



# PROJECT DESCRIPTION

## INFORMATION SYSTEM FOR TIMETABLE MANAGEMENT (TTM SYSTEM)

Ljubljana, April 2026

Contracting Authority: DUJPP

For Contracting Authority: Miran Sečki, director of DUJPP

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## Acronyms:

| Acronym                        | Description   |
|--------------------------------|---|
| <b>ABT</b>                     | Account-Based Ticketing is a back-office system that processes the Taps received from the TGW and is responsible for trip construction, fare calculation, payment processing, and revenue distribution, among other processes.  |
| <b>Account-Based Ticketing</b> | ABT is a back-office system. It processes the Taps received from the TGW and is responsible for trip construction, fare calculation, payment processing, and revenue distribution, among other processes.   |
| <b>API</b>                     | <p>"Stands for "Application Programming Interface"; it is a set of functions, rules (codes), procedures and specifications, which provide a programming library (as an abstraction layer) to be used by other software to communicate with each other.</p> <p>For the purposes of this bid data sheet, an API should be understood as an interface that allows communication between two web applications, this communication being agnostic to the technologies with which both applications are developed."</p> |
| <b>APP</b>                     | Application or Application Program  |
| <b>AVL</b>                     | Automatic Vehicle Location – system providing real-time vehicle positioning data.   |
| <b>AVM</b>                     | Automatic Vehicle Monitoring – system for monitoring vehicle operations and performance.  |
| <b>UAT</b>                     | <p>User Acceptance Testing (UAT) is the testing phase in which end users or the Contracting Authority verify whether the system:</p> <ul style="list-style-type: none"> <li>• meets the business requirements,</li> <li>• functions correctly in real operational scenarios,</li> <li>• is suitable for production use.</li> </ul>  |
| <b>B2B</b>                     | Business-to-Business – electronic interaction between organizations.  |
| <b>BI</b>                      | Business Intelligence – tools and processes for data analysis and decision support.   |
| <b>CBT</b>                     | Card-Based Ticketing – ticketing system where fare media and entitlements are stored on a physical card.  |
| <b>Authorisation</b>           | A process by which the status of a payment device is sent to validate, with the issuer directly or through the acquirer, the sufficiency of funds to cover a payment commitment.  |
| <b>Bidder</b>                  | An individual or legal entity participating in an administrative contracting process by submitting a bid, with which it offers a good, service or work at the request of the Contracting Authority.   |
| <b>CEN</b>                     | European Committee for Standardization  |
| <b>Client</b>                  | A national or foreign individual who uses the services of remunerated passenger public transportation by bus or train to travel within the national territory.  |
| <b>Contactless</b>             | Contactless payment or proximity payment is a communication protocol that allows card payments using radio frequency identification technology (RFID), complying with the ISO 14443 standard, related to smart cards (SmartCards). Thanks to an antenna incorporated in the card and the validator, communication occurs when both objects are at a maximum distance of 10 centimetres.   |

|                       |   |
|-----------------------|---|
| <b>Contractor</b>     | An individual or legal entity that, after submitting its bid, is selected as the successful bidder is responsible for providing a good, service, or work to the Contracting Authority during the contractual execution phase.   |
| <b>DR</b>             | Disaster Recovery – environment and procedures for system recovery after failures.  |
| <b>DUJPP</b>          | PTA of Republic of Slovenija (Družba za upravljanje javnega potniškega prometa)   |
| <b>EMV</b>            | Stands for “Europay Mastercard VISA.” It is an interoperability standard for cards with an integrated circuit for payment authentication developed by the firm EMVCo. It's a Secure payment technology.   |
| <b>FAQ</b>            | Frequently Asked Question   |
| <b>GDPR</b>           | General Data Protection Regulation  |
| <b>GIS</b>            | Geographical Information System   |
| <b>GTFS</b>           | The General Transit Feed Specification (GTFS), or GTFS -S static or static transit to differentiate it from the GTFS-R real-time extension, defines a standard format for public transportation schedules and associated geographic information.  |
| <b>GUI</b>            | Graphical User Interface  |
| <b>HMI</b>            | Human-Machine Interface – interface enabling interaction between users and systems.   |
| <b>HW</b>             | Hardware  |
| <b>IAM</b>            | Human-Machine Interface – interface enabling interaction between users and systems.   |
| <b>ID</b>             | Identification  |
| <b>IJPP</b>           | Integrated public passenger transport   |
| <b>ITxPT</b>          | Information Technology for Public Transport Standards   |
| <b>IVU</b>            | Current Supplier of TTM for Slovenian Railways  |
| <b>LAN</b>            | Local Area Network  |
| <b>MOPE</b>           | Refers to the Ministry of the Environment, Climate and Energy   |
| <b>MTFB</b>           | Mean time between failures  |
| <b>MTT</b>            | Mobility & Transport Transaction  |
| <b>NeTEx</b>          | NeTEx (formally Network Timetable Exchange PD CEN/TS 16614-1:2014', PD CEN/TS 16614-2:2014 and PD CEN/TS 16614-3:2014) is the CEN Technical standard for exchanging Public Transport Information as XML documents.  |
| <b>NFC</b>            | Near Field Communication  |
| <b>OS</b>             | Operating System  |
| <b>OAS</b>            | OpenAPI Specification – standard for describing RESTful APIs.   |
| <b>Payment device</b> | EMV payment instrument, in its different presentations: debit, credit or prepaid cards, as well as stickers, key rings, wristwatches, bracelets, rings, mobile devices such as tablets and smartphones, or any other type of EMV instrument issued or enabled by the issuer under a card brand and that is linked to debit accounts, credit accounts, prepaid accounts or any other type of customer fund accounts. |
| <b>PTA</b>            | Public Transport Agency   |
| <b>PTO</b>            | Public Transport Operator   |
| <b>QA</b>             | Quality Assurance   |
| <b>RAML</b>           | RESTful API Modelling Language – language for describing REST APIs.   |
| <b>RESTful API</b>    | REST API (also known as RESTful API) is an application programming interface that conforms to the constraints of REST architecture  |

|                    |   |
|--------------------|---|
| <b>RPO</b>         | Describes the interval of time that might pass during a disruption before the quantity of data lost during that period exceeds the Business Continuity Plan's maximum allowable threshold or "tolerance." |
| <b>RTO</b>         | Is the duration of time and service level within which a business process must be restored after a disaster in to avoid unacceptable consequences associated with a break in continuity.                  |
| <b>SAT</b>         | System Acceptance Test  |
| <b>SDK</b>         | Software Development Kit  |
| <b>SIEM</b>        | Security information and event management   |
| <b>SLA</b>         | Service Level Agreement   |
| <b>SOAP</b>        | Simple Object Access Protocol (SOAP) is a message specification for exchanging information between systems and applications.  |
| <b>SSO</b>         | Single sign-on  |
| <b>TBD</b>         | To be Determined  |
| <b>TLS</b>         | Transport Layer Security, or TLS, is a widely adopted security protocol designed to facilitate privacy and data security for communications over the Internet.  |
| <b>Transaction</b> | Tap made with a payment device in a validator that is sent for collection.  |
| <b>TTM</b>         | Timetable Management system   |
| <b>UAT</b>         | User Acceptance Testing   |
| <b>UI</b>          | User Interface  |
| <b>UID</b>         | Unique identifier (UID) is an identifier that marks that record as unique from every other record   |
| <b>UX</b>          | User Experience   |
| <b>VDV452</b>      | German public transport standard for exchanging timetable and network reference data.   |

Comment:

In the description of the demands and functional requirement Acronyms DUJPP, PTA and Buyer can interchangeably be used for Acronym Contracting Authority.



# 1 General about the Tender

The Ministry of Environment, Climate and Energy, along with the Directorate for Transport Policy, which operates within the Ministry, has prepared a strategy for upgrading the support systems after several years of operational use of the system to support integrated public passenger transport.

With this strategy, the Ministry aims to transition from the current card-based ticket issuing and management system to a system based on the management of the passenger's central account, with the ticket medium serving as an identification medium.

DUJPP, as the newly established Public Transport Agency (PTA) of the Republic of Slovenia, will lead the tender process.

In the project itself, DUJPP plans to introduce a modern system for managing timetables, which will enable better planning of public passenger transport and allow individual transport providers to plan the use of their resources more precisely.

Through this project and its information tools, DUJPP aims to become one of the leading operators of public passenger transport in this part of Europe and beyond.

The end user of the tools will be DUJPP, whose employees are actively involved in the tender process and later in the project.

## 1.1 About DUJPP

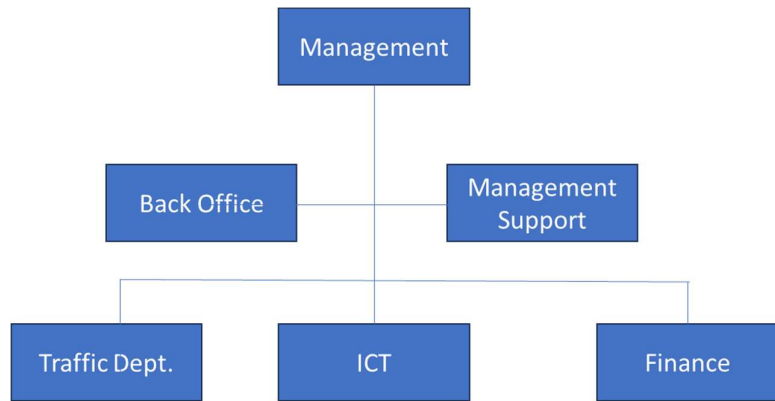
On April 6, 2022, the National Assembly of the Republic of Slovenia adopted the Act on the Management of Public Passenger Transport, published in the Official Gazette of the Republic of Slovenia No. 54/22. The Act entered into force on May 5, 2022, and stipulates the establishment of a Company for the Management of Public Passenger Transport. This company is to be founded by the Republic of Slovenia through a governmental act and the appointment of a director. In accordance with this, on July 14, 2022, the Government of the Republic of Slovenia adopted the Act on the Establishment of the Company for the Management of Public Passenger Transport, d.o.o., and subsequently appointed its director on August 8, 2022.

### 1.1.1 Organizational structure

The company has the following bodies:

- director.
- supervisory board.
- assembly.
- expert council.

In addition to the director, the supervisory board and the general assembly, the company's mandatory body is also the professional council, which is the director's consultative body and whose task is to advise the director in the performance of public passenger transport management tasks.



Picture 1: DUJPP Organization Structure

The scope of this tender falls under the DUJPP Traffic department.

## 1.2 IJPP today

### 1.2.1 A brief description of the current IJPP system

The central information system supporting the integrated public passenger transport in Slovenia (hereinafter: the IJPP) roughly consists of the following elements:

- the server hardware (at the main/primary location and the secondary location)
- terminal equipment on JPP vehicles (buses and trains) and for ticket inspectors (mobile terminals PAX S900, Q90 and Q92)
- ticket sales points (using card readers and the CPA sales application)
- cards used (Mifare DESfire EV1 and EV2)

In terms of content, it consists of:

- the ticketing system (including sales and validations)
- the timetable entry and confirmation system
- the subsidy system (which is technically separate but is part of the ticketing system in terms of content)

The IJPP covers the activities of processing applications for subsidized tickets, issuing tickets, managing ticketing transactions, reporting and timetables or transportation systems (fare scales, the national timetable, downloading operator timetables, etc.) This part is therefore the central processing center of IJPP ticketing transactions.

Other systems, which are connected to the central system (either automatically or manually), include the online application Transportation Subsidies, Excel reports, (phasing out) and in certain parts the operators' information systems.

The acquisition of passenger data for subsidized tickets is also carried out via the national service Pladenj, as well as connectivity with the services of the e-Government portal, and certain data can be exported for

various other purposes (for example to the NCUP national access point or Google Transit in the GTFS format, as well as export to the NeTEx (schedules, fare tables) and SIRI (dynamic data) formats).

The data is stored in SQL databases. The system is connected to the terminal equipment on JPP vehicles for ticket validation and to ticket sales points. The system also offers a pre-defined set of various reports on validations, sales, usage, etc., as well as report generation and on-demand inquiries.

The system is card-centric and is not designed as account-based ticketing. It does not accept EMV cards. However, bank cards can be used in some cases to purchase tickets online, in operators' applications or at sales points.

The operators' systems are technically integrated in the IJPP system based on the IJPP Standard, which sets out the technical requirements and processes for the launch and operation of the operators' sales and validation systems in the IJPP system.

It is a multi-operator and multi-modal system, which allows users to change from one mode of transport to another with a single ticket, regardless of the type of mode or operator, and strives to ensure time-coordinated connections between different vehicles.

Passenger transport is carried out on scheduled lines and using the vehicles of operators providing the service of general economic interest of passenger transport in city and intercity bus transport and rail passenger transport based on a route-zone system. Transportation services are carried out in accordance with the IJPP system uniform rules based on a combined ticket, which is issued by the IJPP manager and is based on an electronic medium as a central ticket carrier (a contactless smart card – the IJPP card).

