resources to expand or improve services and unsuitable models of public transport financing.

Relatively poor public transport infrastructure (terminals, stops).

Lack of coordination between municipalities, cities, counties, regions, and the state.

Dependence on private cars due to cultural habits or lack of awareness (PT is not competitive compared to private cars).

Lack of modern ticketing options (app, web shop, card payment…).

Opportunities

Growing demand for alternative transport modes (e.g., carpooling, on-demand minibuses).

Collaboration with local businesses to support public transport use.

Development of smart mobility apps for real-time information and route optimization.

Introducing new, simple routes.

Threats

Rising operational costs (fuel, maintenance, wages).

Competition from private transport services (ride-sharing apps, taxis).

Resistance to change from local policymakers or residents (e.g. persistent use of private vehicles).

Economic downturns that could reduce public funding.

3.6. Pilot Action conclusions

Overall, the introduction of the pilot line can be considered successful in terms of promoting public transport within the City of Osijek and improving connectivity between residential areas and key urban destinations.

The implementation of the pilot line was carried out in accordance with the original plan and defined objectives, with no significant deviations or major operational modifications required during the pilot phase.

However, several external challenges—most notably extensive infrastructure works affecting the entire public transport network—had a negative impact on both passenger satisfaction and demand for the new service.

Although the objectives of the pilot project were realistic and achievable, these external factors limited their full attainment, resulting in ridership levels that remained below expectations.

Nevertheless, passenger feedback was generally positive, with users particularly valuing the line's role in connecting a densely populated residential area with important points of interest such as shopping facilities, services, and workplaces.

One of the main shortcomings identified through user feedback was the insufficient number of stops, particularly at locations such as the Gospodarski centar and along Svilajska Street, which were clearly highlighted as opportunities for improvement. Looking ahead, a different approach could include the introduction of additional stops, stronger promotional activities, and more targeted measures to encourage ridership.

Despite the challenges encountered, the conditions for a successful evaluation of the pilot project were ensured, as the pilot line provided valuable insights into passenger needs and travel behaviour. With the completion of infrastructure works and improved timetable harmonization, the pilot line would likely achieve stronger performance, higher demand, and increased overall user satisfaction.

3.7. Guidance for future actions for pilot action sustainability

The table below provides guidance for future actions to support the long-term sustainability of the pilot solution, based on the lessons learned and highlighting key steps for continuation and potential scaling.

Table 15: List of activities for achieving sustainability of the implemented pilot solution

Action	Providers	Inputs/resources	Hints
Evaluation of pilot line performance	City transport authority; Public transport operator; Urban mobility planners	Ridership data; Passenger satisfaction surveys; Operational performance indicators; Pilot evaluation reports	This activity is essential for assessing whether the pilot met its objectives and for identifying strengths and weaknesses that should be addressed prior to long-term implementation.
Adjustment and optimization of route and stops	City transport authority; Urban planning department; Public	Spatial analysis; Passenger feedback; Demand and land-use data	Introducing additional stops at key locations (e.g. Gospodarski centar, Svilajska Street) can significantly

Action	Providers	Inputs/resources	Hints
	transport operator		improve accessibility and increase ridership.
Timetable harmonization with existing network	Public transport operator; Traffic management authority	Existing network timetables; Operational data; Scheduling tools	Harmonization reduces transfer times and improves system reliability, which is a key factor for passenger satisfaction.
Completion and coordination with infrastructure works	City infrastructure department; Transport authority; Construction contractors	Infrastructure work schedules; Traffic management plans; Coordination meetings	Stable operating conditions are necessary for sustainable service performance; close coordination with infrastructure works should be ensured.
Strengthening promotion and communication activities	City administration; Public transport operator; Communication and marketing departments	Promotion strategy; Communication materials; Budget resources	Enhanced promotion and targeted campaigns can raise awareness of the line and encourage a shift toward public transport use.
Stakeholder coordination and institutional support	City administration; Public transport operator; Regional and local authorities	Letters of support; Inter-institutional agreements; Steering group documentation	Strong cooperation among stakeholders increases institutional commitment and supports long-term sustainability.
Decision on long-term integration into the network	City council; Transport authority; Public transport operator	Pilot evaluation results; Cost-benefit analysis; Legal framework	A formal decision-making process is required to transition the pilot line into a permanent service and ensure financial and operational sustainability.

4. Comparison of PT network optimisation pilot solutions in Paks and Osijek

Within the OPTI-UP project, pilot activities related to public transport (PT) network optimisation were implemented in Paks and Osijek with the aim of improving accessibility, increasing operational efficiency, and enhancing the attractiveness of PT in medium-sized urban environments.

