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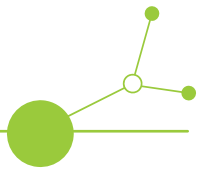
D.1.3.1 Local plan for the city of Grosuplje



Final version

October 2025

Table of Contents

List of Figures

List of Tables

Abbreviations

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

1 Introduction

This document is a plan for development of public transport in a municipality of Grosuplje, in line with the efforts of OPTI-UP project, developed in the framework of EU Interreg for Central Europe programme (Grosuplje Local Plan or local plan).

The Grosuplje Local Plan is derived from:

- Comprehensive strategy for a sustainable and efficient PT networks in Central Europe (giving: list of goals, measures, KPIs stakeholders, etc) (D.1.3.2) and

analyses of the PT (public transport) needs in Grosuplje, through collection of PT demand, operations and policy data, available in

- Comprehensive data report on existing public transport networks and best practices (D.1.1.1)
- Unified database of collected public transport (D.1.1.2)
- Grosuplje transport model (development from the existing base models) (D.1.2.1) and

The local plan will not only facilitate implementation but also evaluation of Local Plans as well as future pilot projects, OPTI-UP pilot project in Grosuplje being one of them.

Through collaboration with project associated partners (AP) and knowledge sharing with other stakeholders, this local plan aims to promote Grosuplje local and further regional development objectives and to serve as a model for other European countries and for future cross-border cooperation.

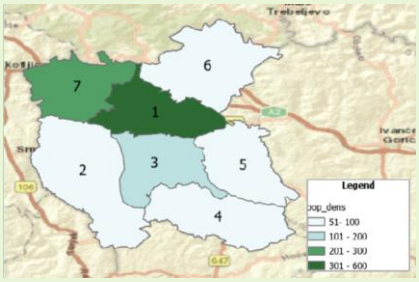
2 Background and Context

This chapter outlines the background and context in which the Local Plan operates. It summarizes the main findings from the territorial, demographic, and transport analyses—with a specific focus on public transport supply and usage—and provides a review of objectives set by higher-level policies and plans on mobility. Together, these results establish the knowledge base for the strategic choices developed in the following chapters.

2.1 Context overview

The information presented in this chapter constitutes a core set of baseline inputs relevant to the development of the Local Plan and derives from the in-depth analysis carried out by Opti-Up in Deliverable D.1.1.1.

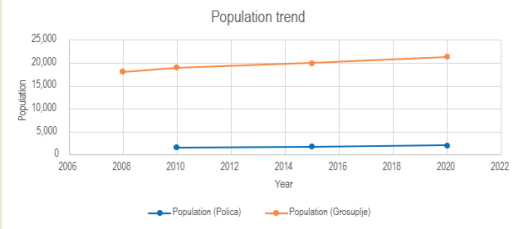
Grosuplje is a medium-sized Slovenian municipality located on the southeastern edge of the Slovenian capital (Ljubljana) with a population of 21,870. Grosuplje belongs to the Ljubljana Urban Region, which unites 25 municipalities and has a population of 537,893 with 163 inhabitants per km^2 on average.



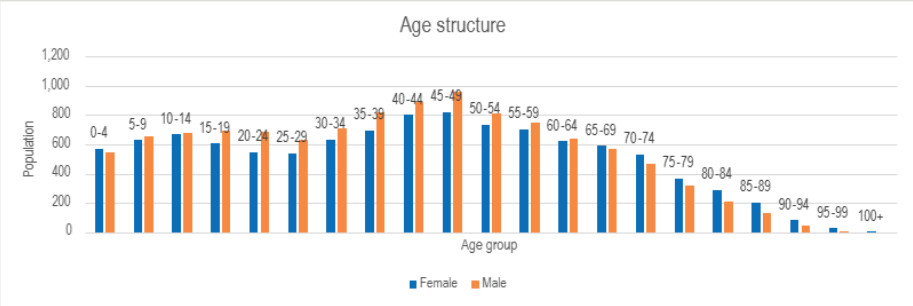
PT in Grosuplje mainly connects relatively small settlements around the centre, to the main transport hub in the centre, where the main bus and railway stations are located. Grosuplje public transport is faced with low ridership out of the peak hours, which are ONLY in the morning and afternoon when primary school students fully occupy the service. Therefore, the lines are not profitable.

On of the typical settlements inside Grosuplje with PT connection scoring low ridership is Polica, which has a population of 2,092. and the number of 9 daily connections in each direction, out of it 4 services intended merely for primary school students. Here, a demand-responsive transport (DRT) may provide a flexible PT to low-demand areas to balance the PT service accessibility and financial viability.

The population number in Grosuplje shows a steady trend of growth in the last years as depicted in the following graph, 20.9% in 2008 – 2020 period.



The demand for transport is high as the population age structure is slightly to the younger side as to the European average. The share of working population (64,7%) is slightly lower on account of younger population (<=15 years of age: 23.1%).



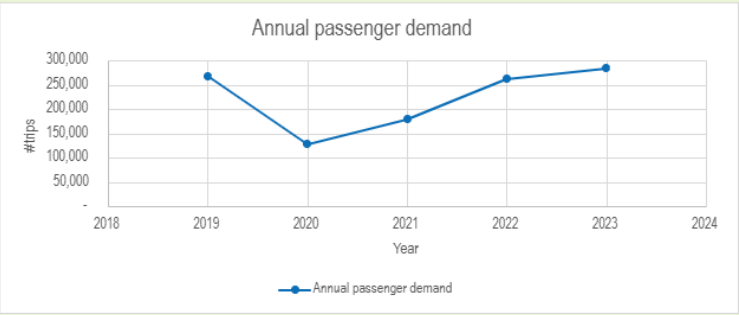
Public transport in Grosuplje began after the 1970s when bus passenger services from Ljubljana started expansion. In 2012 Grosuplje was integrated as the 3rd zone of the Ljubljana city bus system in 2013 also internal municipality lines were rolled out. DRT started in 2022 by introduction of electric car in the city centre and in 2023 an electric shuttle service, operating in larger municipality area. Grosuplje also has a railway line connection since 1892.

Among the 7 bus lines only 3 of them operate on Sundays, altogether running 512,189 km annually.

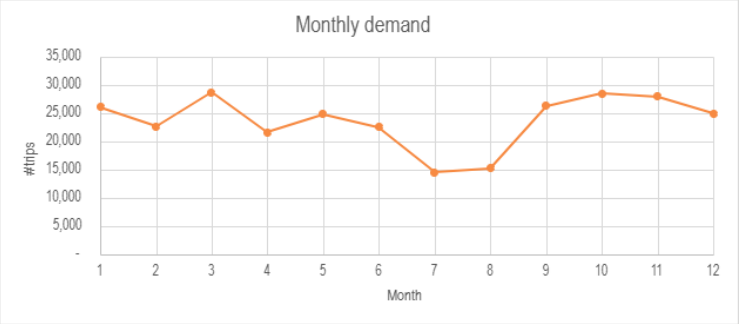
In 2024 public transport in Grosuplje has been operated by the fleet of 14 diesel buses and 3 DRT electric vehicles.

Fleet	Diesel buses	Electric DRT cars	Diesel school buses
Number	14	3	No data
Avg. age (2023)	4.5	1.5	No data
Capacity	50	4	8 to 20

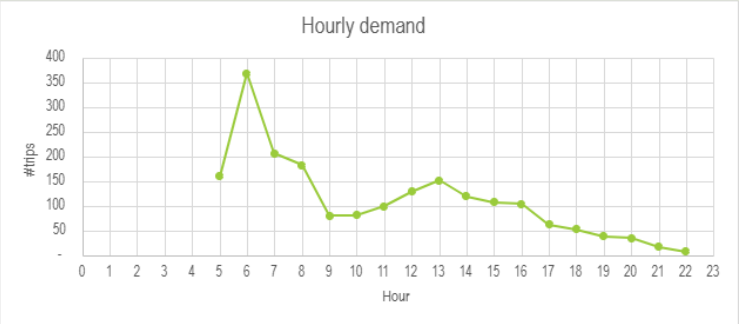
The volume of public transport demand shows a slight growth over the years, with a drop in the pandemic year of 2020.



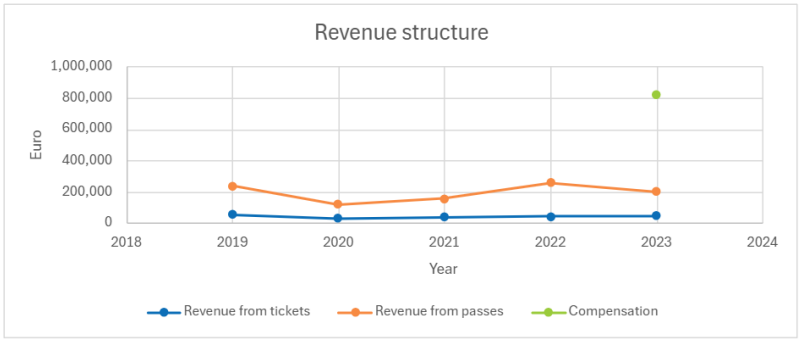
The highest monthly demand of passengers in Grosuplje coincides with the school seasons (March-May, September-December). The demand is the lowest in the summer break (July and August).

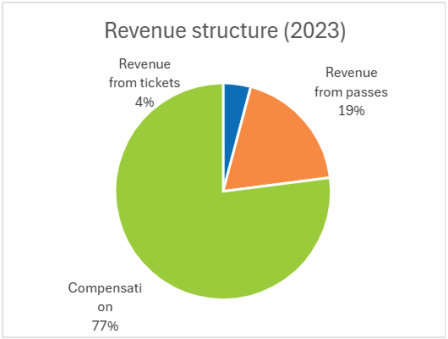


Grosuplje has two distinct peaks, with the morning peak at 6:00 for Grosuplje and the afternoon peak at 15:00-18:00, which is a bit spread due to various afternoon activities.



Apart from the compensation that takes up the most significant part of the revenues with 77% in year 2023, the most income comes from passes, which points to the commuters as the core of the passengers in Grosuplje. The drop of revenue in 2020 due to Covid-19 has been recovered. Reduction of income after 2022 is attributed to the changed tariff pricing which significantly reduced prices of passes for students and also the introduced free passes for retired passengers.





However, various studies have proven that price is not the key factor in choosing a mode of travel, but rather the quality of service. Accordingly, it can be assumed that increasing the price will not result in a significant loss of users but will increase the system's revenue.

PTO and city departments (both from Grosuplje and Ljubljana) are mostly involved in PT planning, operations, and maintenance. DUJPP (Družba za upravljanje javnega potniškega prometa, Public Transport Management Company), created on the national level impacts Grosuplje municipal PT by streamlining management and regulation of the PT.

2.2 National and regional mobility plans goals

The goals and measures defined within a local public transport plan should not be developed in isolation. Instead, they must align with the broader strategic objectives established at European, national, regional, and local levels. For small and medium-sized cities, this alignment is especially important: it ensures consistency with overarching policy directions, facilitates access to funding and technical support, and enhances the strategic coherence of local actions.

A comprehensive understanding of these higher-level frameworks allows cities to build their local strategies on a robust foundation, ensuring that local choices actively contribute to shared goals such as climate neutrality, improved public health, digitalization, and social equity in transport systems.

The main goals of municipality, regional and national mobility and environmental plans that impact development of PT in Grosuplje are listed by the level of authority.