The all-in-one IJPP product is a combined electronic ticket issued on a single electronic medium – the IJPP contactless smart card. All-in-one IJPP products are defined by their uniform tariff scheme and unified terms of use. A uniform tariff system is in place, based on a route-zone model of Slovenia's territory in terms of transportation and geography. Urban areas use the zone system, while in other parts of the country, the tariff system is based on the route kilometer geographical model.

The system encompasses various products (tickets), which can be either non-transferable (tied to a particular user) or transferable (freely transferable between users). They can be valid for a specific route or the whole country, and there are also tickets for specific user groups with certain benefits (registered athletes, pensioners, people with disabilities, people over 65 years of age and war veterans), which are subject to specific right granting rules.

### 1.2.2 IJPP in numbers

#### Number of vehicles used.

Table 1: Approximate numbers of vehicles used in public transport.

|                             | Buses        |              | Trains     |            | Platforms*    | Boats     | Cable car      |
|-----------------------------|--------------|--------------|------------|------------|---------------|-----------|----------------|
|                             | No. Buses    | No. doors    | No. Trains | No. Doors  | No. Platforms | No. Boats | No. Cable cars |
| <b>Current</b>              | <b>1,572</b> | <b>3,664</b> | <b>124</b> | <b>812</b> | <b>489</b>    | <b>4</b>  | <b>5</b>       |
| <b>Added In 24 months**</b> | <b>369</b>   | <b>1,151</b> | <b>30</b>  | <b>210</b> | <b>3</b>      | <b>2</b>  | <b>3</b>       |

\* During the procurement process, PTA can use only one Train or Platform number.

\*\* Known extensions at this moment.

### Number of routes and stations

Table 2: Approximate numbers of routes, stations, and platforms used in public transport.

|                              | Bus         |              |                | Train         |            |            |
|------------------------------|-------------|--------------|----------------|---------------|------------|------------|
|                              | Routes      | Station      | Station Points | Routes        | Stations   | Platforms  |
| <b>Current routes (2025)</b> | <b>1700</b> | <b>5.108</b> | <b>9,950</b>   | <b>821 59</b> | <b>275</b> | <b>489</b> |
| <b>Added in 24 months*</b>   | <b>100</b>  | <b>-</b>     | <b>-</b>       | <b>1</b>      | <b>-</b>   | <b>3</b>   |

\*Plan

### Number of Handheld sales and Inspection devices:

Table 3:

|                               |            |
|-------------------------------|------------|
| <b>Handheld Sales devices</b> | <b>80</b>  |
| <b>Bus Inspection devices</b> | <b>129</b> |

### Number of Retail Sales points:

Table 4:

|                        |            |
|------------------------|------------|
| <b>Offline (bus)</b>   | <b>96</b>  |
| <b>Online (bus)</b>    | <b>5</b>   |
| <b>Offline (train)</b> | <b>41</b>  |
| <b>Online (train)</b>  | <b>2</b>   |
| <b>Offline (total)</b> | <b>137</b> |
| <b>Online (total)</b>  | <b>7</b>   |

### Number of Ticket Vending Machines:

Table 5:

|              |            |
|--------------|------------|
| <b>Train</b> | <b>156</b> |
| <b>Bus</b>   | <b>25</b>  |

### Active users - IJPP

Table 6:

|                                 |                |
|---------------------------------|----------------|
| <b>Active IJPP users (2025)</b> | <b>390.000</b> |
|---------------------------------|----------------|

## 1.3 Demand Context & Current Situation

The MOPE launched the IJPP Scheme in 2016 and introduced the use of contactless smart cards, referred to as "IJPP cards", that hold IJPP products written on the card. The system is a Card-Based Ticketing system

(CBT). The intention is that the IJPP card enables transport customers to pay for the use of various public transport modes in Slovenia with a single IJPP card or with open-loop payment cards. Passengers can use the IJPP card to travel on intercity buses, trains, boats, and cable cars.

Currently, the IJPP card system used for public transport ticketing in Slovenia is based on a physical Contactless Smart Card (CSC) implemented with MIFARE® DESFire® technology. The system was launched in 2016, and up to date, around 300,000 cards have been issued, with 200,000 transactions processed per day as of December 2023.

The system infrastructure covers multiple Public Transport operators (PTOs) and modes of transport in Slovenia (bus, commuter trains) operated as Integrated Public Transport scheme.

MOPE is developing the IJPP Strategy, where MOPE's vision of IJPP is to offer fare collection and payment services both across and beyond integrated Public Transportation. As part of the strategy, a next generation of IJPP fare collection & payment system that supports Account-Based Ticketing (ABT) and other advanced technologies, needs to be implemented to replace the existing legacy system. The ABT system shall be flexible in providing new services and products to the traveling public, with improved security and easy integration for transit and non-transit partners to offer IJPP payment services.

The Contracting Authority is looking to award a contract to a vendor of the Timetable management system to establish the core platform for Timetable management for all public transport services in Slovenia.

The selected Vendor shall be responsible for:

- Delivery of the TTM System, duly customized to support PTA's business needs and expected usage, as described in this document.
- Delivery of the Timetable management system to support PTA and city PTOs for introducing and running efficient timetables for public transport services in Slovenia.

With the Project PTA will enhance:

- use of a Timetable management system and optimization tools to reduce waiting times and optimize schedules all over the country.
- implement new customer journeys and seamless customer experiences that offer happiness and increase public transport ridership,
- customer experience
- benefits from self-services using mobile and web apps,
- benefits of mobile and web apps,
- benefits from reduced queuing and passenger loading times,
- operational improvements,
- enhance partnerships with cities and international service providers,
- support online and near-online systems and avoid latency,

The Contracting Authority is seeking innovative and cost-effective solutions that fulfil the objectives of this tender while ensuring flexibility to accommodate future changes in the DUJPP strategy, policies, and programs. Vendors are expected to deliver comprehensive services—including documentation, installation, configuration, training, testing, warranty and technical support.

All requirements and functionalities specified in the tender documentation are mandatory and must be fulfilled by all bidders responding to this RFP. However, if a bidder proposes an alternative solution that achieves the same functional outcome, and provides clear explanation and supporting documentation, the Contracting Authority may consider it for acceptance.

## 1.4 Procurement content

### 1.4.1 Timetable Management (TTM) System

The Timetable Management (TTM) system forms the core component of this procurement. The system may be offered either as a Software-as-a-Service (SaaS) solution or through a traditional software licensing model.

The scope of supply includes delivery, installation, integration, and ongoing support and maintenance of the TTM software solution.

The primary objective of the TTM system is to optimize the planning, scheduling, and management of public transport services, thereby improving overall operational efficiency and service reliability. The solution should be scalable, user-friendly, and capable of supporting current and future public transport requirements.

#### **Key Functionalities of the TTM System:**

##### **1. Network Data Management:**

- Creation and updating of network data, including stops and routes.
- Ensuring data accuracy and consistency across the network.

##### **2. Timetable Management:**

- Creation and updating of timetables, with the ability to designate specific stops as timing points.
- Flexibility to adjust timetables based on operational needs and constraints.

##### **3. Scheduling System:**

- Creation of trips, either manually or automatically, based on various constraints such as:
  - Specified timing points
  - Headway and frequency
  - Vehicle type
  - Working day and maximum target vehicle mileage constraints
  - Minimizing repositioning of assets
  - Relief points
  - Interworking requirements

##### **4. Printed Timetables:**

- Generation of printed timetables for distribution to passengers and staff.

##### **5. Planning and Simulation Tools:**

- Tools for planning and simulating schedules to optimize resource allocation and service delivery.

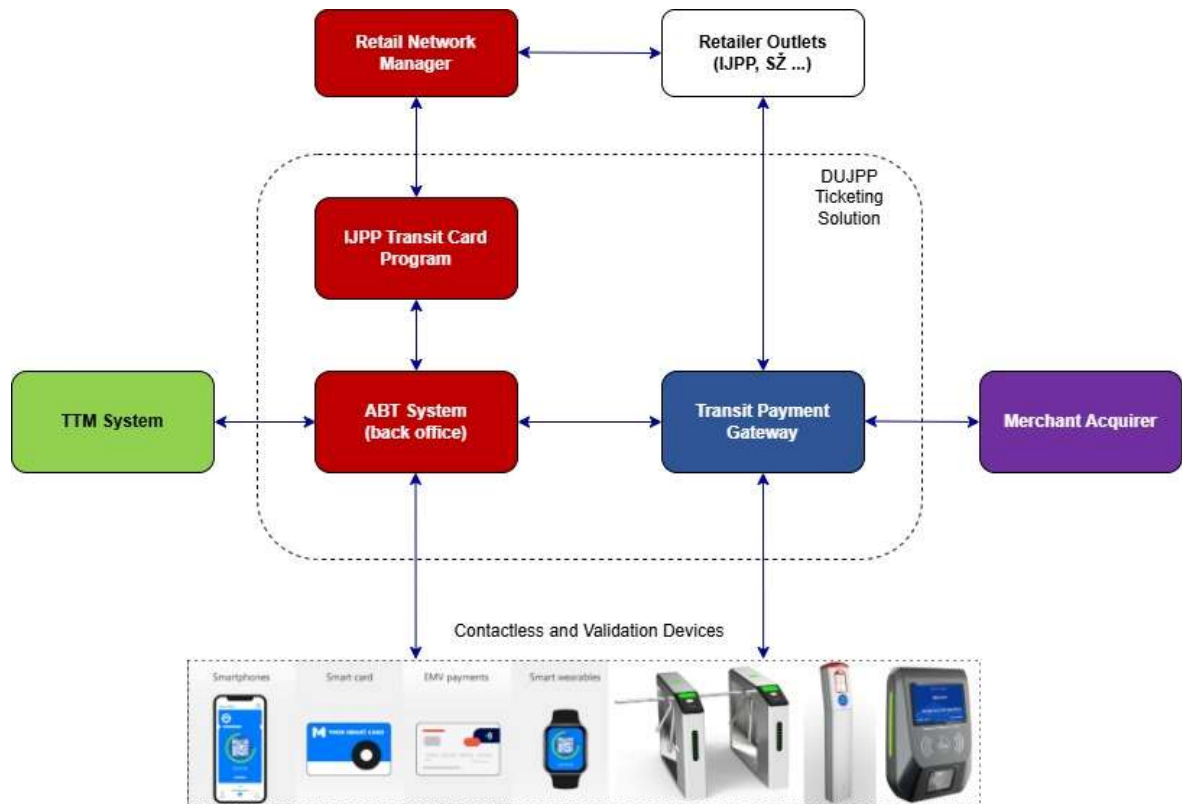
- Scenario analysis to evaluate the impact of different scheduling strategies.
- 6. Reporting:**
  - Comprehensive reporting capabilities to monitor and analyze performance.
  - Customizable reports to meet the specific needs of the transport authority.
- 7. Integration with Existing Systems:**
  - Compatibility with the existing IJPP ticketing system and upcoming new ticketing systems.
  - Support for industry-standard data formats such as GTFS and NeTEx.
  - Mechanisms to support dual or multiple languages where needed.
- 8. Meta-Data Management:**
  - Storage and export of additional meta-data to support the ticketing system and AVM system.
  - Editable meta-data using the TTM System's standard tools.

#### 1.4.2 Role of the TTM System within the Newly Planned IJPP System

The Timetable Management (TTM) system is a foundational subsystem within the newly planned Integrated Journey Planning Platform (IJPP). It serves as the primary source for the creation, maintenance, and management of public transport timetables, and directly supports the core functionality of the IJPP.

The TTM system provides the structured scheduling data required for journey planning, real-time information services, operational planning, and data exchange with internal and external stakeholders. As such, it plays a critical role in ensuring the accuracy, reliability, and efficiency of the overall IJPP ecosystem.

By integrating seamlessly with other modules of the IJPP, including route planning, passenger information systems, and operational control centers, the TTM system ensures consistent and coordinated transport service delivery across all modes of public transit.



Picture 2: Timetable Management System position within the IJPP system



## 1.5 Technology Controls and Standards

The Contracting Authority expects all vendors to apply technology controls and standards consistent with those used in comparable IT projects. This will support DUJPP in maintaining alignment with recommended practices. Engagement teams must consider both technology controls and standards when procuring or designing solutions and ensure compliance wherever applicable. Additionally, the Contracting Authority expects vendors to clearly explain how they have delivered comparable projects in the past.

TCS is expected to be shown in the specifications and features of the procured/developed solution as provided in the RFP and to submit along with the technical proposal.

Contracting Authority reserves the right to enforce the Technology controls & standards on the winning vendor even after the project is awarded for instances/cases where the winning Vendor has not responded appropriately or not adhered to any Technology controls & standards during the bidding process.

## 1.6 Proposal & Presentation

Each vendor is expected to present their proposal through a technically focused presentation, accompanied by a Proof of Concept (PoC) or a business-oriented presentation that demonstrates how the proposed solution or service meets the requirements outlined in this RFP. Vendors should also highlight any additional features or complementary value the solution may offer that could benefit the Contracting Authority in the short or long term.

Presentations must address the key components of the proposed solution or service, the support model, and all relevant aspects within the scope of the tender.

The Contracting Authority may request a live demonstration or a site visit to a Public Transport Authority (PTA) or Public Transport Operator (PTO) where the vendor has implemented a similar solution.