Both pilot actions addressed a shared structural challenge: the need to make PT more competitive compared to private car use by improving connectivity between residential areas and key destinations such as workplaces, services, and educational institutions.

While both cities pursued similar overarching objectives, improving accessibility, increasing ridership and optimising the use of existing operational resources, they adopted different implementation approaches.

Paks focused on targeted network expansion to serve newly developing residential and employment areas through the introduction of a new bus line.

Osijek, by contrast, focused on strengthening functional connectivity within the existing urban structure by introducing a new direct link between a densely populated residential area and an industrial zone.

The following sections present the common characteristics of both pilots, their key differences, shared findings, and considerations for replication and further development.

4.1. Common characteristics of the pilot activities

Both pilot actions introduced new PT lines designed to improve accessibility and optimise the existing PT network without requiring major infrastructure investments.

In both cases:

- new bus services were implemented using the existing fleet,
- the pilots aimed to improve connectivity between residential zones and employment areas,
- operational and performance data were systematically collected,
- stakeholder cooperation between municipalities and PT operators played a crucial role,
- monitoring and evaluation were conducted using predefined KPIs,
- the pilots served as test cases for future network optimisation strategies.

Both pilots demonstrated that relatively small-scale network interventions can significantly improve service coverage and provide valuable insights for long-term planning.

4.2. Key differences between the pilots

The most significant difference between the two pilots lies in their strategic focus and urban mobility context.

In Paks, the pilot action addressed territorial expansion and future growth needs. A new bus line (Line 5) was introduced to connect previously unserved outer residential areas and emerging office developments with the city's mobility network.

This represents a growth-oriented network extension approach, aimed at supporting urban expansion while improving operational efficiency.

In Osijek, the pilot action addressed functional connectivity within an already developed urban structure. A new bus line was introduced to directly connect a densely populated residential area (Retfala) with the industrial zone Jablan — a connection that previously required transfers.

This represents a network simplification approach, focused on improving usability and reducing travel complexity rather than expanding coverage.

Thus, two conceptually different approaches can be identified:

- an accessibility-driven expansion approach (Paks),
- a connectivity-driven simplification approach (Osijek).

4.3. Common findings

Based on the implementation of both pilot activities, several shared findings can be identified:

- Introducing new direct PT links improves accessibility and perceived service quality.
- Network optimisation can be achieved without major capital investment.
- Operational flexibility is essential during pilot phases.
- User acceptance depends strongly on service convenience (directness, reliability).
- External factors (e.g. infrastructure works, weather, fleet availability) significantly influence pilot performance.
- Continuous communication with stakeholders and users is critical.

Importantly, both pilots confirmed that network design plays a key role in increasing the attractiveness of PT — sometimes even more than frequency or fleet characteristics alone.

4.4. Opportunities for improvement

In Paks, further development could focus on:

- scaling capacity in response to future population growth,
- improving coordination with intercity services,
- introducing modern passenger information and ticketing systems,
- strengthening integration with multimodal transport options.

In Osijek, future improvements could target:

- introduction of additional stops along the pilot corridor,
- timetable harmonisation with existing lines,
- stronger promotional activities to increase ridership,
- improved resilience against external disruptions such as infrastructure works.

For both cities, long-term sustainability depends on:

- continued monitoring of demand trends,
- integration of pilot services into long-term planning frameworks,
- stable institutional cooperation,
- maintaining flexibility to adapt services based on real usage patterns.

4.5. Common conclusions

Both pilot projects confirm that targeted PT network optimisation represents an effective pathway towards improving accessibility, operational efficiency, and the overall attractiveness of PT systems in medium-sized cities.

However, the comparison between Paks and Osijek clearly demonstrates that network optimisation can serve different strategic purposes depending on local urban dynamics.

In Paks, the introduction of a new bus line functioned primarily as a tool to support spatial expansion and accommodate future mobility demand linked to new residential and employment developments.

In Osijek, the pilot primarily served to improve functional connectivity within the existing urban structure by simplifying travel between residential and industrial zones.

The first approach links network optimisation with urban growth management and long-term accessibility planning, while the second provides a targeted solution to reduce travel complexity and improve usability within an already developed transport system.

Both models are transferable, depending on local priorities:

- Cities experiencing spatial expansion may apply network extensions to serve emerging development areas.
- Cities with complex or fragmented PT systems may focus on improving direct connections and reducing transfer dependency.

The experiences gained from both pilots therefore provide practical guidance for cities seeking to optimise PT networks and contribute to the broader objective of developing efficient, user-oriented and sustainable urban mobility systems.