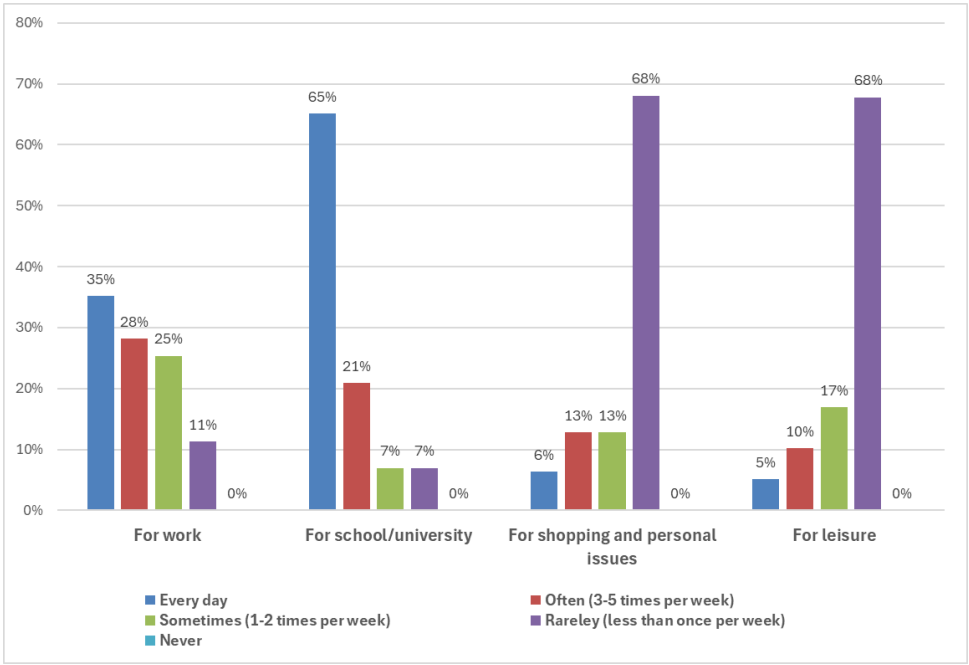
Level of authority	Relevant Goals	Relevant Plans
Local	- Improvement of accessibility of important locations by establishing efficient PT in the municipality centre and the hinterland - Development of PT infrastructure for more comfortable use (upgrading of existing and construction of new bus stops) - Increasing the number of PT users (additional trips, harmonised timetables…) - Reduction of PT emissions	- Integrated transport strategy of Municipality of Grosuplje - Local energy concept of the Municipality of Grosuplje
Regional	- Sustainable mobility (upgrading the infrastructure for PT, modernisation of the PT fleet and improving the management of the PT system) - Energy management - Adaptation to climate change	- Sustainable Urban Mobility Plan of the Ljubljana Urban Region - Regional development programme of the Ljubljana urban region 2021-2027
National	- Improvement of mobility and accessibility - Reduction of energy consumption - Reduction of costs for users and operators - Reduction of environmental burdens	- Resolution on the National Programme for the Development of Transport of the Republic of Slovenia until 2030 - Transport Development Strategy of the Republic of Slovenia until 2030 - Operational plan from 2020 to 2025 - Integrated National Energy and Climate Plan

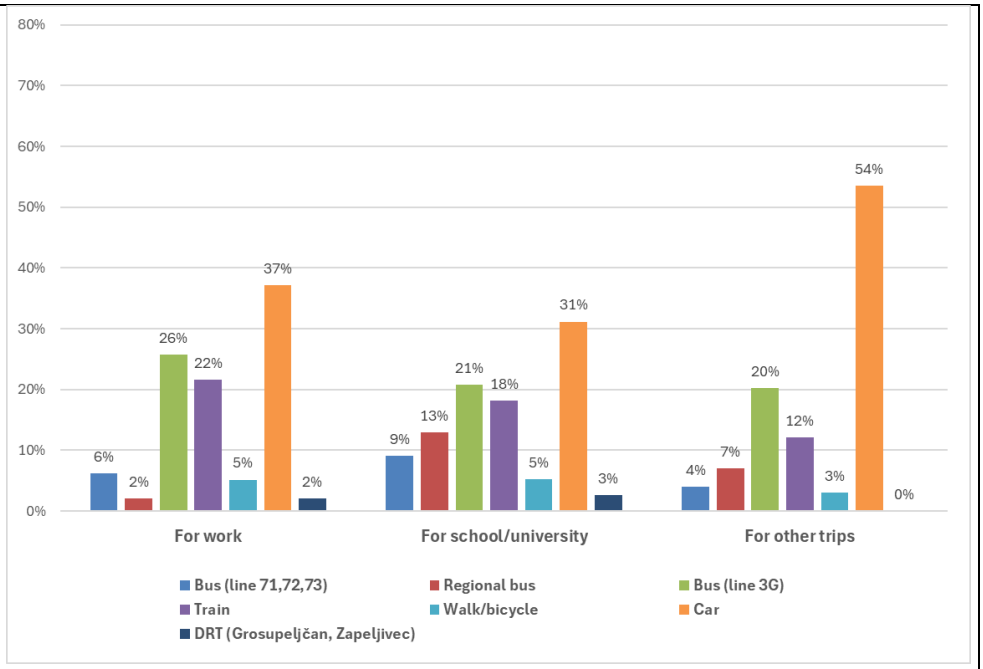
2.3 Results of survey

The goal of the survey is to find out what the current level of citizen satisfaction is, considering various aspects, such as the coverage of the transportation system relative to the city, reliability of schedules, vehicle capacity, and cleanliness, and what can be improved. Users' input can serve Transportation operators

as well as the Public Administration or Municipalities, Regions that manage public transportation, as a basis for future improvements and to create a public transportation system that is more efficient, comfortable, accessible for all, and takes into account the real needs of citizens.

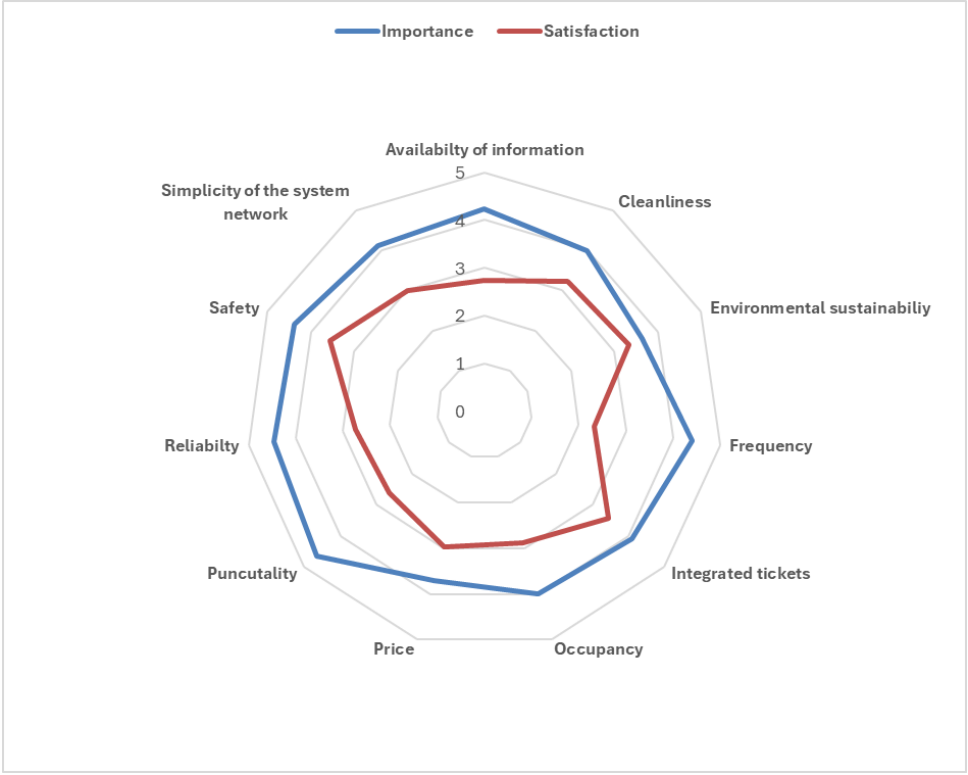
A survey on satisfactions and suggestions for development of public transport in municipality of Grosuplje was conducted among the inhabitants of the municipality between 03/04/2025 and 12/05/2025. The survey was published online. The users were informed about the survey via posts in the Municipality gazette and Municipality Facebook channel. The analysis is based on 104 obtained feedbacks. The results are available in the following.

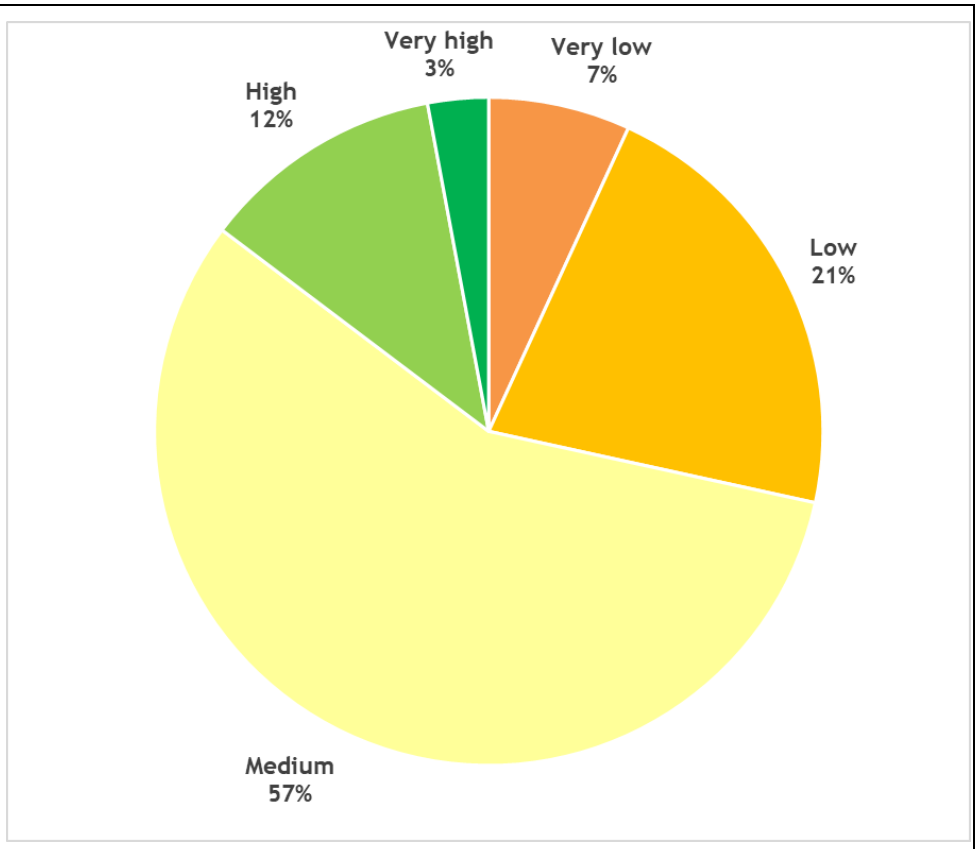
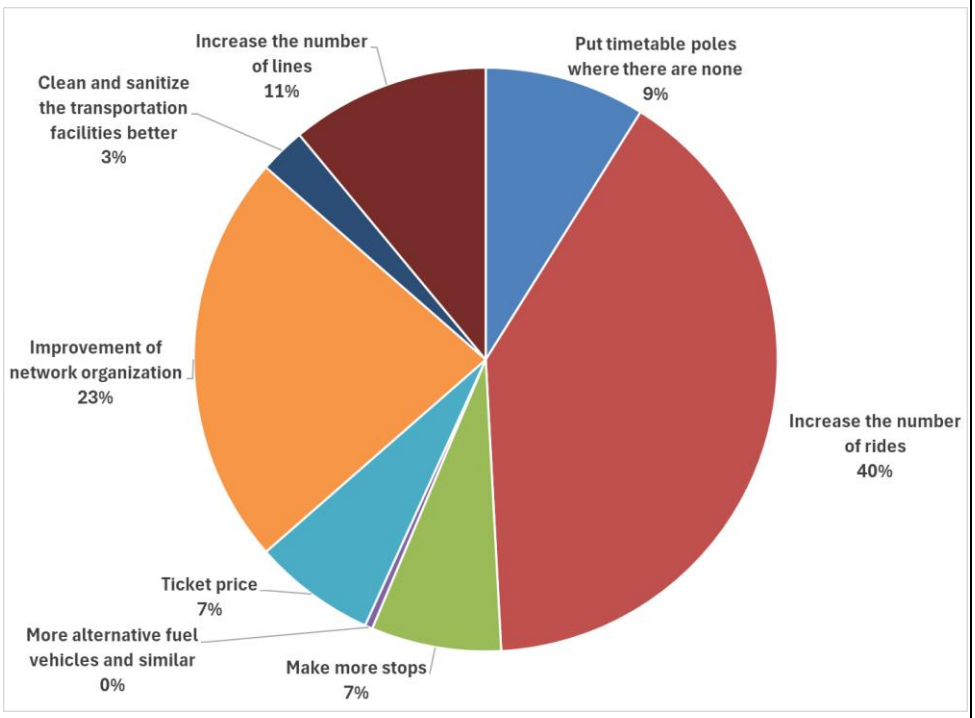
How often do you use the Public Transport?	
Which mode of transport do you use most often?	



Grade the satisfaction and the importance of the following characteristics about the public transport.

[Grades from 1= very low to 5= very high]



Rate your satisfaction with the public transportation you use most frequently?	
What would you suggest to improve the public transport? (max 3) *	
What are additional improvements of PT that you would suggest	- Better connection of surrounding villages with Grosuplje centre - Harmonisation of train and regional bus timetables - More train trips during the day (peak hours and evening)

(not mentioned in the previous question)?	- Establishing service during weekends, at least on Saturdays - Improved reliability and punctuality of regional buses - Make the train faster, punctual and affordable

Results of the survey suggest that almost half of the respondents (45%) does not use public passenger transport, while the other mostly use it irregularly. This suggests there is an interst for improvement PT also to attract new potential users, which are now not sufficiently addressed by the PT.

Among the respondents, a car is still most commonly used (41%), walking, cycling or other alternative forms of transport (DRT service) only in 7%, only half of users regularly use public transport, which results in peak-time traffic congestions on regional roads and also environmental challenges. Active mobility (walking/cycling) and alternative forms (DRT) are not yet widely established.