Vendors must be prepared to present and demonstrate all elements outlined in the test scenarios described in Appendix A. For each item within the test scenarios, the vendor's solution will be evaluated and scored based on predefined criteria. Points will be rewarded according to how effectively and accurately the proposed solution addresses the functional and technical requirements specified in each scenario. Vendors are responsible for preparing and supplying all necessary scenario data and configurations in advance to ensure a smooth and complete demonstration. The overall test performance will form a key part of the evaluation process and may significantly influence the final assessment of the proposal.

## 2 Features and services

### 2.1 General

Vendors must meet all the described and required features and services in the list of functional specifications, and these must be later delivered by awarded vendors.

### 2.2 TTM System requirements

DUJPP expects the following key system requirements to be met within the vendor's solution:

- **Data Management:** The TTM System should facilitate the efficient management of multiple versions of scheduling data.

- **Multi-User Access:** The system must enable multiple users to access a single, shared copy of the scheduling data from separate computers.
- **Client Workstation Specifications:** The vendors must specify the minimum hardware and operating system requirements for client workstations or laptops.
- **Concurrent Data Access:** The TTM system should allow simultaneous access to scheduling data by multiple users.
- **Restrictions Disclosure:** The vendors should clearly outline any restrictions, such as limitations on multiple users working on the same route timetable at the same time and similar.
- **Data Ownership and Access:** DUJPP will retain all rights to the data generated and stored within the vendor's system. The organization should have direct access to this data without incurring any royalties or license fees.

## 2.3 Technical requirements

DUJPP will accept a variety of hosting options for the TTM system. Vendors are required to specify the hosting options available with their solutions and provide detailed pricing for each one. All pricing must include any necessary first- and third-party licenses, as well as hardware and software where appropriate.

Regardless of the hosting model, the TTM system shall ensure a level of information security and business continuity comparable to the requirements of the ISO/IEC 27001 and ISO 22301 standards.

The system shall be designed and operated in a manner that considers the requirements of Directive (EU) 2022/2555 (NIS2), in particular regarding risk management, handling of security incidents, and management of security risks related to suppliers of information solutions.

In the event that the contracting authority permits or provides for a cloud-based solution, it will require the PUE (Power Usage Effectiveness) factor of the location where the cloud solution is hosted, in accordance with the provisions of the Green Public Procurement Regulation. A lower PUE factor may be awarded additional points as part of the evaluation criteria or demo scenario.

### 2.3.1 On premises/hosted

This model allows the vendor to propose a hardware solution intended for deployment at DUJPP premises or a nearby data center. Vendors must include all required hardware and any necessary third-party software in their pricing. DUJPP prefers solutions that can operate effectively within a virtualized environment.

### 2.3.2 Private cloud

In this model, the solution is hosted within a third-party cloud environment. Vendors should provide detailed specifications for server requirements, including CPU, RAM, storage capacity, and expected bandwidth for this hosting option. Data hosted in a third-party cloud environment shall be stored within the territory of the European Union. If the system is hosted in a third-party environment, a level of security and protection of personal data comparable to the requirements of the ISO/IEC 27017 and ISO/IEC 27018 standards shall be ensured. DUJPP will establish a contract directly with the cloud service provider.

### 2.3.3 Fully hosted by the vendor (SaaS model).

In this model, the solution is provided as a service. Vendors must clearly outline the ongoing fees associated with this arrangement, particularly as the fleet size, network, or number of users expands. Data shall be stored within the territory of the European Union. A level of security and protection of personal data comparable to the requirements of the ISO/IEC 27017 and ISO/IEC 27018 standards shall be ensured.

### 2.3.4 Personal Data Residency and Processing Requirements

The system will process personal data, including but not limited to driver identification data (e.g., names and IDs). In accordance with applicable Slovenian legislation on personal data protection, all such personal data must be stored and processed within the territory of the Republic of Slovenia.

This requirement applies to all proposed deployment models (on-premises, private cloud, and SaaS). Vendors must clearly demonstrate how compliance with this requirement will be ensured, including:

- The physical location of data storage and processing,
- The architecture of data flows involving personal data,
- Any subcontractors or third-party services involved in data processing.

Solutions that do not ensure storage and processing of personal data within Slovenia will not be considered compliant.

## 2.4 Interoperation with the IJPP ticketing system

The TTM system must support both the existing IJPP ticketing system and the upcoming new ticketing system in the following ways:

- **Data Export:** Provide a complete export of network and timetable data in a compatible, industry format.
- NeTeX shall be the mandatory format for data export. Additionally, the solution should, where possible, support export in GTFS format. If the vendor's solution enables other export formats or advanced data exchange methods, these should also be described.

**Note:** GTFS does not support multiple languages for fields such as stop names. The vendor should enhance their exports to include a mechanism that supports dual or multiple languages where needed, in a manner compatible with the DUJPP ticketing system.

- **Meta-Data Management:** DUJPP will need to store and export additional meta-data to support the ticketing system and AVM system, such as the tariff zone for each stop and the vehicle destination display code for each route. This meta-data should be editable using the TTM's standard tools.

## 2.5 Timetable Management System (TTM) general requirements

### 2.5.1 Reporting

The vendors shall comply with the reporting requirements provided in the Functional Requirements section and all other relevant subsections of the present RFP. Parts of this segment are:

- Reporting tool
- Business intelligence
- Reporting capabilities
- Data and report access

| Modul                 | Nr.     | Requirement   |
|-----------------------|---------|---|
| Reporting tool        | 2.5.1.1 | <p>The reporting module shall utilize an industry-standard reporting tool with capabilities equivalent to or exceeding those offered by platforms such as SAP BusinessObjects, Microsoft Power BI, Qlik Sense, or similar recognized solutions. The licensing model must be enterprise-grade, providing full web-based access for an unlimited number of users. Additionally, the Public Transport Authority (PTA) shall be granted developer-level access to the reporting modules to enable full customization and management. The proposed tool must be subject to approval by the PTA and offer integrated Business Intelligence (BI) capabilities.</p> <p>The reporting solution must support the generation of fixed-format reports, with functionality to schedule and automatically distribute them via email. It should also provide ad-hoc reporting capabilities for on-demand data exploration and insight generation.</p> <p>The system shall support the use of built-in reports and summary lists, while offering the flexibility to extend reporting content by incorporating user-defined attributes, thereby enabling tailored customization to meet evolving analytical needs.</p> <p>An integrated or compatible external report designer must be provided, granting access to all internal reports and lists, including summary and detailed views. The report designer should offer a comprehensive suite of elements such as tables, pivot grids, charts, headers, footers, and other formatting components to support a wide range of reporting requirements.</p> <p>All internal reports and lists must be exportable to commonly used file formats, including but not limited to Excel, CSV, and XML. Exports should utilize predefined templates to maintain consistency and quality. Furthermore, the system must support seamless data export from all report types and lists in CSV or XML formats to facilitate external analysis and integration.</p> |
| Business Intelligence | 2.5.1.2 | <p>The offered Business Intelligence (BI) system must support data-driven decision-making and comply with the following functional requirements:</p> <ul style="list-style-type: none"> <li>• Provide advanced data analysis capabilities, including the ability to identify patterns, trends, and correlations that support both strategic and operational planning.</li> <li>• Deliver robust reporting functionalities, enabling the generation of structured, timely, and relevant reports, available on both a scheduled and ad-hoc basis.</li> <li>• Include interactive dashboards and data visualization tools for the effective presentation of key performance indicators (KPIs) and trends.</li> <li>• Support flexible and advanced querying functions, allowing users to construct custom queries and retrieve precise, context-specific data outputs.</li> <li>• Incorporate forecasting and predictive analytics features that leverage historical data and statistical models to produce future projections, facilitating proactive decision-making.</li> </ul>   |

|                        |         |  |
|------------------------|---------|--|
|                        |         | <ul style="list-style-type: none"> <li>Ensure the exportability of analytical data—such as pivot tables, summary lists, and other aggregated outputs—for use in external Business Intelligence (BI) applications. This functionality must allow seamless integration with third-party BI tools, thereby enhancing the overall analytical reach and flexibility of the system.</li> </ul>   |
|                        | 2.5.1.3 | The reporting and BI tool must have web and mobile interfaces and be made accessible anywhere/anytime to authorized PTA and PTO users, both at workstations within the PTA & PTO LANs and through external connection.   |
| Reporting Capabilities | 2.5.1.4 | <p>The TTM system shall support at least the following daily / selectable date range reports generation (period shall be configurable):</p> <ul style="list-style-type: none"> <li><b>Planned service offers per selected period</b><br/>(number of trips, vehicle-kilometers and vehicle-hours per line, route variant, operator and mode).</li> <li><b>Stop-level departure report</b><br/>(all planned departures per stop / stop area, per line and direction, for the selected day or period).</li> <li><b>Applied calendar and exception report</b><br/>(service day types, public holidays, school days, special events and exception days applied to lines and trips in the selected period).</li> <li><b>Trip list report</b><br/>(list of all trips operating in the selected period, including line, route variant, direction, validity, first/last stop and planned times).</li> <li><b>Transfer and connection report</b><br/>(overview of planned transfer possibilities between lines at defined interchange stops within the selected period).</li> </ul> <p><b>Timetable validation and conflict report for the selected period</b><br/>(summary of rule violations, timing conflicts, infeasible connections, infrastructure conflicts, etc., detected for timetables valid in the selected period).</p> <p>The list of the existing and expected reports is provided in RFP. PTO specific reports must be included, and the system should allow for ad-hoc reports to be created without any need for software change</p> |
|                        | 2.5.1.5 | <p>The TTM system shall support at least the following monthly reports generation (period shall be configurable):</p> <ul style="list-style-type: none"> <li><b>Monthly planned service supply report</b><br/>(aggregated vehicle-kilometers, vehicle-hours and number of trips per operator, mode, line, route variant and service-day type).</li> <li><b>Line utilization and coverage report</b><br/>(number of operating days per line, span of service, average frequency/headway classes per time-of-day and day type).</li> <li><b>Timetable change and versioning report</b><br/>(overview of timetable versions active in the month, list of changes compared to previous month, including added/removed/modified lines, trips and stops).</li> </ul>   |

|                      |         |  |
|----------------------|---------|--|
|                      |         | <ul style="list-style-type: none"> <li>• <b>Infrastructure utilization report (where applicable, e.g. rail)</b><br/>(aggregated platform and track occupancy per station, per time-of-day band).</li> <li>• <b>Monthly KPI report</b><br/>– planned service KPIs (supply indicators), and, where AVL data is available, aggregated planned vs. actual punctuality, cancellations and shortened trips per operator and line.</li> <li>• <b>Operator summary report</b><br/>(per-PTO overview of supplied service, KPIs and timetable changes in the reported month).</li> </ul> |
|                      | 2.5.1.6 | <p>The TTM system shall support at least the following report export formats for all the above reports:</p> <ul style="list-style-type: none"> <li>• CSV</li> <li>• XLS</li> <li>• XML</li> <li>• PDF</li> </ul>   |
| Data & report access | 2.5.1.7 | All reports produced by TTM system must display only the data pertaining to the user domain of the user who executed the report.   |
|                      | 2.5.1.8 | The reporting module shall also permit authorized users to develop special ad-hoc reports instantly.   |

Additional reporting requirements are outlined in section 2.6.4 and as part of the Test Scenarios in Appendix A.

## 2.5.2 Auditing

The vendors shall comply with the Auditing requirements provided in the Functional Requirements section and all other relevant subsections of the present RFP. Part of this segment is:

- Audit log

| Modul                          | Nr.     | Requirement  |
|--------------------------------|---------|--|
| Audit log for planning         | 2.5.2.1 | <p>All actions made on the TTM management interface for timetable planning shall be recorded in an audit log. This shall include at least:</p> <ul style="list-style-type: none"> <li>• User and date stamp</li> <li>• User login on the management interface.</li> <li>• Any Import or Export in/from the TTM system.</li> </ul>                  |
| Audit log for operations       | 2.5.2.2 | <p>All actions made on the TTM management interface for daily operations shall be recorded in an audit log. This shall include at least:</p> <ul style="list-style-type: none"> <li>• Any changes to the data made by users.</li> <li>• User login on the management interface.</li> <li>• Any Import or Export in/from the TTM system.</li> </ul> |
| General audit log requirements | 2.5.2.3 | Authorized users shall be able to view and export the audit log in a standard report format. It shall be possible to apply filters to this view (per user, per time range, per type of activity).  |
|                                | 2.5.2.4 | All audit log records shall include at least the identification of the system user performing the action, a timestamp, and a text describing the action. When possible, audit log records should also include  |

|  |  |   |
|--|--|---|
|  |  | information on the point of access (mobile number or workstation IP address). |
|--|--|---|

### 2.5.3 General requirements for PTO's premises

The vendors shall comply with the General requirements for PTO's premises requirements provided in the Functional Requirements section and all other relevant subsections of the present RFP. Part of this segment are:

- System configuration
- Topology management
- Reporting

| Modul                | Nr.      | Requirement  |
|----------------------|----------|--|
| System Configuration | 2.5.4.1  | The TTM system shall allow the PTO to nominate a system administrator or super user to manage other users within their organization.   |
|                      | 2.5.3.2  | The TTM system shall allow the PTO system administrator (super user) to set up further PTO users by remote access from its Headquarters.   |
|                      | 2.5.3.3  | The TTM system shall allow the PTO system administrator (super user) to configure which TTM features shall be available to individual user types/categories of user (definition of access rights). |
|                      | 2.5.3.4  | The TTM system shall support the use of groups and roles as well as provide templates for user groups and roles capable of modification by the PTO system administrator.                           |
|                      | 2.5.3.5  | The PTO Users shall not have access to other PTOs data, features or functions.   |
|                      | 2.5.3.6  | Once a user has logged on, the TTM system shall present only those functions available to that particular user depending upon security settings.   |
|                      | 2.5.3.7  | The TTM system shall permit a PTO to assign and manage all, or a portion, of its user rights to organizations/users of any company that it may outsource or sub-contract its operations to.        |
| Topology Management  | 2.5.3.8  | The TTM system shall provide the features for a PTO to export the topology changes in following formats: <ul style="list-style-type: none"> <li>• NeTEx (CEN/TS 16614-1)</li> </ul>                |
|                      | 2.5.3.9  | The TTM system shall expose an API that PTOs systems can implement to download topology files.   |
| Reporting            | 2.5.3.10 | In addition to the standard pre-defined reports, the PTO shall be able to access their data held centrally to define ad-hoc, custom reports from time-to-time.                                     |
|                      | 2.5.3.11 | All reports (whether standard or ad-hoc) shall be capable of export in several standards, including PDF, CSV, XML and too as to permit their import into any other standard reporting tool.        |

### 2.5.4 Special requirements for PTO integration of their TTM systems

The vendors shall comply with the Special requirements for PTO's TTM systems special events provided in the section Functional Requirements and all other relevant subsections of the present RFP.

|                 |         |   |
|-----------------|---------|---|
| TTM Integration | 2.5.4.1 | <p>Core network elements—such as map and stop information—shall be centrally managed to ensure consistency across the system. This includes the use of a common projection and origin, unique segment identifiers, correct connectivity between network segments, handling of territorial overlaps, and the management of stop locations and operational deviations.</p> <p>In this context, TTM should be used as the central system for topology management, implemented in a multi-tenant architecture that enables different stakeholders to maintain their respective topology data within TTM and export it to their own systems as required.</p> |
|                 | 2.5.4.2 | For Bus Routes, there are certain routes that are circular in nature. The TTM system fare calculation must be able to determine the direction that the bus is traveling around this circular route to enable the correct fare to be used.   |
|                 | 3.5.3.3 | Buses may be prone to detours, either planned because of road works or unplanned to avoid accidents, etc. The TTM system must enable the PTA to enter details of these detours and diversions. These detours and diversions may include stops at locations not previously recognized as normal stops.   |

## 2.5.5 Reference Data Management

The vendors shall comply with the Reference data management requirements provided in the Functional Requirements section and all other relevant subsections of the present RFP. Part of this segment is:

- Topology management

| Modul               | Nr.     | Requirement  |
|---------------------|---------|--|
| Topology Management | 2.5.5.1 | <p>The TTM system shall provide the system user the ability to import the topology data from PTA's TTM and each PTO, in NeTEx format (CEN/TS 16614-1). This shall allow the automated import from the scheduling system, for PTA and those PTOs who are using the system.</p> <p>The NeTEx format shall be used as the unified and consistent data exchange standard for all topology, timetable, and related planning data across PTA and all PTOs.</p> |
|                     | 2.5.5.2 | The TTM system shall provide tools for the automatic and manual verification of the overall topology thus compiled.  |
|                     | 2.5.5.3 | The TTM system shall store multiple versions of the network topology (past, present and future). When a new topology import process is started, data shall be stored as a “future” version until approved and deployed in production.  |
|                     | 2.5.5.4 | The TTM system shall allow the deployment of any topology version on the test and pre-production environments.   |
|                     | 2.5.5.5 | The TTM system shall allow the deployment of a new topology version in the production environment only after this version has completed a test and approval workflow, which must include the approval by all involved stakeholders. This workflow shall be defined during the design stage of the project.   |



## 2.5.6 API's

The vendors shall comply with the portals, mobile applications, APIs and SDKs requirements provided in the Functional Requirements section and all other relevant subsections of the present RFP. APIs shall be used primarily for real-time, operational, and transactional data exchange. APIs shall not replace standardized data exchange formats (e.g. NeTEx) for core timetable and planning data. The solution shall ensure that all core data exchanged via APIs is also available in standardized export formats (NeTEx) to guarantee interoperability and data portability. Part of this segment are:

- 3rd Party systems API
- Test APIs

| Modul                 | Nr.     | Requirement  |
|-----------------------|---------|--|
| 3rd Party Systems API | 2.5.6.1 | <p>The vendor is expected to provide full support to 3rd party system providers in the integration of the TTM APIs. Support shall cover (but not limited to):</p> <ul style="list-style-type: none"> <li>• API documentation (in English)</li> <li>• Trainings and workshops</li> <li>• Test environment for integration testing</li> <li>• Source code samples</li> <li>• Make required configurations and changes in ABT system for collecting data as part of two-way integration. (Pull integrations)</li> </ul>   |
| Test APIs             | 2.5.6.2 | <p>All TTM system APIs shall be accessible in PTA test environment (TTM system test instance) from a 3rd party test tool to integrate automated test procedures. Test automation API shall allow operations such as (but not limited to):</p> <ul style="list-style-type: none"> <li>• Status list updates</li> <li>• Transaction logs download</li> <li>• Configuration (business parameters, system parameters...)</li> <li>• Monitoring and Control (supervision)</li> <li>• All Business functions instead of using User Interface</li> </ul> <p>Debug logs activation and download for solution provider investigation.</p> |

## 2.5.7 General Requirements for Systems Interfaces

The vendor shall comply with general requirements for systems interfaces requirements provided in the section Functional Requirements and all other relevant subsections of the present RFP. Part of this segment are:

- API standards
- Security
- Network connectivity
- Time synchronization

| Modul         | Nr.     | Requirement   |
|---------------|---------|---|
| API standards | 2.5.7.1 | <p>The TTM system architecture must provide open APIs-based integration architecture to allow connection of multiple stakeholders. The system architecture must provide the ability to segment business processes and data based on business rules and rights management via each API for each stakeholder.</p> |

|                      |          |   |
|----------------------|----------|---|
|                      | 2.5.7.2  | The TTM system shall support the capability to provide and consume suitable data using open and secure interface. All interfaces must be based on international and industry standards.   |
|                      | 2.5.7.3  | The TTM system shall be able to communicate with multiple number of systems simultaneously in a very scalable way without interfering other communications.   |
|                      | 2.5.7.4  | The TTM system must provide secure integration interfaces to other systems, in the form of Web Application Programming Interfaces (Web APIs). It must control access to resources and functionality accessible through the interfaces through authentication of APIs clients and role-based access control.   |
|                      | 2.5.7.5  | Web APIs shall allow third parties to develop software and systems that integrate to such APIs. This includes machine readable open specification for each API, for example: <ul style="list-style-type: none"> <li>• For SOAP <ul style="list-style-type: none"> <li>o Web Services Definition Language (WSDL - <a href="https://www.w3.org/TR/wsdl/">https://www.w3.org/TR/wsdl/</a>)</li> </ul> </li> <li>• For RESTful APIs <ul style="list-style-type: none"> <li>o RESTful API Modelling Language (RAML - <a href="https://raml.org">https://raml.org</a>)</li> </ul> </li> <li>• OpenAPI Specification (OAS - <a href="https://en.wikipedia.org/wiki/OpenAPI_Specification">https://en.wikipedia.org/wiki/OpenAPI_Specification</a>).</li> </ul> |
|                      | 2.5.7.6  | The TTM system shall support synchronous and asynchronous messages exchanges: <ul style="list-style-type: none"> <li>• Asynchronous: The response is sent after a period or through another mean of communication. An acknowledgement of receipt shall still be sent to the sender of the message.</li> <li>• Synchronous: The data are sent in response to the request.</li> </ul>   |
| Security             | 2.5.7.7  | The communication channels between all modules shall be secured. The communication channel security shall ensure transfer of sensitive data without overhearing and tampering. Security best practices shall be implemented to ensure: <ul style="list-style-type: none"> <li>• Authentication: For the sender, ensure the data arrives at the intended recipient only, and for the receiver that the data comes from the intended recipient</li> <li>• Data integrity: Secure the integrity of data with using signatures.</li> <li>• Data Confidentiality: Encrypting of data to ensure it can only be read by the intended recipient.</li> </ul>   |
|                      | 2.5.7.8  | Mutual authentication shall be implemented where both entities verification is required. The authentication check must be performed by both entities at first time of communication establishment. If the communication is broken for any physical or logical reason and new session started with the new TCP link establishment, the authentication verification process must be performed before transferring any type of data at start of the session.   |
|                      | 2.5.7.9  | Encryption shall be used to ensure confidentiality and data security. Industry proven standard cryptographic algorithms or tokenization shall be used in accordance with legal regulations and PTA security standards. File transfers shall take place using secure application protocols like SFTP. Web APIs shall be secured using TLS 1.3 (RFC 8446) and future versions.  |
| Network connectivity | 2.5.7.10 | Both sender and receiver shall ensure network availability by sending periodic connectivity check signals. The data can only be transferred in case of network availability. The receiver shall send acknowledgement to the sender when data is received.   |

|                      |          |   |
|----------------------|----------|---|
|                      | 2.5.7.11 | In case of network connectivity interruption during data transmission, the data transfer shall resume from the point of interruption when the network is available.   |
|                      | 2.5.7.12 | When a data transmission is not acknowledged within a configurable period, the sender shall retry the transmission automatically. The timeout and number of retries shall be configurable.  |
|                      | 2.5.7.13 | All network connectivity and data transmission issues shall be logged, and corresponding alarms raised to the system monitoring modules.  |
|                      | 2.5.7.14 | All systems shall support at least following communication initiation situations: <ul style="list-style-type: none"> <li>• At reset: At reset of a system, the data must be exchanged to initiate and configure the session with other components or to retrieve the last applicable configuration</li> <li>• On a regular basis: Data is exchanged periodically (configurable period)</li> <li>• On demand: Data is exchanged on request.</li> <li>• Anytime: Data is exchanged following a specific event or transaction type.</li> </ul> |
| Time synchronization | 2.5.7.15 | All the entities logically or physically linked with the TTM system shall be synchronized with standard NTP (Network Time Protocol) with the server in Slovenia.  |

## 2.6 Core Timetable Management System (TTM) requirements

The vendor shall provide the software, installation, deployment, integration, and configuration for all components of the Timetable management system on the PTA system in compliance with the requirements provided in the present RFP.

### 2.6.1 General requirements

The winning Vendor is expected to provide the following functionality of the proposed timetables solution:

- A system featuring a user-friendly interface for multimodal journey planning is sought. Diverse transportation modes, encompassing buses, trains, and other alternatives, should be included, taking into consideration factors such as travel time, cost, and convenience.
- Schedules depicting the departure and arrival times of public transport vehicles are to be provided, enabling PTO and passengers to plan their trips efficiently and avoid delays or missed connections.
- Version management of all basic timetables data sets, involving the tracking of changes and updates made to public transport data, should be implemented to ensure data consistency, accuracy, and easy recovery in case of errors or failures.
- GIS integration is required, utilizing geographic information systems (GIS) to store, analyse, and visualize spatial data related to public transport, improving operational efficiency while providing useful information to PTO planners and passengers.
- The creation of a public transport network, consisting of routes, stops, stations, and vehicle types, should be proposed. This network can operate at different levels, such as regional, suburban, or urban, and support various transport modes like bus, rail (metro), and others.
- Calculation methods for scenarios (what-if scenarios) are expected, enabling the estimation of the effects of different situations or events on the public transport system. This includes changes in demand, supply, and policies, helping in the evaluation of impact and feasibility for decision-making and planning.