The majority of respondents show medium satisfied with nearly all PT characteristics, such as ticket price (59%), environmental sustainabiliy (55%), reliabilty (44%), cleanliness (42%) and information availability (40%) but express high satisfaction with safety (45%), cleanliness (42%) and simplicity of the system network (35%).

Most respondents put high importance to puncutality (71%), reliability (63%), frequency (58%), safety (54%), integrated ticket (43%) and availability of information (42%) and only medium importance to the price (39%).

In general, that the situation is not critically bad. More than half of the respondents (57%) are at least moderately satisfied with public passenger transport, while only 3% express high satisfaction.

The two mostly expressed proposals for improving public passenger transport are an increase in number of rides/trips (39 %), followed by an improvement of network organization (22%).

Respondents also suggested other improvements in public passenger transport, such as better connection of surrounding villages with Grosuplje centre, harmonisation of train and regional bus timetables to achieve balancing of the regional transport, more train trips during the week days and establishment of weekend service, in particular on Saturdays. More attention should be paid to improving reliability and punctuality of regional buses, and making faster, punctual as well as affordable train service.

In general, we can see that inhabitants have many suggestions but the offer of the public transport doesn‘t really answer to the demand.

The ridership on municipality public transport is low, also by virtue of inefficiency of regional and national transport.

Namely, the local transport merely provides feeder lines for regional transport to Ljubljana urban hub.

3 SWOT and Best Practice Analysis

The following chapter is structured in two parts: the first regarding the SWOT Analysis and the second one regarding the collection of Best Practices.

3.1 SWOT Analysis

The SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) is a strategic tool that helps small and medium-sized cities assess their current public transport landscape and develop a forward-looking plan for improvement. This methodology enables the city of Grosuplje to systematically evaluate its transport systems from economic, environmental, and social perspectives, ensuring a balanced and sustainable approach to future development. The analysis incorporates and summarizes all findings from the previous qualitative and quantitative work and is enhanced by engagement with stakeholders.

Table 1: SWOT definition

Strengths	What is currently working well in your LPT system, or what characteristics of your city support a good LPT service?
Weaknesses	What is NOT working well in your LPT system, or what characteristics of your city make it difficult to provide a good LPT service?
Opportunities	Are there any future developments in your city (not necessarily related to transport) that could improve the LPT service?
Threats	Are there any future developments in your city that could negatively impact the LPT service?

Strengths (S)
Lower congestion compared to large cities allows for more reliable scheduling.
Services like schools, sports facilities, shopping centres, public offices and transfer points to the regional public transport services are few and concentrated, making route planning easier.
PT occupancy shows distinctive bottoms and peaks and makes it easier to identify time windows for planning different forms of PT services.
Grosuplje municipality has a mass transit connection to the regional centre of Ljubljana by train.
Existing infrastructure (roads, stop shelters) and availability of vehicles is sufficient for connectivity needs within the municipality of Grosuplje.
National PTA (DUJPP) manages efficiency of PT services and supports projects for better and efficient connectivity.
The PTO already has capacities to provide DRT instruments (call centre, smaller electrical vehicles)
Use of electric vehicles for DRT services intended to transport elderly people (1 “Zapeljivček” car operated in the city centre and 2 “Grosupeljčan” cars for the wider municipality transportation).
A secure bike storage shed at the location of Grosuplje bus and railway stations.

A large multimodal information display at the location of Grosuplje bus and railway stations where local and regional PT services are displayed to support multimodality.
A P+R garage at the location of Grosuplje bus and railway stations for boosting use of regional PT railway and bus services.
Weaknesses (W)
Dependence on private cars due to cultural habits and insufficient offer of PT services
Scattered settlements in the municipality hinder efficiency of PT network layout and frequency
Congested roads from the Grosuplje to the Ljubljana employment/study destination at the peak hours and only a single-track railway connection from Grosuplje to Ljubljana.
Lower ridership levels, except for school intended service, make it harder to sustain frequent services.
Limited availability of weekend services.
Insufficient bus stops in new growing settlements in the municipality.
Poor integration with regional railway and bus transport to Ljubljana.
Operation of large 50-seater buses on low-occupied trips causes air pollution and energy and cost inefficiency due to low vehicle occupancy.
Opportunities (O)
Potential for strong community engagement and feedback integration; the municipality, PTO, the national PTA (DUJPP) and the Ministry are supportive of PT improvement initiatives and projects.
Local, regional and national legislations support deployment new forms of PT in order to encourage better use of public transport.
Introduction of eco-friendly solutions electric buses.
Introduction of micromobility (bike sharing to support PT use).
Existing national transport model can be updated and finetuned for analysis and simulation of scenarios in the municipality of Grosuplje.
Participation in the Ljubljana Urban Region transport initiatives.
Support of EU funded projects and pilot activities for sustainable mobility solutions.
Development of bicycle network within the scattered settlements and connection roads to the municipality centre to incentivise alternative to the car transport.
Growing demand for alternative transport modes (e.g., carpooling, on-demand minibuses) in the areas without PT connectivity – usually only served by school transport service.
Collaboration with local schools and pension organisations in order to better understand needs for PT.
Development of smart mobility apps for real-time information, route optimization and DRT support, connecting municipality and regional transport services.
Demographic challenges – aging population might need more PT service.

Inclusion of private transport services (like Flixbus) to PT offer (by accepting PT tickets and negotiating financial clearing).
Threats (T)
Limited financial resources to upgrade single railway track to the double-track, which would allow higher capacity and shorter travel times (opposite direction train crossing) between Grosuplje and Ljubljana.
Shortage of drivers with D-category driver license – difficult planning of drivers' shift.
New forms of PT are rather subject to sporadic initiatives of PTOs, EU projects than strategic planning within the municipality, since smaller municipalities don't have
Demographic challenges – aging population might need more attention when introducing new infomobility services (ticket vending machines, P+R parking use, mobility apps…).
Resistance to change from local policymakers or residents (e.g. persistent use of private vehicles).
Economic downturns that could reduce public funding.

3.2 Best Practices

In the table below is a selection of relevant best practices from other EU cities/countries that were identified in the OPTI-UP project. The selected practices provide source of successful PT development actions for shaping the objectives of the Grosuplje local plan on PT development and the lists of goals and planned actions.

Table 2: Best Practices

Best Practice	City	Relevance to Actions
Mokumflex - replacement of fixed public transport line by DRT transport in rural area	Amsterdam, Netherlands	• Deployment of DRT, involving too complex digital tools, resulted in reduction of PT passengers • Large timeframe for the desired departure time • DRT is more efficient that standard bus lines
Kutsuplus - pursuing Mobility on Demand	Helsinki, Finland	• City centre transport service • High operational costs • Lack of awareness about the service
ShuttleMare - free DRT service for summer season	Rimini, Italy	• Complementary to the PT service • Dimensioning number of buses, drivers and expected trips • Changing mobility habits • Interaction between the different bodies involved
RUMOBIL - optimization of data DRT service data collection	Modena, Italy	• Understanding which are the main KPIs to monitor and analyse a DRT service • Web tool for DRT booking • Analysis of the DRT service use
Prostofer - free transport for the elderly people	across Slovenia	• Volunteering drivers • Need for sponsorships • Help enhancing community connectivity

		• Sparsely populated areas
Adjustment of Public Transport Routes	Strakonice, Czechia	• Revision and optimization of existing public transport routes • Increasing the efficiency and accessibility of public transportation • Engaging and coordinating with various stakeholders
New public transport lines	Pula, Croatia	• Direct consultation with users and the city • Collaborative approach between the municipal administration and public transport operators • Tailoring public transport services to community needs • Clear communication using informative flyers
Development of public transport by purchasing electric buses	Győr, Hungary	• Use of electric PT vehicles • Eco-friendly new transport options • Involvement of citizens
Improving urban mobility through self-driving electric shuttle	Merano, Italy	• Driverless electric shuttle for DRT • Self-driven, autonomous, electric small buses or shuttles • Mobility on demand • Using an app

4 Vision and Goals

The vision represents the overarching, long-term aspiration for the evolution of the local transport system. It provides a unifying direction that guides decision-making and serves as a reference point for all subsequent planning choices. Defining a clear and shared vision helps ensure coherence in the strategy, aligning individual measures with a broader transformative goal.

The goals translate this vision into concrete ambitions, outlining what the local public transport plan aims to achieve through its intervention measures. These goals encompass mobility, social, economic, and environmental aspects. The integration of goals referring to different dimensions is a crucial moment in the planning process, as it is often necessary to pursue conflicting goals simultaneously.

In this chapter the city lists its vision and goals based on:

- The results of the SWOT Analysis
- The results of the survey on LPT
- The political view in your city

4.1 Vision

Our vision is to create a sustainable, efficient, and inclusive public transport system that meets the needs of all residents and visitors. We strive to offer a reliable, affordable, and eco-friendly mobility network that connects Grosuplje municipality centre, where most official, commercial and leisure facilities as well as connection points to regional transport and suburban settlements are located. The public transport offer will reduce reliance on private vehicles, and thereby enhance the quality of life in our community. By integrating innovative solutions, fostering accessibility, and promoting active transportation, we aim to build a resilient transport system that supports economic growth, social equity, and environmental sustainability for future generations.

4.2 Goals

The following Goals are related to at least one of the four main dimensions:

- Mobility
- Economic
- Social
- Environmental

Table 3: List and descriptions of Local Plan's Goals

No.	Goal	Description
G1	Improve the accessibility and connectivity of local public transport (Mobility/Social)	Extension and new bus stops on the bus network, increasing frequency of PT lines, harmonisation of municipality and suburban line timetables
G2	Increase the number of public transport passengers on a given line (Mobility)	Increase of number of passengers by better PT frequency, expansion of services to weekends, better

		harmonisation of services and optimisation of lines network
G3	Reduce congestion and emissions (Mobility/Environmental)	Reduction of emissions by introduction of electrical vehicles to PT and expansion of PT offer in additional municipality settlements to incentivise modal change
G4	Promote digitisation and smart mobility (Mobility/Social)	Introduction of infomobility systems to support passengers (a mobile app for management DRT service review and registration)
G5	Improve efficiency of public transport operations by DRT (Economic/Environmental/Social)	Introduction of new DRT services to replace regular services, additional DRT services and extension of scope of DRT services

4.3 Goals coherence analysis

When defining goals, it's important that they derive from higher level strategies. In this case Local Goals should be coherent with the goals defined at a European level, as well the national/regional goals.

The following table shows a coherence checks of the Local Plan's goals.

For the European level, the Priority of the Strategy related to the Goal has been indicated. The Priority1 has been assignied if the observed goal is fully adressed with the EU stragy, the Priority 2 if it is partialy adressed and Priority 3 if it is not directly covered by EU stategy.

For the National and Regional/Local level, indicate a level of coherence according to the following scale:

■ ■	Strong Coherence
■	Coherence
□	Weak coherence

No.	Local Plan's Goal	European Strategies Priority	National Strategies on mobility and transport	National Strategies on Energy/ Environment	Regional/ Local Strategies on mobility and transport	Regional/ Local Strategies on Energy/ Environment
G1	Improve the accessibility and connectivity of local public transport (Mobility/Social)	Priority 1	■ ■	■ ■	■ ■	■ ■
G2	Increase the number of public transport passengers on a given line (Mobility)	Priority 1	■ ■	■ ■	■ ■	■ ■

No.	Local Plan's Goal	European Strategies Priority	National Strategies on mobility and transport	National Strategies on Energy/ Environment	Regional/ Local Strategies on mobility and transport	Regional/ Local Strategies on Energy/ Environment
G3	Reduce congestion and emissions (Mobility/ Environmental)	Priority 1	■ ■	■ ■	■ ■	■ ■
G4	Promote digitisation and smart mobility (Mobility/Social)	Priority 1	■ ■	■	■ ■	■
G5	Improve efficiency of public transport operations by DRT (Economic/ Environmental/ Social)	Priority 1	■ ■	■ ■	■ ■	■ ■

5 Actions

This chapter introduces the first structured outline of possible actions that the city of Grosuplje may undertake to achieve its vision and goals. These actions are grounded in the results of the SWOT analysis and developed through participatory dialogue involving technical experts, political representatives, citizens, and relevant stakeholders.

At this stage, the actions are presented in a general and strategic form. They represent a preliminary list of intervention measures that address identified needs and opportunities and reflect the city's ambitions in improving its public transport system.

However, these proposed actions are not final. They will undergo a validation process through scenario-based assessments and modelling tools. This process will help refine the actions, add technical and financial detail, and establish a hierarchy of priorities based on impact, feasibility, and consistency with the overall strategy. In this way, the initial list becomes a foundation for informed decision-making in the subsequent phases of the plan.

Table 4: List of actions

Actions	Action name	Brief description	Goals
A1	Introduction of the combined DRT line 72	Re-categorization of line 72 to the line combining regular and DRT trips at a given schedule, operated with electrical vans	G3, G5
A2	Introduction of additional stop points on municipality bus line	Introduction of a new stop point at “Dole pri Polici” on 72 bus line	G1, G2
A3	Expansion of municipality bus line timetable, including additional weekend services	Additional trips during the week and introduction of 3 daily trip pairs on Saturdays and Sundays on 72 bus line	G1, G2
A4	Harmonisation of transfers among municipality lines	Harmonisation of bus line 73 with other municipality lines (71 and 73) at Grosuplje bus station	G1, G2
A5	Management of DRT service via user mobile app	Inclusion of municipality DRT lines in DRT app for registration of service operated by the LPP or DUJPP	G4
A6	Harmonisation of transfers between municipality and suburban PT services	Harmonisation of municipality bus lines (71, 72 and 73) with suburban transport (trains and bus line G3) at the Grosuplje bus/railway station	G1, G2
A7	Extension of existing suburban bus lines within the municipality	Extension of G3 suburban line from Ljubljana to the settlements “Sončni dvori” and “Arcus”- 2 additional bus stops	G1, G2
A8	Research of demand of Grosupeljčan” complimentary car DRT service	Survey of demand for expansion of “Grosupeljčan” complimentary car DRT service to include additional transport beneficiaries (user groups) and purposes	G5

6 Actions and Transport Model Scenarios

Transport modelling was applied on 3 actions A1, A2 and A3, defined in section 5 to model scenarios of modifications on line 72 in Grosuplje. Grosuplje municipality line 72 operates during the week from Monday to Friday scheduling 9 pairs of daily trips according to the timetable.

The selected scenarios are modelled for the actions that are planned to be implemented in short-term and to generally showcase the approach of planning public transport measures:

- A1: Introduction of the combined DRT line 72,
- A2: Introduction of additional stop points on municipality bus line,
- A3: Expansion of municipality bus line timetable, including additional services.

Action A1 was induced by the local community and supported by the public transport agency (DUJPP) and the transport operator LPP to reduce polluting gas emissions and operational costs, by reducing the number of empty runs and increase occupancy. The trips in the timetable with low occupancy will be operated as DRT service and by using eco-friendly electric cars or vans or smaller 20-seater diesel bus as a replacement of 50-seater diesel bus. VISUM model cannot precisely model user-behaviour or expected operational enhancements of the 72 line, therefore scenarios that are modelled ca only simulate operation of DRT and should be interpreted carefully.

The actions A2 and A3 pursue requests by the population along the observed line 72 to increase the existing PT service by introducing additional bus stop and schedule additional trips, either as a regular or DRT service. The aim of the actions A2 and A3 is to increase the volume of public transport users.

Four short-term transport model scenarios were applied for simulation of the applied interventions:

- scenarios 1 and 2 to simulate intervention action A1,
- scenario 3 for action A2 and
- scenario 4 for action A3.

Additional explanation of actions is available in section 6.2.

The modelled scenarios compare KPIs with the baseline model that denotes the current state of PT without applying interventions. The KPIs measure changes of passenger flow distribution, gas emissions, travelled kilometres, cost of operations (fuel), volume of passengers.

Grosuplje transport model is based on a national Slovenian transport model and serves as a macro-level model. The national model was brought to the micro-level by redefinition of the baseline model data. Based on a new definition of the baseline model, the short-term transport scenarios were applied.

6.1 Definition of baseline model

Transport model for Municipality of Grosuplje was implemented in Visum, based on the data collected for a national transport model. The macro level national model applied for Grosuplje was modified to micro level, in order to obtain a baseline model, suitable for testing short-term scenarios on the level of municipality of Grosuplje, in particular one PT line. Transport model scenarios will be observed on municipality public transport (PT) line 72 that serves as example, but the same approach will be applied on other municipality PT lines. Development of PT scenarios for municipality of Grosuplje is based on a structured process combining data analysis, query of users' needs, stakeholders' feedback, and local transport priorities.

The volume of passengers in the national transport model was brought to the micro-level modelling by recalculation of volume of passengers on the observed bus route (line 72). The **basic formula** for estimating the number of passengers on a bus route was used:

$Q^1 = P \times R \times M \times A \times F$

Were,

- Q = number of passengers on the line in a daily period
- P = population in the catchment area of the line
- R = proportion (share) of the population using transport daily (mobility rate)
- M = modal share (share of all trips made by bus)
- A = attractiveness of the line (quality of connection, directness, speed, comfort)
- F = frequency factor (higher frequency means higher usage

6.1.1 Implementation of the baseline model

Approach to implementation of the baseline model for the line 72:

- The route of 72 bus line is adopted from the national transport model (layout and bus stops);
- Adjustment of volume of passengers on the line (section 6.1.1.1);
- Timetables are updated (section 6.1.1.2);
- Each bus stop was put to a separate zone and linked with the connector;
- Number of passengers (Q) was adjusted to the micro level by< using the formula Q = P × R × M × A × F;
- OD matrix PuT was adjusted to micro level by applying the passenger counting and ticket validations and Q (section 6.1.1.3);
- Passengers were distributed along the line (section 6.1.1.4).

Some steps of the approach are illustrated in the following subsections.

6.1.1.1 Adjustment of volume of passengers on the line

Volume of passengers on the line is defined by using the **basic formula** for estimating the number of passengers on a bus route: Q = P × R × M × A × F = 155.

The following values of parameters were used:

- **P=577**; population catchment area is selected as 500 m circumference around bus stops – estimated on walking distance; population size was determined by using QGIS tool;
- **R=0.8**; reasoning: most of daily activities are outside the residence area: kinder garden, school, work...;
- **M=0.6**; reasoning: realistic for rural areas with cars, taking into account students that mainly use public transport service;
- **A=0.7**; reasoning: relatively good competitiveness (20-minute ride), but not top-level;
- **F=0.8**; 9 trips are sufficient for basic coverage, but not for flexibility;

[1] Literature: UITP (International Association of Public Transport). "Public Transport: Planning the Networks"; Vuchic, Vukan R. (2005). "Urban Transit: Operations, Planning, and Economics"; ISBN: 978-0-471-72170-3; Ceder, Avishai (2007). "Public Transit Planning and Operation: Theory, Modelling and Practice"; ISBN: 978-0750669241; TRB – Transit Cooperative Research Program (TCRP) Report 95: "Traveller Response to Transportation System Changes"; Ortúzar, Juan de Dios & Willumsen, Luis G. (2011). "Modelling Transport" (4th ed.); ISBN: 978-0470760390

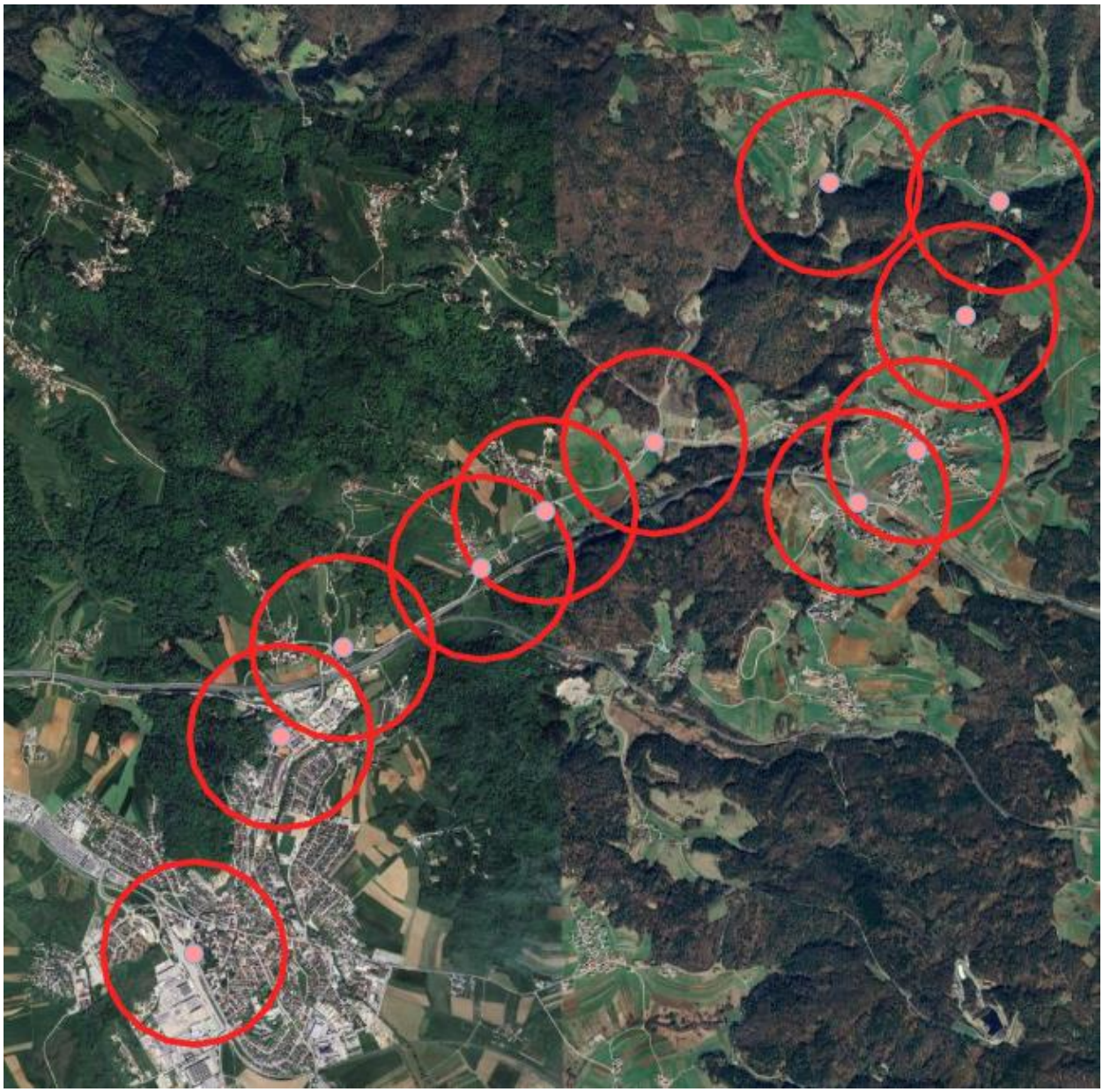


Figure 1: QGIS estimation of population in 500 m circumference around bus stops on the line

The population in the catchment area along the line is **P=577**, which gives the estimated volume of passengers **Q=155**.

6.1.1.2 Update of timetables

Timetables were updated in VISUM by the valid data in year 2025.

Figure 2: Initial tabular and graphical timetables from the national transport model are updated

6.1.1.3 Adjustment of macro model OD matrix (PuT)

Macro model OD PuT matrix was adapted by counting validations of tickets on the 3 selected characteristic days in the past (source: LPP bus operator) in combination with counting campaigns made available by the transport operator (LPP).

Matrix editor (Matrix '5 PUT')

11 x 11			1000046	1000047	1000048	1000049	1000050	1000051	1000054	1000060	1000061	1000062	1000063
	Name		Troščine	Kožljevec	Žabja vas	Polica	eč pri Polic	Drobnič	suplje_pos	lika Stara v	ala Stara v	Perovo	osuplje Mo
		Sum	18.00	12.00	10.00	9.00	43.00	10.00	34.00	2.00	2.00	3.00	4.00
1000046	Troščine	19.00	0.00	0.00	0.00	0.00	14.00	0.00	5.00	0.00	0.00	0.00	0.00
1000047	Kožljevec	11.00	0.00	0.00	0.00	0.00	8.00	0.00	3.00	0.00	0.00	0.00	0.00
1000048	Žabja vas	10.00	0.00	0.00	0.00	0.00	7.00	0.00	3.00	0.00	0.00	0.00	0.00
1000049	Polica	9.00	0.00	0.00	0.00	0.00	4.00	0.00	5.00	0.00	0.00	0.00	0.00
1000050	Peč pri Polici	43.00	14.00	8.00	7.00	4.00	0.00	6.00	4.00	0.00	0.00	0.00	0.00
1000051	Drobnič	10.00	0.00	0.00	0.00	0.00	6.00	0.00	4.00	0.00	0.00	0.00	0.00
1000054	Grosuplje_postaja	35.00	4.00	4.00	3.00	5.00	4.00	4.00	0.00	2.00	2.00	3.00	4.00
1000060	Velika Stara vas	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
1000061	Mala Stara vas	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
1000062	Perovo	3.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00
1000063	Grosuplje Motel	3.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00

Figure 3: Updated PuT matrix (public passenger transport trips)

6.1.1.4 Distribution of passengers along the line

The passengers were distributed along the two routes of the line 72 on the basis of a stochastic route choice model ("Lohse Choice") in VISUM. This model is used in passengers assignment process as being more sophisticated than a simple "shortest path" model (All-or-Nothing). Passengers do not always choose the shortest path; instead, their choice is probabilistically distributed among the available alternatives based on "travel cost" as well as perceived comfort/preferences. This method is particularly useful in urban and public transport networks, where multiple lines, transfers, and alternatives exist.