- Connection planning and optimization processes should be designed, coordinating schedules and transfers of different public transport modes and services, such as buses and trains, to enhance accessibility, convenience, and competitiveness.
- Proposal submissions should include measures for assessing the quality and efficiency of public transport services, including trip and wait times. These measures gauge factors such as the duration and frequency of trips and waiting times for public transport vehicles, influencing passenger satisfaction and behaviour.
- The proposed solution should classify public transport services based on characteristics and functions, including distance, speed, capacity, and frequency. These services may be categorized as regional, suburban, or urban, each with specific requirements and regulations.
- Bidders should present solutions for effective contract management, encompassing the agreements and relationships between public transport authorities and operators. This includes managing terms, conditions, obligations, responsibilities, payments, and resolving disputes or issues.
- Proposals should include solutions for passenger counting, measuring, and recording the number of passengers using public transport services, focusing on boarding, alighting, and on-board occupancy. The solution is not required to provide origin–destination (O/D) data directly but should allow integration with external systems (e.g. ticketing systems) to support extended analysis for planning and management.
- Proposals should include schedule representation of public transport services in relation to dates and times of the year, such as weekdays, weekends, holidays, and seasons. These schedule representations help organize and adjust public transport services based on variations and patterns of demand and supply.
- Operations activities and processes, involving the delivery and execution of public transport services, such as dispatching, driving, monitoring, and controlling public transport vehicles and staff, should be outlined. These operations help provide and maintain public transport services, ensuring the smooth and efficient functioning of the public transport system.
- The solution should include support for planning simulation processes, involving the creation and testing of virtual models or scenarios of the public transport system. This includes network, demand, and supply simulations, using mathematical and computational methods and tools such as algorithms and software. These simulations help explore and compare outcomes and implications of various public transport options and strategies, supporting planning and decision-making.
- The proposal should include solutions for statistics and analytics functionalities, encompassing methods and techniques for collecting, processing, and interpreting data and information related to public transport. This involves passenger, vehicle, route, timetable, etc., data and information, using statistical and analytical tools and software such as graphs, charts, and tables. These functionalities help understand and evaluate the characteristics and trends of public transport, providing insights and recommendations for improvement and innovation.
- The Scheduling System should enable the creation of personalized timetables in various formats, including booklets, posters, portrait-format bus stop timetables, static HTML timetables, and optional searchable timetables. The latter should support both client-side and server-side scripting for website integration.
- Customization features for timetable output should include easily modifiable templates allowing the inclusion of logos and graphics, as well as adjustments to overall appearance, such as typography, colours, and layout. Additionally, the system should provide support for multi-language output for stop names and other key fields.

- The solution must additionally allow smaller local or regional PTAs to use the same TTM platform as separate organizational domains, including the ability to import and manage their own data, administer their own users, and generate reports limited to their domain.
- The system shall support the modelling of railway infrastructure, including stations and platforms, as well as basic planning attributes (e.g. capacity, occupancy time).

## 2.6.2 Network planning

Contracting Authority requires that the solution must support the following main network elements: routes, stops, route options, and links. Routes are sequences of links that connect stop points (stops / stop areas) and are organized in various operating branches. Route options are alternative sequences of links for a route. Links are segments of the transport network that have a mode of transport attribute to support multimodality and control the behaviour of the georeferencing algorithm.

The solution must also support street segments and their characteristics, such as speed, direction, and turn restrictions. Contracting Authority requires additional user-defined attributes, such as images, descriptions, notes, and measures, for the main network elements to be imported or added using the user interface of the solution.

Contracting Authority requires the functionality of adding user-defined objects (not present on the GIS map), such as stops, time points, landmarks, ticket agents, and portals (doors or exits of station facilities), to the network.

The solution must also enable the creation of network events to define road closures and associated calendar information. Routes and route options, as well as localized objects and network events, must be associated with attributes, such as announcement or vehicle destination texts, notes, and other attributes.

Contracting Authority requires implementation of different network statuses: Current network, Archived network, Work in progress network (another user defined). Network status is defined as the union of all network elements of the same characteristic in the same time frame. Each network element must have its own property, that can change over time defining the validity of this particular in defined time frame. A network element can belong to different network statuses by changing its attributes in a specific time frame. Some examples of network element statuses are: Used in the current network (using the present time frame) or being a member of an archived network (using a past time frame).

Contracting Authority requires connection of the external demographic data to network data.

Basic statistical functionality (or basic mathematical functionality) must be allowed using existing network data and newly imported demographic data. depending on the availability of the data.

The vendors shall comply with the Network Planning Requirements provided in the section Functional Requirements and all other relevant subsections of the present RFP.

| Module           | Nr.     | Requirement  |
|------------------|---------|--|
| Network planning | 2.6.2.1 | Support of importation of GIS data from standard sources, using recognized industry formats including Geopackage, Shapefiles, MultiNet, MapInfo, Navstreets, and OpenStreet Maps.<br><br>PTA expects to jointly define, in cooperation with each provider, a unified data import format for the TTM system, ensuring optimal conditions for efficient, consistent, and high-quality data ingestion.  |
|                  | 2.6.2.2 | The solution must offer a user-friendly way to edit or add segments and shapes to the standard imported GIS schema and merge them into a unified GIS dataset. The solution must allow adding custom shapes and local information where needed.   |
|                  | 2.6.2.3 | Buyer requires the functionality of adding user-defined objects (not present on the GIS map), such as stops, time points, landmarks, ticket agents, and portals (doors or exits of station facilities), to the network.  |
|                  | 2.6.2.4 | The solution must support export of GIS data. Localized information and manually added shapes should be able to be exported for use in other applications such as AVL. One of the recognized standard industry formats should be used for exporting GIS data: Geopackage, Shapefiles, MultiNet, MapInfo, Navstreets, and OpenStreet.   |
|                  | 2.6.2.5 | Buyer requires that the solution must support the following main network elements: routes, stops, route options, and links. Routes are sequences of links that connect stop points (stops / stop areas) and are organized in various operating branches. Route options are alternative sequences of links for a route. Links are segments of the transport network that have a mode of transport attribute to support multimodality and control the behavior of the georeferencing algorithm. The solution must also support street segments and their characteristics, such as speed, direction, and turn restrictions. |
|                  | 2.6.2.6 | Buyer requires additional user-defined attributes, such as images, descriptions, notes, and measures, for the all-network elements to be imported or added using the user interface of the solution. All additional custom added attributes must be available for the reporting functionality. All additional custom information must be available for exporting functionality.  |
|                  | 2.6.2.7 | DUPJP requires flexible grouping functionality so that different parts of the network can be defined using user-defined attribute lists for grouping. Examples of such groupings include concession areas, urban areas, and EV-supported areas. This grouping must be utilized for primary selection and filtering through the user interface (UI).  |
|                  | 2.6.2.8 | Buyer necessitates the capability to assign fundamental calculation units, namely time and kilometers, to each pathway between two stops. These two parameters should be seamlessly integrated into all calculation processes and analytical tools, ensuring comprehensive functionality across the system.  |
|                  | 2.6.2.9 | Buyer requires implementation of different network statuses: Current network, Archived network, Work in progress network (another user defined). Network status is defined as a union of all network elements of same characteristics in the same time frame. Each network element must have its own property, that can change over time, defining the validity of this particular in defined time frame.<br><br>A network element can belong to different network statuses by changing its attributes in a specific time frame. Some examples of network element statuses   |

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|  |          | <p>are: Used in the current network (using the present time frame) or being a member of an archived network (using a past time frame).</p> <p>The solution shall provide functionality for comparing ("diff") different network states (current, archived, and in-progress), including a clear and structured visualization of all changes. It shall support controlled transfer and merging of network elements between states, with full traceability. All changes and transfers must be recorded in an audit trail to ensure accountability and compliance.</p>   |
|  | 2.6.2.10 | <p>The system should support linking the network data with the external demographic data. Buyer will provide demographic and statistical information along with GIS information, so that the data can be attached to different parts of the networks as extra layers on the GIS map. The suggested solution should support importing external data either as polygons or as point layers, depending on the type of network elements.</p>   |
|  | 2.6.2.11 | <p><b>Enhanced Demographic Data Integration</b></p> <p><b>Objective:</b><br/>The system should seamlessly integrate demographic information, offering the flexibility to import data either as polygons or as a point layer in the form of shapefiles. Furthermore, the solution must support basic statistical attributes, empowering users to utilize these attributes in calculations through customizable attribute formulas.</p> <p><b>Detailed Requirements:</b></p> <p><b>Data Import Capability:</b><br/> a. The system should allow for the import of demographic information in two distinct formats: polygons and point layers in the form of shapefiles.<br/> b. The import process should be efficient and user-friendly, ensuring a seamless integration of data into the system.</p> <p><b>Data Representation:</b><br/> a. Demographic information imported as polygons should be accurately represented within the system.<br/> b. Point layers, when imported, should be clearly visualized, allowing users to comprehend the spatial distribution of demographic data.</p> <p><b>Statistical Attributes:</b><br/> a. The solution must support a set of basic statistical attributes relevant to demographic data.<br/> b. Statistical attributes should include but not be limited to population density, age distribution, gender ratios, and other pertinent metrics.</p> <p><b>Attribute Formulas:</b><br/> <ul style="list-style-type: none"> <li>• Users should have the ability to create custom attribute formulas using the available statistical attributes.</li> <li>• The system must facilitate the integration of these formulas into calculations, providing users with a powerful tool for deriving valuable insights from demographic data.</li> </ul> </p> <p><b>Calculation Flexibility:</b><br/> <ul style="list-style-type: none"> <li>• The system should offer a wide range of calculation options, allowing users to perform complex analyses based on the imported demographic information.</li> <li>• Calculations should be dynamic and adjustable, enabling users to explore different scenarios and derive meaningful conclusions.</li> </ul> </p> |

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|  | 2.6.2.12 | The solution must perform topological validation of the GIS network and warn about errors such as broken connections, unreachable stops, incorrect directions, loops, duplicate elements, and inconsistencies between geometry and attributes.   |
|  | 2.6.2.13 | The system shall support the management of timetable calendars (annual, weekly and daily service types), public holidays, school holidays and exceptional days, and shall allow these calendar elements to be linked to specific timetable versions.<br>The system must allow the definition of run-time rules (timetable operating regimes) by time of day, season, direction, and day type (e.g., working day / holiday), and must automatically recalculate timetables when network elements or run-time rules are changed. |
|  | 2.6.2.14 | Upon importing operational data (AVL, passenger counting, etc.), the solution must perform basic quality checks (missing values, outliers, temporal inconsistencies) and allow marking and excluding inadequate data from analyses.  |
|  | 2.6.2.15 | The system must support concurrent work by multiple users with mechanisms to prevent editing conflicts (locking, conflict warnings, or check-out/in), including full change history.   |
|  | 2.6.2.16 | The system must provide an audit trail (who/when/what/why) for all changes to the network, routes, timetables, and publications, and must allow reverting to a previous state (rollback).  |

### 2.6.3 Network Routing

#### Compiling Timetables

The software must provide a robust and user-friendly solution for creating and updating timetables for different lines and business areas, as well as for different days of the week (working days, Saturdays, Sundays). The software must support both tabular and graphical displays of timetables, as well as the ability to export them in various formats.

The software must enable the users to generate line timetables based on predefined or custom criteria, such as line definition, frequency, headway, vehicle type, working day, maximum vehicle mileage, relief points, interworking requirements. The users must have the option to create timetables manually, automatically, or by combining the two methods.

The software must also allow the users to perform the following tasks for timetables:

- Assign line number and name.
- Assign status to timetables, indicating whether they are public (current, approved) or non-public (in progress, cancelled, disabled, etc.).
- Add notes or internal information to timetables, such as "temporary timetable", "school holidays timetable", etc.
- Add comments or information to timetables that are visible externally via the reporting to external devices or prints.
- Add a validity term to timetables.
- Add identifiers to stops that are meant only for boarding or exiting, or that are on-demand. Any other stop attribute should be able to use and print.
- View timetables as vehicle journey tables and make changes to vehicle running times if necessary.
- Make operational modifications to timetables within a specified date range, for example when road works are taking place.
- Determine the block and the type of vehicle servicing vehicle journey, if necessary.



- Approve timetables and prevent any modifications to approved timetables. To amend an approved timetable, the user must first change the status of the timetable.
- Create a timetable based on an existing timetable used as a template.
- Perform the following activities from the timetable view:
  - Open the departure times of all stops on the line.
  - Compare the departure times from a stop with the departure times of other lines passing through the same stop.
  - Shift the departure times of a specific line, which will result in changes to the departure times of the entire line, if necessary.