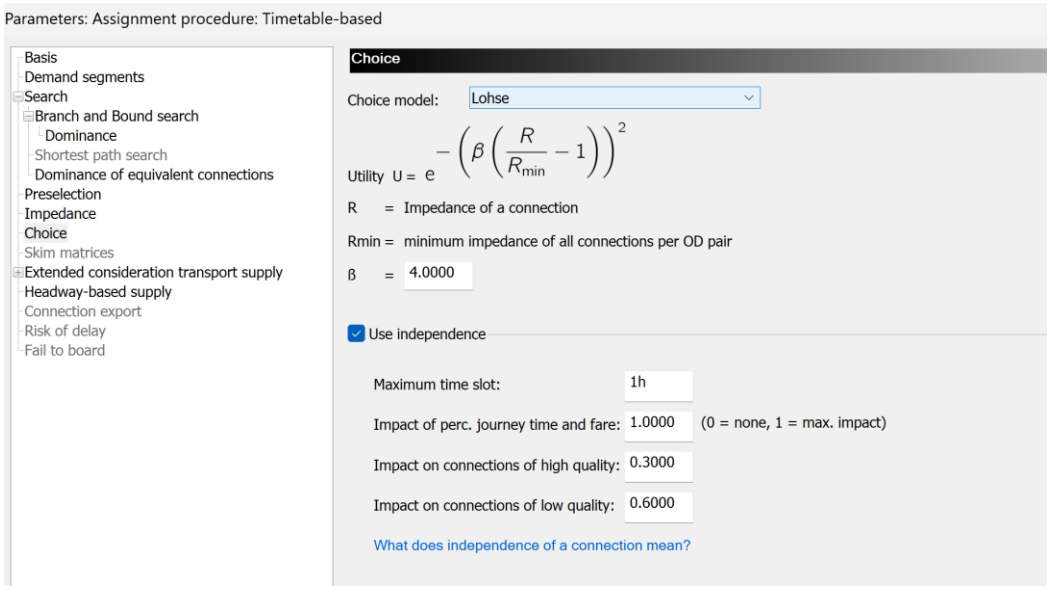


Figure 4: Choice model used in PTV Visum

Figure 5: Distribution of passengers along the line 72

6.2 Transport model scenarios of transport measures

Four short-term scenarios were modelled as presented in the following sub-sections:

1. ST1 - to A1 (introduction of the combined DRT line 72): environmental and cost gains through change of vehicle propulsion on DRT trips (4 trip pairs from the timetable operated by an electric car instead of diesel bus),
2. ST2 - to A1 (introduction of the combined DRT line 72): environmental and cost gains through reduction of empty DRT trips (one pair of electric car-operated timetable trips removed from the timetable, keeping 3 other pairs operated by an electric car),
3. ST3 - to A2 (introduction of additional stop point on the line 72): rise of passenger volume through better connectivity for the population along the line 72 (one additional bus stop and recalculation of expected number of passengers Q by using the model),
4. ST4 - to A3 (expansion of the line 72 timetable): rise of passenger volume through better connectivity for the population along the line 72 (one pair of timetable trips added to the timetable and recalculation of expected number of passengers Q by using the model).

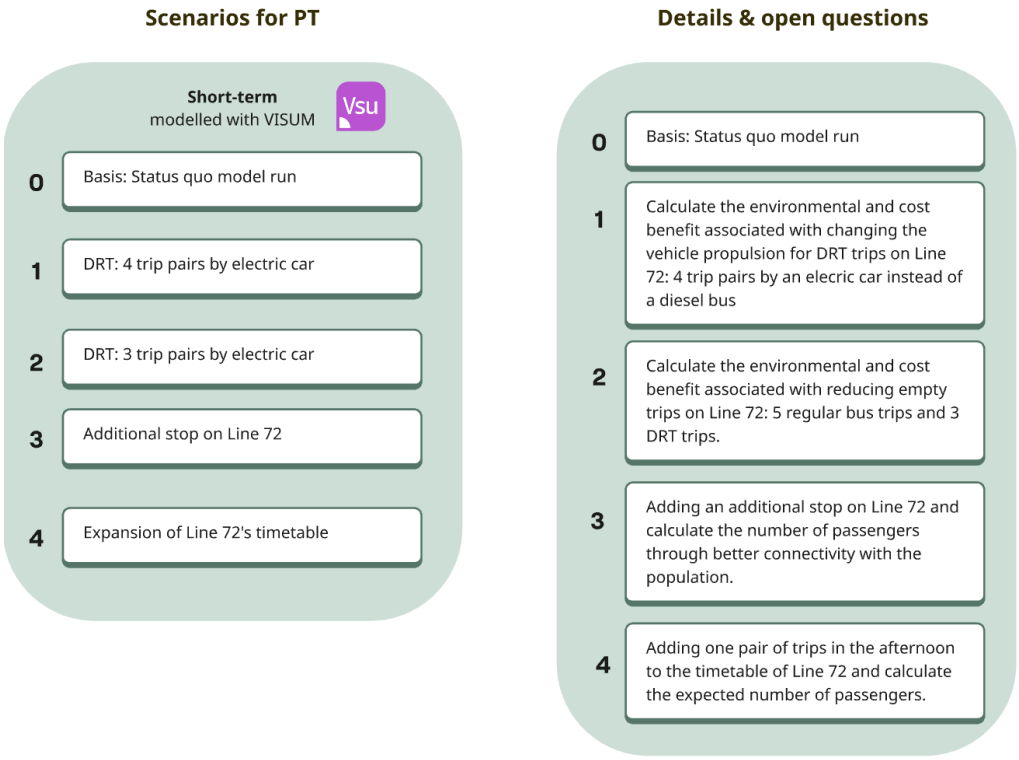


Figure 6: VISUM model scenarios in the case study area of Grosuplje

For calculation of the results of the modelling we used:

- PTV Visum for distribution of passengers among the bus stops
- Basic formula for calculation of number of expected PT passengers on the line and
- EEA (European Environment Agency; European Environment Agency (EEA)) assumptions for polluting gas emissions per types of vehicles.

6.2.1 Scenario ST1 – introducing electric car operated trips to the timetable

This scenario addresses an introduction of the combined operation of the line 72 that is currently according to the given timetable on a regularly basis. The line is operated by using 50-seater buses, and passenger occupation is very low, in particular on 4 pairs out of 9 timetable scheduled trip pairs. The combined operation of line 72 means that 5 scheduled pairs of trips in the timetable will be operated on the regularly basis, whereas 4 pairs of trips will be operated as DRT – they will be operated if the passengers have registered a journey in the call centre and they will be operated by using an electric car, electric van or a small bus – depending on the number of registrations per trip.

Scenario ST1 will introduce electric cars for the 4 DRT declared pairs of trips in the line 72 timetable to replace a 50-seater diesel bus. The objective is to reduce operational costs and polluting gas emissions as well as raise passenger occupancy.

The results of Scenario ST1 simulation versus base line model are presented in the Table 5.

Table 5: scenario ST1 vs. baseline model

		Baseline	ST1
		Line 72	Line 72
Operational distance (km/year)	Diesel	41,040	22,800
	Electric	/	18,240

Operational cost (EUR/year)	Diesel	17,729	9,850
	Electric	/	730
Emissions (kg/year)	CO_2	39,727	22,070[2]
	NO_x	55	31
	N_2O	1.44	0.80
	CO	17	10
	NH3	0.37	0.21
	NMVOC	1.48	0.82
Number of passengers (per year)		38,750	38,750

The results of scenario ST1 confirm drastic reduction of emissions of CO_2 from 39,727 kg per year to 22,070 kg per year due to 44 % of yearly kilometres done by electric car instead of the 50-seater electric bus. Operational costs for the fuel has dropped remarkably as well from 17,729 EUR to 10,579 EUR per year. The saved cost can be redirected to funding additional lines or trips elswhere in the municipality or in the region managed by the PTA.

6.2.1.1 VISUM modelling

Visum modelling was not applied in this scenario. The transport model remains the same as baseline model, the operational costs and emissions are calculated with external modelling.

6.2.2 Scenario ST2 - introducing electric car operated trips and reduction of timetable

This scenario addresses an introduction of the combined operation of the line 72 that is currently operated according to the given timetable on a regularly basis. The line is operated by using 50-seater buses, and passenger occupation is very low, in particular on 4 pairs out of 9 timetable scheduled trips. The combined operation of the line 72 means that 5 scheduled pairs of trips in the timetable will be operated on the regularly basis, whereas 4 pairs of trips will be operated as DRT – they will be operated if the passengers have registered a journey in the call centre and they will be operated by using an electric car, electric van or a small bus – depending on the number of registrations per trip.

Scenario ST2 will remove 1 pair of trips from the given baseline timetable as empty runs, or no DRT registrations are expected for the respective trips. The 3 left DRT declared pairs of trips in the line 72 timetable will be operated by an electric car, replacing a 50-seater diesel bus. The objective is to additionally reduce operational costs and polluting gas emissions as well as raise passenger occupancy. Impact on the number of passengers and passenger distribution will be also observed.

The results of scenario ST2 simulation versus base line model are presented in the Table 6.

Table 6: Scenario ST2 vs. baseline model

		Baseline	ST2
		Line 72	Line 72
Operational distance (km/year)	Diesel	41,040	22,800

[2] We didn't take into account the indirect CO_2 emmissions generated by electric power generation plant, since we don't dispose of data for diesel fuel generation, either.

	Electric	/	13,680
Operational cost (EUR/year)	Diesel	17,729	9,850
	Electric	/	547
Emissions (kg/year)	CO_2	39,727	22,070
	NO_x	55	31
	N_2O	1.44	0.80
	CO	17	10
	NH3	0.37	0.21
	NMVOC	1.48	0.82
Number of passengers (per year)		38,750	36,732

The results of scenario ST2 confirm drastic reduction of emissions of CO_2 from 39,727 kg per year to 22,070 kg per year due to 38 % of yearly kilometres done by electric car instead of the 50-seater electric bus; any further reduction of electric car operated trips does not affect the emissions. Operational costs for the fuel has dropped remarkably as well from 17,729 EUR to 10,397 EUR per year. The saved cost can be redirected to funding additional lines or trips elswhere in the municipality or in the region managed by the PTA The expected number of passengers was slightly reduced due to the lower attractiveness and frequency on the line: Q: 155 >> 147. Distribution of passengers along the line remains within the same proportions.

Implementation of ST2 scenario makes operation of the line additionally efficient in terms of costs as well as polluting gas emissions.

The following sections outline the process of scenario modelling in VISUM.

6.2.2.1 VISUM modelling

- Timetable is updated: 2 selected trips (forming a pair “forth and back”) were removed from baseline timetable;
- Number of passengers was adjusted according to the basic formula;
- The OD links’ volumes were reduced proportionally over the whole matrix;n
- Passengers were distributed along the line.

Adjustment of volume of passengers in consideration of fewer trips:

Recalculation of number of passengers on the line (**Q**) due to lower attractiveness of the line (**A=0.65**) and lower frequency (**F=0.7**)[3].

$Q = 577 \times 0.8 \times 0.6 \times 0.65 \times 0.7 = 147$

Adjustment of the baseline OD matrix (PuT)

Given the number of passengers on the line in the daily period (**Q**), the total number of passengers was populated to OD links in Visum PuT matrix by keeping the proportions among baseline OD links (expert corrections are possible).

[3] Determination of the factors A and F is related to the monthly observation of daily average of passengers on the departure pair, removed from the timetable (departure at 11:20 - Grosuplje and 11:40 Polica).

Matrix editor (Matrix '5 PUT')

11 x 11			1000046	1000047	1000048	1000049	1000050	1000051	1000054	1000060	1000061	1000062	1000063
	Name		Troščine	Kožljevec	Žabja vas	Polica	eč pri Poli	Drobnič	suplje_pos	lika Stara v	ala Stara v	Perovo	osuplje Mo
		Sum	17.00	10.00	10.00	8.00	43.00	8.00	31.00	2.00	2.00	3.00	3.00
1000046	Troščine	18.00	0.00	0.00	0.00	0.00	14.00	0.00	4.00	0.00	0.00	0.00	0.00
1000047	Kožljevec	11.00	0.00	0.00	0.00	0.00	8.00	0.00	3.00	0.00	0.00	0.00	0.00
1000048	Žabja vas	10.00	0.00	0.00	0.00	0.00	7.00	0.00	3.00	0.00	0.00	0.00	0.00
1000049	Polica	8.00	0.00	0.00	0.00	0.00	4.00	0.00	4.00	0.00	0.00	0.00	0.00
1000050	Peč pri Polici	43.00	14.00	8.00	7.00	4.00	0.00	6.00	4.00	0.00	0.00	0.00	0.00
1000051	Drobnič	9.00	0.00	0.00	0.00	0.00	6.00	0.00	3.00	0.00	0.00	0.00	0.00
1000054	Grosuplje_postaja	28.00	3.00	2.00	3.00	4.00	4.00	2.00	0.00	2.00	2.00	3.00	3.00
1000060	Velika Stara vas	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
1000061	Mala Stara vas	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
1000062	Perovo	3.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00
1000063	Grosuplje Motel	3.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00

Figure 7: Updated PuT matrix (public passenger transport trips)

Distribution of passengers along the line:

The passengers were distributed along the two routes of the line 72 on the basis of the **stochastic route choice** model ("Lohse Choice") in VISUM.

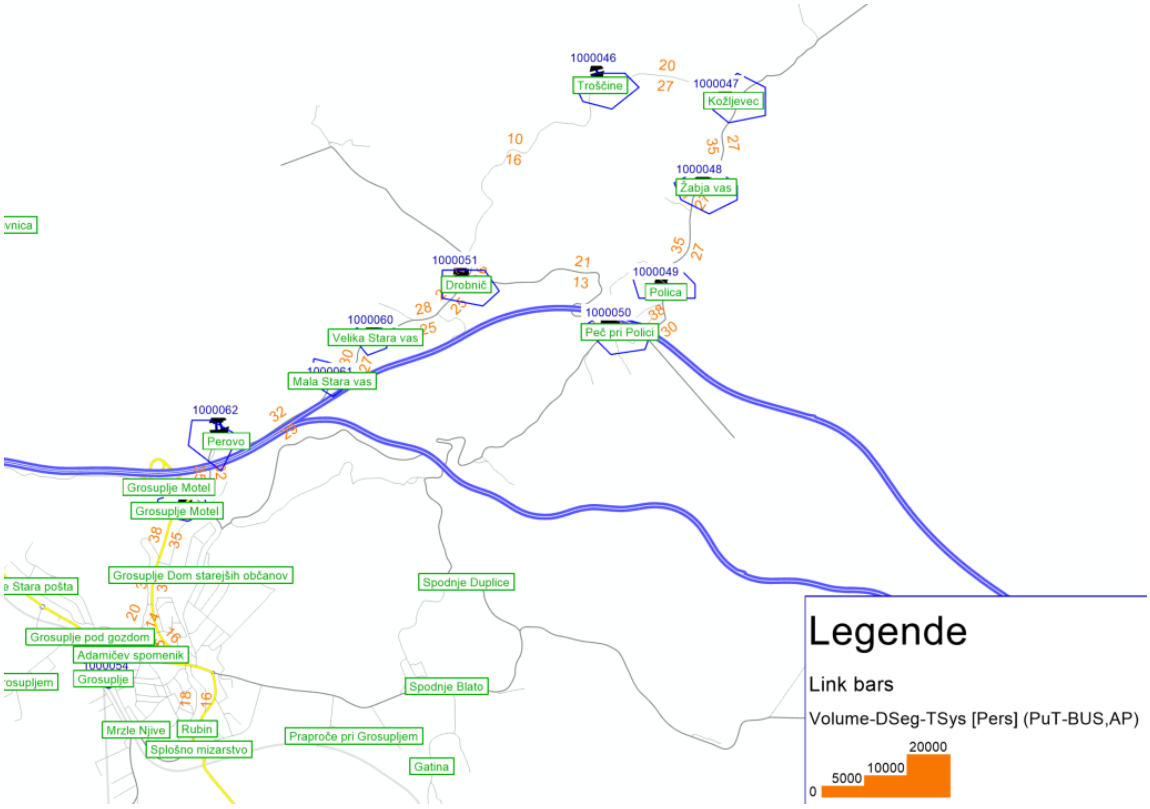


Figure 8: Distribution of passengers along the line

6.2.3 Scenario ST3 - additional bus stop on the route

This scenario addresses better connectivity for the passengers, for which the level of PT service was too low or was not accessible by foot. According to the demand of local population in the area of Polica (demand stated in the survey), an introduction of an additional bus stop on the line 72 is needed at the location "Gradišče" settlement.

Scenario ST3 will introduce a new bus stop in the timetable of the line 72 at location of "Gradišče" (Figure 8). The objective is to bring better connectivity of PT to the community of "Gradišče" and thereby also raise use of PT in the whole municipality. Impact on operational costs and polluting gas emissions, number of passengers and passenger distribution along the line will be observed.

The results of scenario ST3 simulation versus base line model are presented in the Table 7.

Table 7: Scenario ST3 vs. baseline model

		Baseline	ST3
		Line 72	Line 72
Operational distance (km/year)	Diesel	41,040	41,040
	Electric	/	/
Operational cost (EUR/year)	Diesel	17,729	17,729
	Electric	/	/
Emissions (kg/year)	CO_2	39,727	39,727
	NO_x	55	55
	N_2O	1.44	1.44
	CO	17	17
	NH3	0.37	0.37
	NMVOC	1.48	1.48
Number of passengers (per year)		38,750	42,500

The major impact of the scenario ST3 is on the number of passengers. Introduction of the new stop in Gradišče does not affect the travel time on the line but substantially improves connectivity of the population. The expected number of passengers on the line 72 increased (Q: 155 >> 170) by connecting additional 538 inhabitants (P) to the catchment area of the line (P: 576 >>615) and thereby also better attractiveness (A) of the line. In this scenario there is practically no impact on operational cost and polluting gas emissions.

The following sections outline the process of scenario modelling in VISUM.

6.2.3.1 VISUM modelling

- An additional stop point was added at Visum, with expansion of timetable and OD matrix PuT by the new stop point;
- Number of passengers was adjusted according to the basic formula;
- The OD links were augmented;
- Passengers were distributed along the line.

An additional stop point has been added to the existing route in Visum

A stop point at location of Gradišče was created in Visum and linked to the route (after linking, a new stop point in the timetable and OD matrix is available).

A new zone Gradišče was created and the Gradišče stop point was linked to the new zone.

Adjustment of the volume of passengers in consideration of additional passengers served at the stop

Recalculation of number of passengers on the line (**Q**) due to extension of the line catchment area around Gradišče bus stop (**P=615,** 57 additional **inhabitants as potential passengers**), and higher line attractiveness due to better accessibility – more stations (**A=0.72**)

Q = 615 × 0.8 × 0.6 × 0.72 × 0.8 = 170

Adjustment of the baseline OD matrix (PuT)

Given the number of passengers on the line in the daily period (**Q**), the majority of additional passengers were distributed to OD links, which were preferred by the respondents in the dedicated questionnaire that asked for the additional stop at Gradišče (basically Gradišče linking to "Peč pri Polici" and "Grosuplje").

Matrix editor (Matrix '5 PUT')

12 x 12			1000046	1000047	1000048	1000049	1000050	1000051	1000054	1000060	1000061	1000062	1000063	1000064
	Name		Troščine	Kožljevec	Žabja vas	Polica	eč pri Poli	Drobnič	suplje_pos	lika Stara v	ala Stara v	Perovo	osuplje Mo	Gradišče
		Sum	18.00	12.00	10.00	9.00	43.00	10.00	41.00	2.00	2.00	3.00	4.00	8.00
1000046	Troščine	19.00	0.00	0.00	0.00	0.00	14.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
1000047	Kožljevec	11.00	0.00	0.00	0.00	0.00	8.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00
1000048	Žabja vas	10.00	0.00	0.00	0.00	0.00	7.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00
1000049	Polica	9.00	0.00	0.00	0.00	0.00	4.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
1000050	Peč pri Polici	43.00	14.00	8.00	7.00	4.00	0.00	6.00	4.00	0.00	0.00	0.00	0.00	0.00
1000051	Drobnič	10.00	0.00	0.00	0.00	0.00	6.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00
1000054	Grosuplje_postaja	43.00	4.00	4.00	3.00	5.00	4.00	4.00	0.00	2.00	2.00	3.00	4.00	8.00
1000060	Velika Stara vas	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
1000061	Mala Stara vas	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
1000062	Perovo	3.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00
1000063	Grosuplje Motel	3.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00
1000064	Gradišče	7.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	0.00	0.00	0.00	0.00	0.00

Figure 9: Updated PuT matrix (public passenger transport trips)

Distribution of passengers along the line

The passengers were distributed along the two routes of the line 72 on the basis of the **stochastic route choice** model ("Lohse Choice") in VISUM.

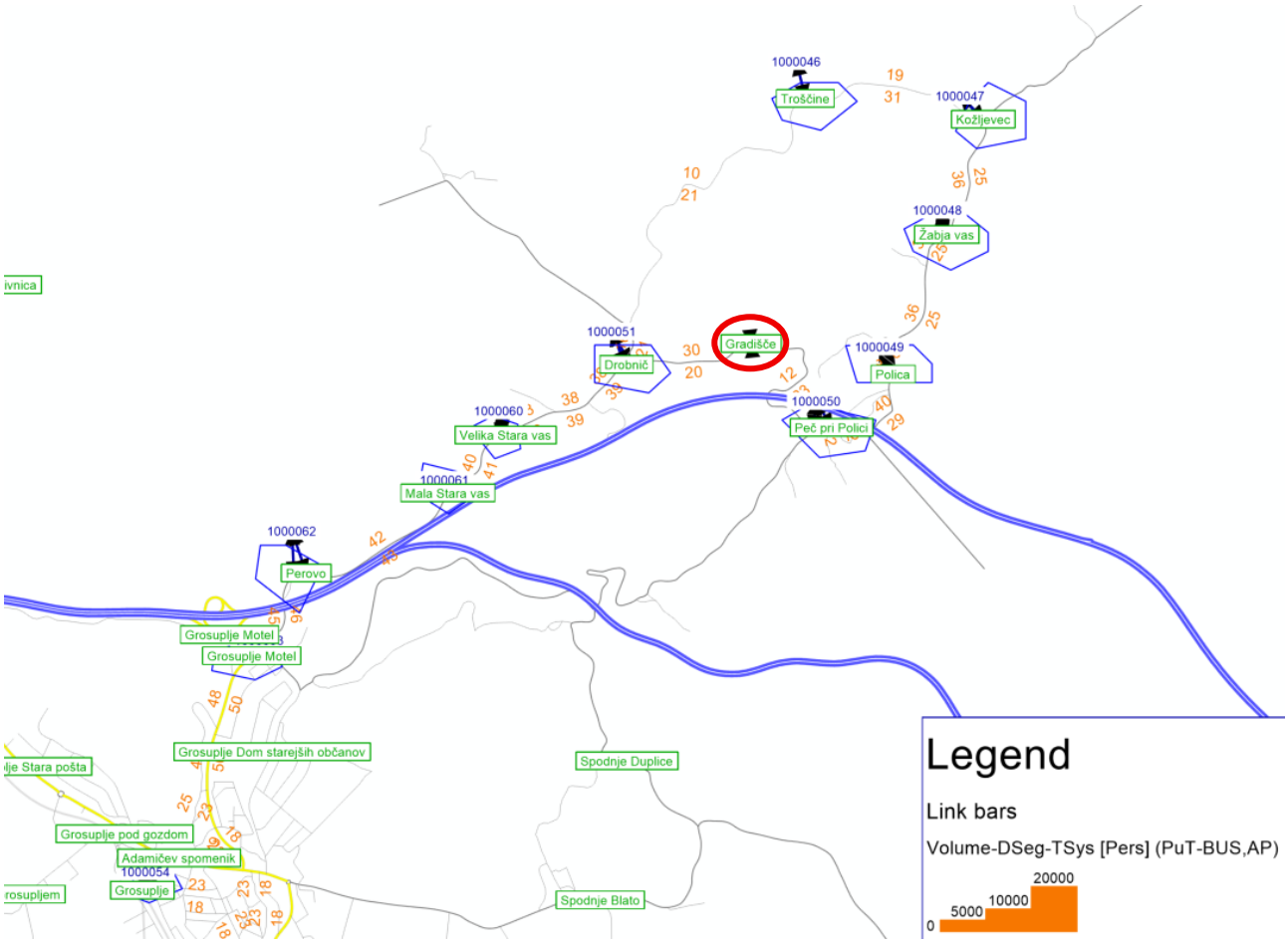


Figure 10: Distribution of passengers along the line

6.2.4 Scenario ST4 - additional trips in the timetable

This scenario addresses better connectivity for the passengers along the line 72 by increasing the level of PT service with more frequent PT service. According to the demand of local population in the area of Polica (demand stated in the survey), additional service is needed in particular in the afternoon.