The software must ensure that the stop departure and vehicle running times are accurate to the minute. The software must also allow the users to assign the following to a specific stop of a specific line.

| Module          | Nr.     | Requirement  |
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| Network routing | 2.6.3.1 | <p>Contractual Authority requires that the vendor must provide a solution for managing timetables, which offers the following basic functionality using a simple and intuitive user interface:</p> <ul style="list-style-type: none"> <li>- Assign line number and name to each timetable.</li> <li>- Assign status to each timetable, indicating whether they are public (current, approved) or non-public (in progress, cancelled, invalid, etc.).</li> <li>- Add notes or internal information to each timetable, such as “temporary timetable”, “school holidays timetable”, etc.</li> <li>- Add comments or information to each timetable that are visible externally via the reporting to external devices or prints, such as “This is the on-demand line Nr”.</li> <li>- Add a validity term to each timetable, such as from 1 April 2023 to 30 April 2023.</li> <li>- Add identifiers to stops that are meant only for boarding or exiting, or that are on-demand, such as “Board” or “Exit”.</li> <li>- Use and print any other stop attribute, such as stop name, location, accessibility.</li> <li>- Additional attributes for timetable: transport type, operator (PTO) and concession area, timetables should be grouped by concession areas.</li> <li>- Vehicle type attribute should be assignable to each line.</li> </ul> |
|                 | 2.6.3.2 | <p>The Contracting Authority requires the Vendor to provide a comprehensive solution for <b>planning and managing bus routes and timetables</b>, delivered through a <b>simple, intuitive, and efficient user interface</b>. The solution must, at a minimum, support the functions listed below. All functionalities must be demonstrated <b>out-of-the-box</b>, without any modification of program code.</p> <p><b>A. Timetable management &amp; attributes</b></p> <p>The system should provide a user-friendly timetable management environment that enables users to create, edit, validate, group, and publish timetables. The following functions must be supported:</p> <ol style="list-style-type: none"> <li>1. <b>Timetable identification and classification</b> <ul style="list-style-type: none"> <li>○ Assign a <b>line number/code and line name</b> to each timetable/line.</li> <li>○ Assign a <b>status</b> to each timetable indicating whether it is:               <ul style="list-style-type: none"> <li>▪ public (e.g., current, approved), or</li> <li>▪ non-public (e.g., in progress, cancelled, invalid, draft).</li> </ul> </li> <li>○ Assign <b>transport type</b> (e.g., bus, minibus, on-demand).</li> <li>○ Assign <b>vehicle type</b> to each line.</li> </ul> </li> </ol>                              |

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|  |  | <p>2. <b>Timetable validity and calendars</b></p> <ul style="list-style-type: none"> <li>○ Define a <b>validity period</b> for each timetable (start and end dates).</li> <li>○ Create and manage <b>timetable calendars</b> with: <ul style="list-style-type: none"> <li>▪ clear visualization of validity,</li> <li>▪ rule-based day types (e.g., weekdays, Saturdays, holidays),</li> <li>▪ exceptions (e.g., school holidays, special events),</li> <li>▪ ability to reuse calendars across timetables.</li> </ul> </li> </ul> <p>3. <b>Internal and external notes</b></p> <ul style="list-style-type: none"> <li>○ Add <b>internal notes</b> to timetables for planning/operations (e.g., “temporary timetable”, “school holidays timetable”).</li> <li>○ Add <b>public-facing comments</b> that are visible through reporting feeds, external devices, or printed outputs (e.g., “This is the on-demand line No. X”).</li> </ul> <p>4. <b>Stop attributes and usage rules</b></p> <ul style="list-style-type: none"> <li>○ Support stop-level operational identifiers/flags such as: <ul style="list-style-type: none"> <li>▪ <b>boarding-only, alighting-only,</b></li> <li>▪ <b>on-demand stops,</b></li> <li>▪ or equivalent attributes (e.g., “Board”, “Exit”).</li> </ul> </li> <li>○ Use and print <b>standard stop attributes</b>, including at least: <ul style="list-style-type: none"> <li>▪ stop name,</li> <li>▪ geolocation,</li> <li>▪ accessibility information,</li> <li>▪ and any other configurable stop properties.</li> </ul> </li> </ul> <p>5. <b>Operator and concession grouping</b></p> <ul style="list-style-type: none"> <li>○ Assign each timetable/line to: <ul style="list-style-type: none"> <li>▪ an <b>operator / Public Transport Operator (PTO),</b></li> <li>▪ a <b>concession area.</b></li> </ul> </li> <li>○ Timetables must be <b>grouped and filterable by concession area</b> in the UI and reporting.</li> </ul> <p><b>B. Timetable editing UI, validation &amp; guidance</b></p> <p>6. Provide an <b>intuitive timetable editor</b> that includes embedded guidance/wizards (e.g., IntelliSense-like support, recommendations, or equivalent) to ensure efficient:</p> <ul style="list-style-type: none"> <li>○ creation of trips and variants,</li> <li>○ editing of times and patterns,</li> <li>○ automatic validation and error reporting (e.g., missing stops, invalid sequences, conflicting times),</li> <li>○ user-friendly correction workflows.</li> </ul> <p><b>C. Route planning, GIS editing &amp; network management</b></p> <p>7. The system shall support <b>route mapping and network planning</b>, including:</p> <ul style="list-style-type: none"> <li>○ design of routes within a transport network,</li> <li>○ management of route variants and patterns,</li> <li>○ editing of network elements and topology.</li> </ul> <p>8. Provide <b>interactive GIS-based map editing</b>, enabling users to create and maintain directly on the map:</p> <ul style="list-style-type: none"> <li>○ stops,</li> <li>○ routes/lines,</li> <li>○ route variants,</li> </ul> |
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|  |         | <ul style="list-style-type: none"> <li>○ and other network objects, with immediate visual feedback.</li> </ul> <p><b>D. Operational visualization &amp; optimization tools</b></p> <p>9. Provide a <b>Gantt chart visualization</b> for operational planning, showing at least:</p> <ul style="list-style-type: none"> <li>○ blocks,</li> <li>○ vehicle duties / run allocations,</li> <li>○ and/or operational cycles,</li> </ul> <p>with interactive editing (drag/drop, resize, reassignment).</p> <p>10. Provide a <b>time–space (graphical timetable) diagram</b> to visualize trips over time and distance/space, supporting analysis and optimization of operational efficiency (e.g., headways, layovers, vehicle circulation).</p>   |
|  | 2.6.3.3 | <p>The vendor must provide a solution that links schedules to versions, which can be defined within or outside calendar structures. The solution must provide different statuses for each version, such as “Approved”, “Draft”, “Work in Progress”, or “Archived”, when it is in a calendar structure. The vendor must also explain how the calendar structure sets the default versions for new schedules, which can be inherited or adjusted by the schedulers. Contractual Authority requires unlimited versions that can be associated with a vehicle schedule, such as route, run times, parameters, rules, and layover default.</p>   |
|  | 2.6.3.4 | <p>Basic route definition attributes are required, including a unique internal route ID, a displayed public route ID, and other parameters such as mode, service type, color, run time calculation methods, custom description, and attributes for display on public displays.</p> <p>Routes must be maintained with stops, which are localized on map and can be adjusted using drag and drop and manually in the table. A comprehensive variant model allows for the definition of different path possibilities on the route. In the map, users only need to select a few stops, and the application will automatically detect stops on the path and provide a selection list where the user can choose which stops to include in the variant, and among those, which ones should be time points.</p> <p>After route definition, distances must be automatically calculated. Run times can then be entered in a matrix format between the timing points. All networks run times that exist in the run time version associated with the schedule must be presented and displayed as a proposal in a table. Times can be modified and saved as route-specific run times</p> |
|  | 2.6.3.5 | <p>Contractual Authority requires that the solution responds whenever consistency problems occur during the creation of routes, timetables, and their variants. All the detailed protocols or logs should be available, providing information to analyze data integrity and consistency.</p>  |
|  | 2.6.3.6 | <p>The solution must support the creation of new stops directly on the maps using a user interface and optionally inserted in the selected variants. Drag and drop functionality for existing stops is required, providing that new stops can be dragged and dropped to modify their location, or a new temporary or permanent dated location can be created. Changes to locations must trigger automatic calculation of distances for selected route variants. Validations of new configurations must be allowed. Affected schedules must be automatically recalculated and validated when they are open. In case of doubt or errors in the calendar, manual changes need to be allowed to provide correct validations to indicate that schedules need updating.</p>   |

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|  | 2.6.3.7  | Contractual Authority necessitates a robust functionality enabling end-users to seamlessly incorporate "user-defined" attributes, thereby extending the network's capabilities, routes, and route options through an intuitive user interface. Users should have the ability to declare these attributes, specifying their types (such as text, number, date, and other standard data types) and optionally set default values. The management of these user-defined attributes should be seamlessly integrated into the standard UI, ensuring their inclusion in statistics, reports, and even export/import operations.  |
|  | 2.6.3.8  | <p>Contractual Authority requires that the entry of timetables is created/modified through the user interface. Users should be empowered to make a preliminary decision on whether to employ the model of trip time profiles or the time pattern model. The system must provide comprehensive support for essential functions during timetable creation, including shifting, copying, inverting, and generating from GIS data. Moreover, a multiselect option should be available to enhance user efficiency.</p> <p>Timetables are required to be created with the utmost flexibility, allowing users to choose between manual, semi-automatic, or automatic generation utilizing advanced timetable algorithms embedded within the system. Notably, the timetables must accommodate flexible day exceptions, accounting for trips that operate irregularly or possess distinct characteristics outside the daily schedule type. Validation or generation of timetables may leverage additional data inputs such as service requirements and passenger load matrices.</p>   |
|  | 2.6.3.9  | <p>Contractual Authority mandates fundamental workflow functionality for scheduling and modifying timetables, necessitating the incorporation of distinct statuses, including "working," "waiting for approval," "approved," and "published," complemented by corresponding security profiles. These statuses play a pivotal role in information visibility control, ensuring that only authorized personnel can access specific data.</p> <p>Furthermore, the system must provide facilitation of dynamic status changes, triggering user-defined actions upon transitions between statuses. For instance, actions may include automated email notifications dispatched to individual users or designated user groups.</p>  |
|  | 2.6.3.10 | <p>In compliance with Contractual Authority requirements, the system must support basic PTA tender operations encompassing two essential steps:</p> <ol style="list-style-type: none"> <li>1. Preparation of Tender: In a comprehensive multistep procedure, planners are empowered to define new routes, route options, and variants. The flexibility extends to incorporating duty parameters and adhering to legal constraints. Statistical modules are integral, facilitating the estimation of costs for each variant. Geographic information is seamlessly integrated to visually present relevant data on maps, providing an intuitive understanding of the proposed plans. Service guidelines play a pivotal role in this step, allowing the definition of service levels. These guidelines encompass service spans, headways, (optional target vehicle occupancies, and passenger capacity weights). Such elements can be defined globally or at a more granular level, including specific routes, directions, time intervals, or other parameters. The versatility of service guidelines extends to their use in generating associated services and validating schedules.</li> <li>2. Importing and verifying PTO Offers: The system ensures the smooth importation of PTO (Public Transport Operator) offers and schedules from external sources. Basic validation mechanisms are in place to assess how these offers align with predefined service standards. The implementation includes user-friendly import/export facilities or standardized interfaces such as GTFS and NeTEx, facilitating efficient exchanges of schedules with PTOs. This feature</li> </ol> |

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|  |          | expedites discussions and enhances collaboration, ensuring a swift turnaround when required during tender operations.  |
|  | 2.6.3.11 | <p>Primary functions required for planning the operation of bus and rail services shall include the following key features:</p> <ol style="list-style-type: none"> <li>1. Intuitive Timetable Editor:<br/>The system mandates an easily navigable UI timetable editor, enhanced by intuitive wizards such as IntelliSense or recommendation wizards. This ensures a user-friendly experience for efficient timetable creation.</li> <li>2. Route Mapping and Calendar Creation:<br/>Efficiently map routes to the transport network and create timetables within calendars, providing planners with a comprehensive overview of the operational schedule.</li> <li>3. Gantt Chart Visualization:<br/>A Gantt chart diagram is essential for visually presenting vehicle blocks and duties, offering a clear and organized representation of the operational timeline</li> <li>4. Route Time Diagram / Graphical Schedule:<br/>The inclusion of a route time diagram or graphical schedule enhances the visual representation of blocks, aiding planners in optimizing operational efficiency.</li> <li>5. Interactive Map Manipulation:<br/>Employ an interactive map for the creation and manipulation of stops, routes, and network data, fostering a dynamic and user-friendly environment for route planning.</li> <li>6. Robust Security Management:<br/>Implement robust security measures to allow different operators to collaborate within the same system seamlessly, eliminating the need for external interfaces and ensuring data integrity.</li> <li>7. Conflict detection in timetable planning: the system shall enable the detection of conflicts, including those related to rail transport (e.g. platform occupancy, time overlaps, turnaround times), and provide users with appropriate alerts and</li> </ol> |

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|  |          | <p>support for resolving them.</p> <p>The user workflow involves creating new route options on a map or through a guided wizard. Subsequently, routes are mapped to the transport network, calendars are defined, and timetables are created in conjunction with vehicle and/or duty schedules.</p> <p>The system's capabilities extend beyond basic planning functions to include the ability to evaluate scenarios. Additionally, it empowers users to perform customer impact analyses, cost calculations, multimodal synchronization, and census and population analyses. Any predefined optimization can be effortlessly applied to any bus route, providing flexibility in planning.</p> <p>To facilitate analysis and decision-making, the system presents insights through a map-based interface, coupled with statistical data for a comprehensive understanding of operational performance. This multifaceted approach ensures that the planning tool not only meets but exceeds the requirements outlined in the RFP, offering a robust and versatile solution for effective bus route management.</p>  |
|  | 2.6.3.12 | <p>Beyond the standard planning tools, the application is required to provide specialized support for Train planning with a focus on the following key features:</p> <ol style="list-style-type: none"> <li>1. Precise Track Infrastructure Definition:<br/>The application must enable users to accurately define track infrastructure, allowing for the meticulous modeling of rail constraints. This includes considerations for crossings, sidings, detailed yard structures, time buffers, platform capacities, spur capacities, and other pertinent factors.</li> <li>2. Conflict Resolution and Movement Validation:<br/>A critical functionality involves the ability to validate movements and resolve conflicts within the train schedule. The application should offer an intuitive interface to visualize train movements on a track map, aiding planners in identifying and addressing potential conflicts.</li> <li>3. Management of Various Trainset Sizes:<br/>The application is expected to support the management of diverse trainset sizes, encompassing an extensive feature set for coupling and uncoupling units. This flexibility is crucial for accommodating the varied requirements of different train configurations.</li> </ol> |