Scenario ST4 is similar to ST3 in providing an additional service along the Line 72. Specifically, it models an additional pair of trips in the timetable of the line 72 in the afternoon period. The objective is to bring better connectivity to the population of Polica settlement and thereby also raise use of PT in the municipality as a whole. Impact on number of passengers and passenger distribution along the line will be observed. Operational costs and polluting gas emissions are expected to be higher but will differ in case additional trips will be a regular or DRT service,

The results of scenario ST4 simulation versus base line model are presented in the Table 8.

Table 8: Scenario ST4 vs. baseline model

		Baseline	ST4
		Line 72	Line 72
Operational distance (km/year)	Diesel	1,040	45,600
	Electric	/	/

Operational cost (EUR/year)	Diesel	17,729	19,699
	Electric	/	/
Emissions (kg/year)	CO_2	39,727	44,141
	NO_x	55	61
	N_2O	1.44	1.60
	CO	17	19
	NH3	0.37	0.41
	NMVOC	1.48	1.64
Number of passengers (per year)		38,750	44,113

The major impact of the scenario ST4 is on the number of passengers. Introduction of the additional trips to the timetable adds to the operational distance per year but on the other hand improves connectivity of the population, in particular in the time period when requested. Scenario anticipates regular operation of the additional pair of trips but it can be re-categorized to DRT service in case of low occupancy which would lower operational costs as well as emissions. According to the model results, the expected number of passengers on the line 72 increased (Q: 150 >> 171) due to the higher attractiveness (A=0.75) and better frequency of trips on the line (F=0.85). Distribution of passengers along the line remains within the same proportions.

The following sections outline the process of scenario modelling in VISUM.

6.2.4.1 VISUM modelling

- Timetable is updated: 2 trips (forming a pair “forth and back”) were added to Visum timetable in the afternoon peak;
- Number of passengers was adjusted according to the basic formula;
- The OD links’ volumes were augmented proportionally over the whole matrix;
- Passengers were distributed along the line.

Adding and editing of additional trips in the Visum timetable

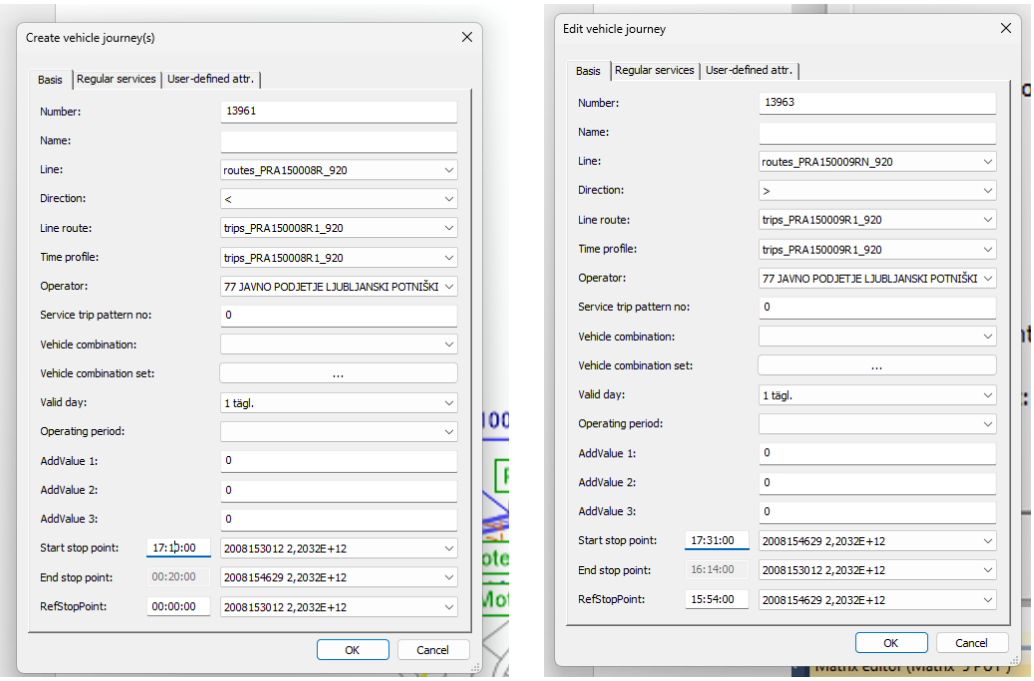


Figure 11: Adding new timetable trips in Visum

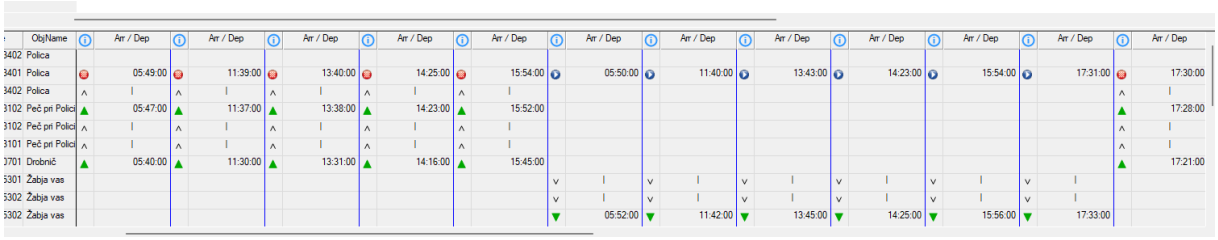


Figure 12: Editing timetables in Visum

Adjustment of volume of passengers in consideration of additional trips

Recalculation of number of passengers on the line (**Q**) due to higher attractiveness of the line (**A=0.75**) and higher frequency (**F=0.85**)[4]

$Q = 577 \times 0.8 \times 0.6 \times 0.75 \times 0.85 = 176$

Adjustment of the baseline OD matrix (PuT)

Given the number of passengers on the line in the daily period (**Q**), the total number of passengers was populated to OD links in Visum PuT matrix by keeping the proportions among baseline OD links (expert corrections are possible).

[4] Determination of the factors A and F is related to the monthly observation of daily average passengers on the departure pair, removed from the timetable (e.g. departure at 11:20 - Grosuplje and 11:40 Polica).

Matrix editor (Matrix '5 PUT')

11 x 11			1000046	1000047	1000048	1000049	1000050	1000051	1000054	1000060	1000061	1000062	1000063
	Name		Troščine	Kožljevec	Žabja vas	Polica	eč pri Polic	Drobnič	suplje_pos	lika Stara v	ala Stara v	Perovo	osuplje Mo
		Sum	19.00	14.00	11.00	9.00	44.00	10.00	47.00	4.00	3.00	3.00	4.00
1000046	Troščine	20.00	0.00	0.00	0.00	0.00	14.00	0.00	6.00	0.00	0.00	0.00	0.00
1000047	Kožljevec	12.00	0.00	0.00	0.00	0.00	8.00	0.00	4.00	0.00	0.00	0.00	0.00
1000048	Žabja vas	12.00	0.00	0.00	0.00	0.00	7.00	0.00	5.00	0.00	0.00	0.00	0.00
1000049	Polica	9.00	0.00	0.00	0.00	0.00	4.00	0.00	5.00	0.00	0.00	0.00	0.00
1000050	Peč pri Polici	43.00	14.00	8.00	7.00	4.00	0.00	6.00	4.00	0.00	0.00	0.00	0.00
1000051	Drobnič	12.00	0.00	0.00	0.00	0.00	6.00	0.00	6.00	0.00	0.00	0.00	0.00
1000054	Grosuplje_postaja	43.00	5.00	6.00	4.00	5.00	5.00	4.00	0.00	4.00	3.00	3.00	4.00
1000060	Velika Stara vas	5.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
1000061	Mala Stara vas	5.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
1000062	Perovo	4.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00
1000063	Grosuplje Motel	3.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00

Figure 13: Updated PuT matrix (public passenger transport trips)

Distribution of passengers along the line

The passengers were distributed along the two routes of the line 72 on the basis of the **stochastic route choice** model ("Lohse Choice") in VISUM.

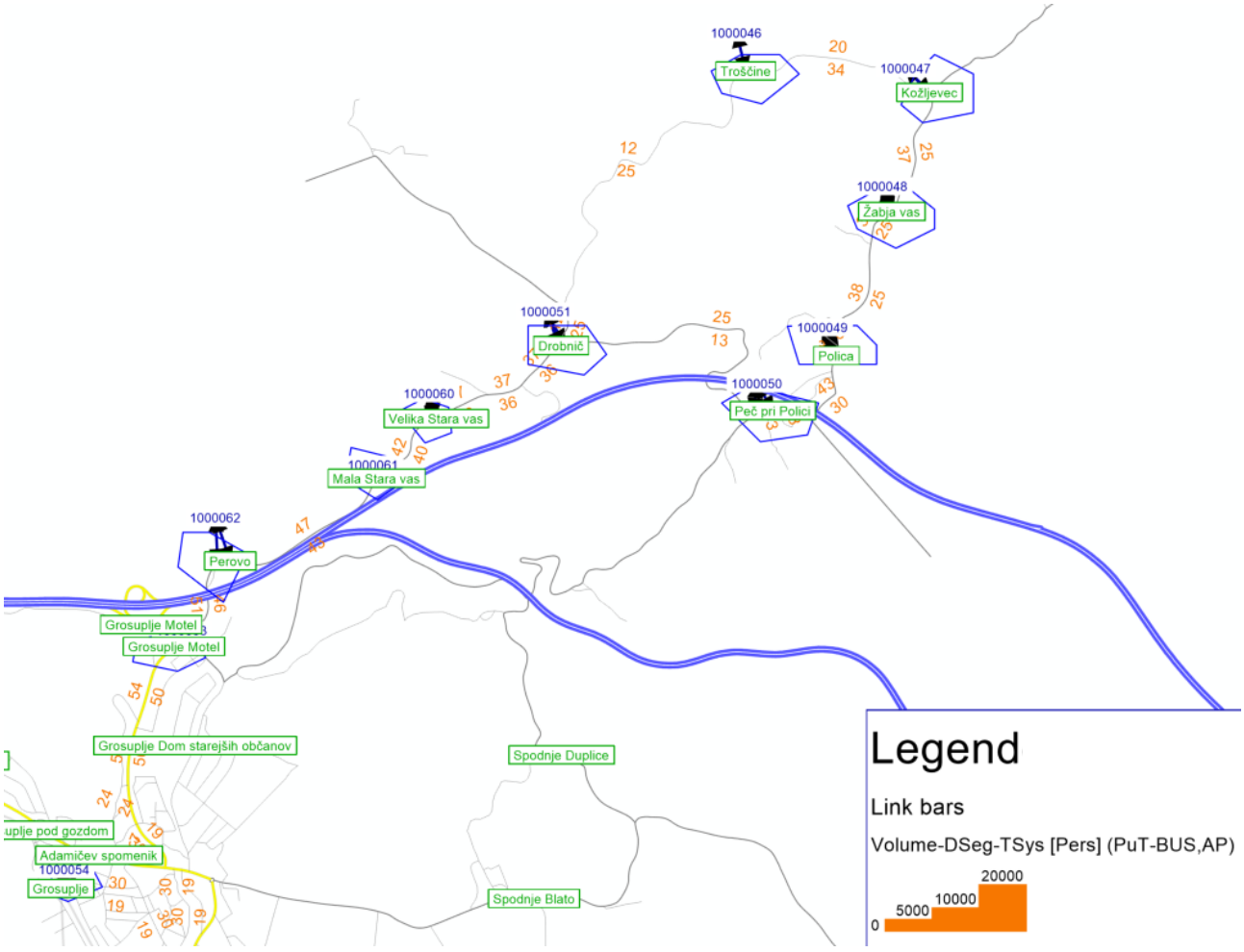


Figure 14: Distribution of passengers along the line

6.3 Conclusion of scenario modelling

Summary of scenario modelling results

The presented scenarios, modelled in PTV VISUM, evaluate potential improvements of public transport connectivity and accessibility on one hand and operational costs and emissions of polluting gasses on the other hand. Modelled scenarios clearly showed improvements in either PT connectivity or in PT emissions.

Improvement of connectivity and emissions need to be brought to balance as better connectivity does not always entail bigger costs and pollution if the solution is carefully streamlined with the demand. Better connectivity can be achieved by introducing additional bus stops (the case of Gradišče) on the existing lines or by considering DRT service on the additional timetable trips.

All scenarios meet the demands by the passengers, either for lower emissions or better connectivity, as stated in the survey among the population in the catchment area along the Grosuplje line 72.

Modelling in VISUM was complemented with the formula ($Q = P \times R \times M \times A \times F$) for estimation of the expected passengers from the catchment area along the observed line in order to better leverage the potential of PTV VISUM.

Connections with Local Goals and Visions set in Chapters 4 and 5

The modelling presented in Chapter 6 focuses on the assessment of three key actions defined within the Local Plan, each designed to contribute to specific strategic goals.

Action A1 (applied in scenarios ST1 and ST2) – Introduction of the combined DRT line 72 addresses Goals G3 (Reduce congestion and emissions) and G5 (Improve efficiency of public transport operations through DRT) by introducing a more flexible, environmentally friendly, and cost-efficient public transport service.

Action A2 (applied in ST3) – Introduction of additional stop points on the municipality bus line contributes to Goals G1 (Improve accessibility and connectivity) and G2 (Increase the number of public transport passengers) by improving spatial coverage and enabling more residents to conveniently access public transport.

Action A3 (applied in ST4) – Expansion of the municipality bus line timetable, including additional weekend services also supports Goals G1 and G2 by enhancing service frequency and temporal availability, thereby making public transport more attractive and reliable for a wider range of users.

These actions were modelled across different scenarios (ST1–ST4) to evaluate their impact on the performance and sustainability of the local transport system. All actions and goals are derived from the overarching vision of the Local Plan, which aims to establish a sustainable, efficient **and inclusive public transport system** that meets the needs of all residents and visitors of the Grosuplje municipality.

Together, these goals create a coherent framework that translates the Local Plan's vision into practical actions, ensuring that the municipality's transport system evolves toward greater sustainability, inclusiveness, and resilience.

Limitations in Scenario Definition, Modelling, and Results Analysis

A 4-stage national transport model was used in the study, therefore an additional 4-stage modelling was not applied in this study therefore only distribution of the passengers in two route variants was possible in VISUM. For distribution of passengers in VISUM, an OD matrix (PuT) is needed. In order to circumvent this issue we have applied basic formula for prediction of the number of passengers and used passenger counting data in order to form an OD matrix (PuT() manually. Implementation of DRT in Grosuplje is specific and VISUM does not allow direct functionality to model it.

How the Modelling Action Informs the Selection of Local Actions

The modelled scenarios are related to actions A1, A2 and A3 from this local plan. Similar scenario modelling could also be applied to other lines, municipalities and other PT areas but also to other actions from the Local plan for development of public transport in Grosuplje.

7 Stakeholders

Stakeholder engagement is emphasized through regular meetings, networking opportunities, experience sharing, and study tours, with reports compiled to document best practices and lessons learned.

Table 9: List of stakeholders

Stakeholder	Type	Role	Importance	Influence
Municipality of Grosuplje	Local authority	provider of resources (parking spaces, bus stops); co-financer of regional transport; provider of municipality transport demand; provider of local transport data; promotion of new PT services; impact on implementation of PT development actions	Very important	High
LPP	Bus public transport operator	operator of municipality and regional transport; provider of transport resources; timetable harmonisation; provider of PT operational data; impact/provider on implementation of PT development actions	Very important	Very High
DUJPP	National integrated public transport authority	provider of authority for PT; provider of concession financing; definition of timetable; timetable harmonisation; financial resources for pilot actions; impact/provider on implementation of PT development actions	Important	High
RRA LUR	Regional development agency	strategic planning of PT development in a region; promotion of new PT services; impact on implementation of PT development actions	Medium	Low
SŽ – Slovenian Railways	Railway public transport operator	operator of regional and sub-urban transport to the municipality; harmonisation of timetables; provider of PT operational data; impact/provider on implementation of PT development actions	Medium	Medium
MOPE – Ministry of the Environment, Climate and Energy	National ministry	strategic/long-term planning of public transport	Very important	Very High

Ministry of Infrastructure	National ministry	financial investments and planning of railway and regional bus infrastructure	Very important	Very High

8 Action Plan

For each Action proposed in Chapter 5 and validated in chapter 6 the following information are defined:

Resources (Identify and allocate the resources needed to support the implementation of the Action Plan. This will help the financial implementation of the pilot project),

Timeline (Create a timeline or calendar for the implementation of the Action Plan. Define approximate start and end dates for each action, as well as any intermediate milestones. This will make it easier to follow the development and implementation of the action plan),

Stakeholders (Identify for each action possible stakeholders that could help or support you for a specific activity),

Expected impacts (Actions always have impacts, positive or negative, on the users involved. Identify what type of impact the identified action may have),

Risks and mitigation (Identify and address obstacles or risks that may arise during implementation. Think at possible contingency plans or mitigation strategies to minimise disruptions to progress).

Table 10: Actions descriptions

Actions	Resources	Timeline	Stakeholders	Expected impact	Risk
A1	Low	July 2025	MOPE, DUJPP, OPTI-UP, LPP, Municipality, PIL	Reduce cost of operation on lines 71 and 72 and improve environmental impact by using smaller vehicles on the same timetable	-Reluctance of the users to the imposed registration -Opposition of the users to reduction of the level of service
A2	Low	September 2026	DUJPP, LPP, Municipality	Improve accessibility of local and regional transport to inhabitants of “Dole pri Polici” and increase of number of passengers on 72 line	Obtain permission from DUJPP for construction of bus stop due to safety reasons
A3	Medium	March 2027	DUJPP, LPP, Municipality	Improve accessibility of inhabitants of Polica and surrounding settlements to the municipality centre and regional transport during weekends; increase of PT use in the municipality	- Obtain permission of DUJPP for expansion of timetable - financial risk due to low ridership

A4	Low	September 2026	DUJPP, LPP, Municipality	Improve accessibility of inhabitants, shorter travel times; better use of municipality transport	- Reluctance to change of trip by passengers
A5	Low	December 2026	DUJPP, LPP	Introduction of smart mobility – better information and management of PT use for passengers	- app should provide API for other providers of mobility information enable use of DRT
A6	Low	September 2026	DUJPP, LPP, Municipality	Improve accessibility of inhabitants, shorter travel times, better use of municipality and regional transport	- Reluctance to change of trip by passengers
A7	Medium	September 2026	DUJPP, LPP, Municipality	Improve accessibility of inhabitants of "Sončni dvori" community to suburban transport of Ljubljana (G3 line); increase ridership of PT	- Obtain permission of DUJPP for expansion of timetable - planning of operations and drivers by LPP due to longer line travel time
A8	Low	December 2026	LPP, Municipality	Improve knowledge by Municipality on needs for DRT service for vulnerable groups of passengers	- lack of capacity of cars and drivers engaged in DRT service offer

9 Monitoring and KPIs

A constant monitoring is important to ensure that local plans proceed as planned, with predefined reporting deadlines for each action (action proposed in Chapter 5.)

In this chapter a scheme of KPI's and their main features is proposed.

Table 11: Local Plan KPIs

KPI	Actions	Brief description	Unit	Target
KPI_1	A1, A5	Average number of registrations of DRT service on lines 71, 72 (Transport 17)	number of calls (per week)	3
KPI_2	A1, A2, A3, A4, A5, A6, A7	Cost of energy (fuel, electricity, gas, etc.) consumption per km travelled per passenger on lines 71, 72 and 73 (Environmental 40)	EUR/km (per week)	

KPI_3	A1, A5	Average total eligible concession cost per km on lines 71, 72 (Transport additional KPI)	EUR/km (per week)	< 2,27[5] EUR/km
KPI_4	A1, A5	Percentage of fulfilled requests (service coverage vs demand) on DRT trips on line 71, 72. (Transport 18) Share of excessive vehicle capacity due to fake registrations (the passengers didn't show up: van operation when no passenger showed up or bus operated where less than 8 passengers showed up)	% of runs (per week)	< 10%
KPI_5	A1, A3, A4, A5, A6	(A1, A4…) Average number of empty runs per working day on lines 71, 72 and 73 (Transport 16) (A3) Average number of empty runs per weekend day on lines 71, 72 (Transport 16)	% of trips (per week)	< 15%
KPI_6	A1, A5	Number of DRT runs (lines 71 and 72) without registrations of passenger (Transport additional KPI)	% of trips (per week)	< 10%
KPI_7	A1, A2, A3, A4, A5, A6	Occupancy of vehicles on lines 71, 72, 73 (Transport-additional KPI)	% of total capacity	50%
KPI_8	A1, A2, A3, A4, A5; A6, A7	Number of complaints of passengers to the PT operation per week for lines 71, 72 and 73 (Social additional KPI)	number of complaints /week	< 10/week
KPI_9	A1, A2, A3, A4, A5; A6, A7	Number of commendations of passengers to the PT operation per week for lines 71, 72 and 73 (Social additional KPI)	number of commendations/week	1/week
KPI_10	A1, A5	Amount of exhausted CO_2 on lines 71 and 72 (Environment-additional KPI)	tonnes	
KPI_11	A1, A2, A3, A4, A5, A6	CO_2 emissions per km travelled per user on lines 71, 72, 73 (Environment-35)	tonnes/passenger	
KPI_12	A1	Share of needed B driver's licenses for operation of DRT (lines 71, 72) (Economic additional KPI)	% of licenses	>30%
KPI_13	A5	Average number of registrations of DRT service received via mobile app on lines 71, 72 (Transport 17)	number of registrations (per week)	5
KPI_14	A8	Number of vulnerable groups of passengers included in "Grosupeljčan" DRT service (Social additional KPI)	number of groups (derived at the end of survey)	
KPI_15	A8	Number of eligible purposes (destinations) included in "Grosupeljčan" DRT service (Social additional KPI)	number of purposes (derived at	

[5] BUS concession cost (2,27 EUR/km); VAN concession cost1,30 EUR/km).

			the end of survey)	

9.1 Description of data sources & tool for KPIs

In this section, data, data sources or providers of data as well as tools (measurement or calculation) in order to collect or calculate key performance indicators (KPIs) are identified. Several data may need to be calculated for each KPI. A methodology (description or mathematical formula) for determination of the KPI will define the required input data. If direct data sources (e.g. data providers) are not available, also data acquisition devices (measurement sensors and measurement devices) or data processing tools (dedicated software) will be employed.

Table 12: Identification of data sources & tools for KPIs data

KPI	Data list	Methodology	Data source	Data tool
KPI_1	- Number of DRT service registrations received weekly (for lines 71, 72)	Weekly trend: [number of calls per week]	PTO (LPP)	Excel
KPI_2	- Number of km travelled on lines 71, 72, 73 - Average consumption of diesel [l/km] - price of diesel [EURO/l] - weekly cost on electric charging station for the electric van on lines 71, 72 - number of passengers (count of validations) on lines 71, 72, 73	Weekly trend: [cost of fuel + cost of electricity]/([travelled kms]*[number of passengers])	PTO (LPP)	Excel
KPI_3	- Number of bus km travelled on the lines 71, 72 - Number of van km travelled on the lines 71, 72	Weekly trend: ([bus km]*2,27+[van km]*1,30)/ ([bus km]+[van km])	PTO (LPP)	Excel
KPI_4	- Number of validations per run on lines 71, 72 - Type of vehicle (bus or van) per run on lines 71, 72	Weekly trend: ([number of van runs with 0 validations]+[number of bus runs with less than 8 passengers])/([number of van runs]+[number of bus runs])	PTO (LPP)	Excel
KPI_5	- Number of validations per run on lines 71, 72, 73	Weekly trend: : [number of runs with 0 validations]/[number of all runs]	PTO (LPP)	Excel
KPI_6	- for each DRT run mark if it was operated or not (lines 71, 72)	Weekly trend: 1-[number of operated DRT runs]/[number of all DRT declared runs]	PTO (LPP)	Excel

KPI_7	- type of operated vehicle per run - capacity of operated vehicle per run[6] - number of validations per run (71, 72, 73)	Weekly trend: weekly average across all runs([number of validations per run]/[capacity of operated vehicle per run])	PTO (LPP)	Excel
KPI_8	- list of complaints on lines 71,72,73 - reason of complaint: identify action	Weekly trend: total number of complaints on PT operation in a week	PTO (LPP)	Excel
KPI_9	- list of commendations on lines 71, 72, 73 - reason of complaint: identify action	Weekly trend: total number of commendations on PT operation in a week	PTO (LPP)	Excel
KPI_10	- length of each run in km on lines 71, 72 - type of vehicle on each run	Weekly trend: [number of kms by BUS]*0,00025 tonnes/km	PTO (LPP)	Excel
KPI_11	- length of each run in km on lines 71, 72, 73[7] - type of vehicle on each run - number of validations per each run	Weekly trend: [number of kms by BUS]*0,00025 tonnes/km/[number of passengers]	PTO (LPP)	Excel
KPI_12	- type of vehicle on each run on lines 71, 72	Weekly trend: [number of DRT runs per week operated by VAN]/[number of all DRT runs per week]	PTO (LPP)	Excel
KPI_13	- DRT registration channel for each DRT run registration (lines 71, 72)	Weekly trend: [number of DRT registrations by app]	PTO (LPP)	Excel
KPI_14	- vulnerable groups to use “Grosupeljčan” service	After survey analysis: Number of identified vulnerable groups to use “Grosupeljčan” service	Municipality	on-line survey
KPI_15	- eligible purposes for using “Grosupeljčan” service	After survey analysis: Number of identified eligible purposes for using “Grosupeljčan” service	Municipality	on-line survey

[6] Capacity of vehicles is 50 for a BUS and 7 for a VAN

[7] Average CO2 exhaustion for a 50-seater bus is 250 g/km