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|  | 2.6.3.13 | <p>In the context of connection planning, a crucial aspect that the application must encompass is the ability to establish connections either manually, leveraging system parameters, or through the utilization of built-in trip meet constraints.</p> <p>Key requirements for this functionality include:</p> <p>Definition of Transfer Times:<br/>The solution should empower users to define ideal or minimum transfer times between routes at specific locations - stops. This feature ensures a meticulous approach to connection planning, considering the time constraints for smooth transitions between different modes of transportation.</p> <p>Calculation of Transfer Times:<br/>The system is mandated to efficiently calculate transfer times between bus routes and train trips at designated locations. This involves a dynamic and automated process that considers various factors influencing transfer durations, enhancing the accuracy of connection planning.</p> <p>Transfer Priority Mechanism:<br/>A vital component of the solution is the incorporation of a mechanism to establish transfer priorities. This feature enables the differentiation between critical connections and less important ones. By providing a means to prioritize transfers, the system ensures that essential connections receive due attention in the planning process.</p>  |
|  | 2.6.3.14 | <p>Trip Wait Time functionality required as:</p> <p>Trip Wait Time and Flexibility: The application must be equipped with the capability to define trip wait times at designated time points. This feature proves invaluable in ensuring adequate load times at high traffic stops or establishing synchronization windows for seamless connections. Additionally, users can specify start time flexibility for each trip, offering a dynamic approach to trip planning.</p> <p>Trip and Wait Time Clusters: To enhance efficiency, the application introduces the concept of trip and wait time clusters (groups). These clusters are generally applicable to entire operating branches within defined time windows throughout the operating day. Users have the flexibility to associate trip and wait times, fostering a more cohesive and systematic approach to scheduling.</p> <p>User-Activated Overwrite Mode: For greater control, an overwrite mode is available, allowing users to activate it. Once activated, users assume responsibility for ensuring data consistency. This mode empowers users to tailor trip and wait times according to specific requirements, enabling a customized approach to scheduling within the designated time windows.</p> <p>Dynamic Block Building Algorithm: The system must have feature for a robust block building algorithm capable of shifting trips within permissible windows, optimizing the blocking solution. Trip shifting must be seamlessly integrated into the blocking scheme, allowing for multiple solutions with trip shifts. Users must have the flexibility to explore different blocking scenarios, refining the solution to meet specific operational goals.</p> <p>Final Approval and Publication: Once the optimal blocking solution is achieved and approved, the trip shifts can be applied to the trips for final publication. This streamlined process ensures that the approved solution, incorporating trip shifts, is seamlessly implemented in the final scheduling.</p> |

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|  | 2.6.3.15 | <p>The following block planning and duty cycle functionality are required:</p> <p><b>Block Planning and Vehicle Characteristics:</b> The system must support block planning by incorporating trip and block rules, enabling seamless interlining, and multi-depot considerations. It should be attuned to the unique characteristics of vehicles, including electric buses, to ensure a comprehensive and adaptive approach to scheduling.</p> <p><b>Vehicle and Duty Rostering Functionality:</b> Robust functionality for vehicle and duty rostering is imperative. The data associated with these rosters should be easily accessible and editable simultaneously through versatile perspectives such as tabular forms, Gantt charts, and trip/time diagrams.</p> <p><b>Integration with GIS Data:</b> The system should be intricately connected to GIS data, leveraging this integration to automatically propose potential dead-runs and connecting trips. This feature streamlines the addition of new data, ensuring quick and easy updates while maintaining consistency across interfaces.</p> <p><b>Consistency Checks and Key Performance Indicators:</b> Consistency checks and dynamic key performance indicators (KPIs) for created duties should be updated in real-time. This ensures a high level of working speed, particularly during manual duty creation. By providing instantaneous feedback, the system guarantees the integrity and quality of the duties generated.</p> <p>– <b>Compliance with labour legislation:</b> the system must perform continuous monitoring of driver work to ensure compliance with legal limits (driver rest periods, working time duration, driving time limits).</p> |
|  | 2.6.3.16 | <p>For work orders and duties, the system must empower the PTO to create work orders using the schedules stored in the TTM system. Work orders and operational schedules shall be exchanged using a standardized, documented, and vendor-independent data format. Where applicable, the format shall be aligned with NeTEx or another agreed European standard. API-based communication may be used for real-time transmission, but the underlying data model shall remain standardized and fully documented. The solution shall not require proprietary PTO-side modules for receiving or processing work orders. The following procedure should be facilitated:</p> <ul style="list-style-type: none"> <li>- The PTO needs to access active timetables within the TTM system, either through API integration or export/import functionality.</li> <li>- Work orders should be generated by the PTO based on the timetable data extracted from the TTM system.</li> <li>- The PTO should import or transmit work orders to the TTM system, utilizing either import/export functions or API communication.</li> <li>- The PTA is responsible for verifying and approving the generated work orders.</li> <li>- Once approved, the work orders must be transmitted to both the ticketing system (ABT) and AVL (driver's console).</li> </ul> <p>The solution should empower the PTO to efficiently dispatch large quantities of work orders without substantial manual effort. Simultaneously, the PTA's involvement in this process should be minimized, facilitated by the system's capability for automatic verification.</p>  |
|  | 2.6.3.17 | <p>Simulation and/or scenarios functionality requested such as:</p> <p>Essential rules and parameters can easily be adjusted or deactivated to produce new version or variation of solution. All existing validation and compare tools should be able to be used to evaluate the different variant.</p>  |



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|  | 2.6.3.18 | <p>Contractual Authority necessitates the inclusion of supplementary user-defined attributes, encompassing images, descriptions, notes, and measurements, for all timetables and trips to be either imported or added via the solution's user interface. An illustrative attribute is the bus type (e.g., suitable for disabled individuals, small bus, double-decker bus, 52 seats, etc.).</p> <p>It is imperative that all additionally customized attributes are accessible for the reporting functionality, ensuring comprehensive and tailored insights. Moreover, this additional custom information must be seamlessly available for the export functionality, facilitating data retrieval and external utilization.</p> |
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## 2.6.4 Operation & Reporting

The software must offer a complete and adaptable solution for creating and customizing timetables in different formats, such as:

- Timetable booklets, with the full timetable for a single route.
- Timetable posters, with the full timetable for a route at a bus stop shelter or bus station.
- Portrait-format bus stop timetables, with a diagram of the route and timings at an individual stop.
- Static HTML timetables, which can be integrated into a website and easily themed.

The users must have the option to customize the timetables by using templates that enable them to add logos and graphics, and adjust the typography, colours and layout of the timetables. The software must also support multi-language output for stop names and other key fields.

The software must allow users to prepare and download posters based on templates, in PDF, CSV or XLSX formats. The users must have the flexibility to change the font type and size and layout of the posters and add user fonts for printing posters. The software must include at least 10 poster templates specially designed for the Contracting Authority according to their preferences. The users must also could add new templates and modify and delete them afterwards.

| Module     | Nr.      | Requirement   |
|------------|----------|---|
| Operations | 2.6.4.1. | <p>The application must provide standard interface for AVL, encompassing real-time interfaces to facilitate seamless daily operations. Additionally, interfacing tools within the system should empower users to create specific interfaces or adjust existing ones to accommodate evolving needs.</p> <p>During operational phases, AVL is tasked with collecting passing times and passenger loads. It is imperative that this collected information is seamlessly imported into the TTM module. This integration serves to support post-operations analysis within the reporting and analysis module, ensuring comprehensive insights and data-driven decision-making capabilities</p> |

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|           | 2.6.4.2. | <p>The system necessitates the capability to plan schedule deviations systematically through a feature referred to as 'events.' The event functionality is expected to facilitate the creation of event types by specifying impacted network elements, routes, and schedules. It should enable the seamless generation of new deviations within the scheduling framework.</p> <p>Moreover, this functionality should encompass the ability to copy existing timetables and vehicle schedules, enabling the creation of new, time-limited routes. During this duplication process, all attributes and parameters must be replicated to generate route versions that encapsulate potential alternative route options. These alternative routes should remain accessible and editable by users across all components of the system, ensuring flexibility and adaptability to changing operational requirements</p>   |
| Reporting | 2.6.4.3. | <p>The application is required to deliver standard reporting capability, empowering users with the following functionalities:</p> <p>Utilization of built-in reports and lists, with the added flexibility to incorporate additional user-defined attributes for enhanced customization.</p> <p>Integration of an internal or external report designer, providing access to all internal lists and reports, including summary lists. The report designer should offer a comprehensive set of reporting elements such as lists, pivot tables, basic graphs, headers, bodies, footers, and more.</p> <p>Seamless exporting of all internal lists to commonly used formats, including Excel, CSV, and XML, leveraging predefined templates to ensure consistency. Additionally, the system should support the export of data from all lists in CSV or XML formats.</p> <p>The analytics data, encompassing pivot tables, summary lists, etc., should be exportable for analysis by external Business Intelligence (BI) applications. This feature enables users to integrate the application's data seamlessly into their preferred BI tools, enhancing the overall analytical capabilities of the system.</p> |

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|  | 2.6.4.4. | <p>The selected system must deliver a robust reporting mechanism that encompasses a range of standard reports. All standard reports must incorporate a comprehensive filtering system utilizing relevant TTM (Transportation and Traffic Management) attributes, ensuring the ability to select precise outputs based on specific criteria.</p> <p>The filtering system within each standard report should be intuitive and allow users to customize output based on relevant TTM attributes. This flexibility is crucial for tailoring reports to specific analytical needs.</p> <p>The system should incorporate effective data visualization tools to present complex information in a clear and easily interpretable format. Graphs, charts, and dashboards should be utilized to enhance the user experience.</p> <p>Standard Reports and Filtering Capabilities includes:</p> <ul style="list-style-type: none"> <li>a. Transport Kilometers Report - Calculation of kilometers for seats, standing room, and disabled seats, segmented per line and transport vehicle type.</li> <li>b. Line Capacity and Vehicle Types Report - Productive operating time and kilometers, total operating time, and total kilometers, calculated per line and transport vehicle type.</li> <li>c. Costs Per Vehicle Type and Concession Area Report: - Comprehensive breakdown of costs per transport container type and concession area.</li> <li>d. Productive Performance Mass and Timetable Efficiency Report: - Calculation of productive performance and efficiency per line group, operating branch, and concession area.</li> <li>e. Power Mass per Line and Cost Unit Report: - Productive operating time, productive kilometer performance, total operating time, and total kilometer performance calculated per line and cost unit.</li> <li>f. Statistics for Transport Container Types Report: - Seat kilometers, standing room kilometers, and disabled person kilometers calculated for each transport container type.</li> <li>g. Peak Vehicle Utilization Report: - Identification of peak vehicle utilization for selected transport types and areas.</li> </ul> |
| Statistics and analytics functionalities | 2.6.4.5. | <p>The application is expected to offer tools for advanced analysis of all existing data. This includes the following functionalities:</p> <ul style="list-style-type: none"> <li>• Advanced filtering and search functions, ad-hoc statistics, configurable Key Performance Indicators (KPIs), validations, and coloring options to provide users with a versatile analytical toolkit.</li> <li>• Empowerment of users to directly export data, facilitating the creation of more advanced reports in external tools. This feature ensures flexibility and accommodates diverse reporting needs.</li> <li>• Accessibility of all planning and scheduling data, scheduling and measurement tables, ensuring that the analytics module can seamlessly interact with and derive insights from critical operational information.</li> </ul>   |

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| Forecasting             | 2.6.4.6. | Forecasting support is an essential component with the following specifications:<br>The solution is expected to facilitate the definition of new service definitions and passenger load versions. In addition to this, when conducting scenarios based on passenger load, the system should empower users to selectively establish growth parameters, both positive and negative. This functionality allows for the automatic generation of forecasted load data at specific points in the future. Notably, these load forecasts can be intricately derived from traveler origin-destination information, ensuring a comprehensive and accurate projection of future demand.   |
|                         | 2.6.4.7. | <p><b>Publication Management and Timetable Versioning</b></p> <p>The selected system must encompass standard functionality for creating and managing publications of timetables. The publication products should be centrally managed through a simple and intuitive user interface. The system should support the creation of various publication formats, including timetables, timetable books, and large printed works with multiple sub-volumes. Additionally, support for web publishing and specialized formats for different display types is essential. Timetables can also be created in a graphical representation (stylized timetable in the form of a line) with departures that can be equipped with any comments. A more detailed explanation of these functionalities is provided in module Special Requirements No. 2.6.5.9.</p> <p>The timetables support versioning with validity, ensuring that the published information accurately reflects the status of timetable data. The system should seamlessly account for restricted validity periods, such as those related to construction sites, throughout the platform and in the generated documents. Key features include:</p> <ul style="list-style-type: none"> <li>a. Versioned Timetables: - Ability to create and manage different versions of timetables with specified validity periods.</li> <li>b. Automated Validity Determination:- User-defined validity periods for each issue, with the application automatically determining corresponding trips.</li> <li>c. Validity Display: - Inclusion of the defined validity period on the printed output for passenger awareness.</li> </ul> <p>The system must support web publishing, and it should provide specialized formats for diverse display types. This ensures optimal presentation across various platforms and devices and compatibility with web-based publication formats for online accessibility.</p> <p>Provision of specialized formats is required for use for different station or vehicle display types, enhancing user experience.</p> <p><b>Print Attributes and Customization</b></p> <p>The system must offer extensive support for print attributes, allowing for customization during the creation of output. This includes pagination, stamps, handlebars, and the integration of custom data, such as advertising. Key features include:</p> <ul style="list-style-type: none"> <li>a. Automated Print Integration - Seamless integration of print attributes, including pagination, stamps, and handlebars during output creation.</li> <li>b. Custom Data Integration - Capability to incorporate custom data, such as advertising, in the generated publications.</li> </ul> <p>The system should allow the assignment of specific purposes to trips and stops for individual layout products. Consideration for interconnections, such as passengers remaining seated during cross-route rotations, must be reflected in the posted timetable and timetable book.</p> |
| Timetable search engine | 2.6.4.8. | Comprehensive timetable search engine is required, that facilitates searches based on diverse parameters such as timetable number, operating mode, station, type of vehicle for a specific journey, or any other parameters present in the timetable.  |

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|  |           | Furthermore, it should support the exploration of connections between any two stops, yielding a comprehensive list of all potential connections between the specified stops.  |
|  | 2.6.4.9.  | <p>The requested functionality for planning and optimizing connections is comprehensive, relying on connection definitions that specify the relationship between incoming lines with direction and outgoing lines with direction at a given stop.</p> <p>Flexibility is essential, allowing for different stops for departing lines and considering travel times between stops. Each connection definition can encompass multiple validities, defining parameters such as minimum and maximum transfer times or substituting them with calculated travel times for a specified period.</p> <p>The connection definition must be utilized as a condition to identify all relevant trip pairs adhering to the specified connection validities. Custom evaluation functions are crucial and can be defined in each cycle timetable work area. Depending on the connection type and maximum transfer time, distinct evaluation functions can be applied.</p> <p>The connection situation should be visually represented through a timetable offering various views:</p> <ul style="list-style-type: none"> <li>- Network map: A schematic representation of connections, color-coded to denote quality.</li> <li>- Cycle journeys: A list of journeys organized into cycles, providing details on cycle time, required vehicles, and the number of breaks.</li> <li>- Breaks: A list of all trips without trip pairs.</li> <li>- Trip pairs: A detailed presentation of individual trip pairs.</li> </ul> |
|  | 2.6.4.10. | <p>The system must enable the partial or full automation of connections between different lines by predefining a condition that links two lines through transfers. Consequently, the system automatically prevents (or alerts) the creation of a schedule that does not allow for the specified connection or transfer. There are two types of connections here: single modal, where we create connections between lines using a tool that facilitates easier linkages; and multimodal, where, for example, a passenger traveling by bus needs to transfer and wait for the train.</p>  |

The software must enable the users to produce automatic posters with timetables for stops affected by a changed line, after approving the changes. The posters must display the following information:

- The working day, Saturday and Sunday timetables.
- The date of effect of the timetable.
- The departure times of low-floor vehicles.
- The other stops on the line for this direction.
- The travel direction of the line.
- The name and ID of the stop.

The software must provide a powerful and adaptable solution for reporting or analysis, based on the network and timetable data. The users must be able to generate reports or perform analysis using various criteria, such as line, route, stop, vehicle, frequency, headway, etc. The software must also support different formats and layouts for the reports or analysis, such as tables, charts, and graphs.

The vendor must provide a detailed description of the optimization functionalities that the software offers, using either optimization methods or AI functionality. Contracting Authority requires that the software has built-in optimization or AI procedures that can be customized according to the current needs.

The vendor must provide a clear and detailed description of how the software supports user interface localization and multilingual support. The vendor must demonstrate how the software enables users to create and manage user interfaces in multiple languages, using either built-in or external tools. The vendor must also show how the software ensures the quality and consistency of the localized user interfaces across different platforms and devices.

## 2.6.5 Specific Requirements

The vendor must provide a clear and detailed description of how the software supports Timetables Management for people with disabilities. The vendor must demonstrate how the software ensures the accessibility, usability, and readability of the timetables for people with different types of disabilities, such as visual, auditory, cognitive, or physical impairments.

The vendor must also provide a clear and detailed description of how the software supports the use of electric vehicles (EVs) in the network.

| Module                | #        | Requirement  |
|-----------------------|----------|--|
| Specific requirements | 2.6.5.1. | <p>The following attributes should be provided when designing public transport timetables for individuals with disabilities:</p> <p>Special Vehicle Attributes:</p> <ul style="list-style-type: none"> <li>- The specific standards offered for vehicles catering to people with disabilities should be defined.</li> </ul> <p>Special Stop Attributes:</p> <ul style="list-style-type: none"> <li>- Additional attributes to describe the standards offered at each stop, accommodating the requirements of individuals with disabilities, should be defined.</li> </ul> <p>Additional Attributes and Functionality:</p> <ul style="list-style-type: none"> <li>- Features that allow for adjusted displays, ensuring accessibility and easy communication for individuals with visual or cognitive impairments, should be integrated into the timetables.</li> </ul> |
|                       | 2.6.5.2. | <p>Support for Electric Vehicles (EVs). The selected vendor will be responsible for incorporating essential functionalities :</p> <p>Key Attributes and Functionalities:</p> <ul style="list-style-type: none"> <li>- Additional information of Charging Infrastructure: location, type and other attributes needed to describe the charging infrastructure.</li> <li>- EV Battery Charge Time</li> </ul>  |

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|  |          | <ul style="list-style-type: none"> <li>- Is Smart Charging supported and how</li> <li>- Battery Swapping functionality :attributes and swapping time.</li> </ul> <p>Range of EV in various conditions: weather, route alignment, departure occupancy, relation of capacity and discharge time</p>  |
|  | 2.6.5.3. | The proposed system should possess the capability to leverage fundamental system data for the purpose of generating diverse scenarios. These scenarios must be amenable to statistical comparison through the utilization of the system's integrated reporting and analytical tools.   |
|  | 2.6.5.4. | <p>The following requirements regarding user interface is requested:</p> <p>Multilingual Support:</p> <ul style="list-style-type: none"> <li>• Proposals should detail how the software will support multiple languages for basic User Interface (UI) elements.</li> <li>• The software must be equipped to seamlessly display UI elements in various languages and allow users to input data in their preferred language.</li> </ul> <p>Language Selection:</p> <ul style="list-style-type: none"> <li>• The software should provide a user-friendly language selection feature.</li> <li>• Users should have the ability to choose their preferred language from a list of available options, and the software should facilitate effortless switching between languages during operation.</li> </ul>   |
|  | 2.6.5.5. | The software must have the capability to support multiple languages for basic data objects, particularly in text fields such as stops, routes, line names, and descriptions. For each defined language, the software should enable the entry of distinct content for the same object. This encompasses the functionality to display text fields of data objects in various languages and the capability to input data objects using different languages.   |
|  | 2.6.5.6  | <p>Graphical Display and Publication of Timetables</p> <p>The Contractor shall provide a system for the graphical display of timetables in both schematic and tabular formats, enabling web access as well as the preparation of exports for physical printing and publication at stops and stations. The solution must not be limited to pre-prepared and supplier-locked templates, but shall allow full configurability by the Contracting Authority.</p> <p>The system shall include the following functionalities:</p> <ul style="list-style-type: none"> <li>– enabling the Contracting Authority (PTA) to independently create, edit, and manage custom timetable templates without the need for intervention by the Contractor or developer,</li> <li>– enabling the definition of graphical template elements (layout of stops, display of departures, marking of transfers, highlighting of selected stops, logos, colour schemes, language versions, etc.),</li> <li>– enabling the storage of multiple template versions and their use for different types of lines, areas, or operating regimes,</li> </ul> |

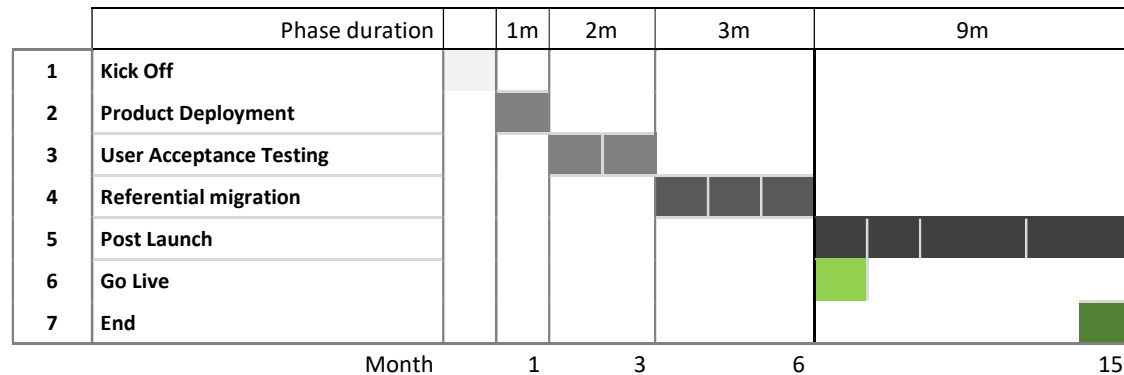
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|   |         | <ul style="list-style-type: none"> <li>– enabling bulk export of timetables based on a selected template according to the needs of the Contracting Authority (individual line, area, entire network, etc.).</li> </ul> <p>Export for print:</p> <ul style="list-style-type: none"> <li>– the possibility to generate a standardized timetable printout suitable for printing and publication at stops or stations,</li> <li>– support for various formats (e.g. A4, A3, or other formats specified by the Contracting Authority),</li> <li>– clear graphical highlighting of the stop or location where the timetable will be posted,</li> <li>– automatic adjustment of layout according to content (number of stops, number of departures, seasonal variations, etc.),</li> <li>– the possibility to include logos, concession area markings, and other elements of the Contracting Authority's corporate visual identity,</li> <li>– the possibility to provide space for additional graphical elements of the Contracting Authority.</li> </ul> <p>Management and automation:</p> <ul style="list-style-type: none"> <li>– the possibility of bulk generation of printouts for the entire network or selected area,</li> <li>– integration with data from the production environment without the need for manual retyping or additional processing,</li> <li>– version traceability and validity date tracking for each published timetable.</li> </ul> |
| On-Demand Transport – Functionalities for the PTA | 2.6.5.7 | <p>The system must enable:</p> <p>Service planning and configuration:</p> <ul style="list-style-type: none"> <li>– definition of service areas for on-demand transport (geographical zones, virtual stops, “door-to-door” areas),</li> <li>– definition of operating hours, service rules, and operational parameters (e.g., maximum detour, maximum waiting time, vehicle capacity),</li> <li>– the possibility of combining fixed-route services and on-demand transport within a hybrid model.</li> </ul> <p>Vehicle and trip management:</p> <ul style="list-style-type: none"> <li>– assignment of vehicles to individual requests or trips,</li> <li>– optimization of vehicle scheduling and dispatching (automatic or semi-automatic),</li> <li>– consideration of vehicle capacity, special equipment (e.g., vehicles accessible for wheelchair users), and other vehicle attributes,</li> <li>– management of pooled trips (combining requests from multiple passengers into a single trip).</li> </ul> <p>Service monitoring:</p> <ul style="list-style-type: none"> <li>– real-time vehicle tracking (AVL integration),</li> <li>– display of active trips and statuses (en route, passenger pickup, completed trip, etc.),</li> </ul>  |



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|  |         | <ul style="list-style-type: none"> <li>– alerts in case of deviations (delays, parameter violations, SLA non-compliance),</li> <li>– historical overview of completed trips.</li> </ul> <p>Reservation management:</p> <ul style="list-style-type: none"> <li>– overview and management of reservations (acceptance, modification, cancellation),</li> <li>– support for multiple booking channels (mobile application, web interface, call center),</li> <li>– recording of passengers' special needs.</li> </ul> <p>Analytics and reporting:</p> <ul style="list-style-type: none"> <li>– reporting on occupancy rates, average waiting time, and trip duration,</li> <li>– efficiency analysis (e.g., cost per passenger, ride pooling rate),</li> <li>– statistical comparison with fixed-route services.</li> </ul>  |
| On-Demand Transport – Functionalities for the passengers | 2.6.5.8 | <p>The system must enable:</p> <p>Trip planning:</p> <ul style="list-style-type: none"> <li>– integration of on-demand transport services into the multimodal journey planner (together with bus and rail services),</li> <li>– display of service availability based on location and time,</li> <li>– calculation of the estimated time of arrival (ETA) and waiting time.</li> </ul> <p>Submitting a ride request:</p> <ul style="list-style-type: none"> <li>– the possibility to submit a ride request via a web interface and/or mobile application,</li> <li>– selection of pick-up and drop-off locations (stop, virtual point, or address),</li> <li>– the possibility to indicate special requirements (e.g., wheelchair, stroller),</li> <li>– booking confirmation including the estimated pick-up time.</li> </ul> <p>Notifications:</p> <ul style="list-style-type: none"> <li>– notifications regarding confirmation, changes, or cancellation of the trip,</li> <li>– real-time vehicle tracking (live vehicle arrival monitoring),</li> <li>– notifications of delays.</li> </ul> <p>Accessibility and multilingual support:</p> <ul style="list-style-type: none"> <li>– compliance with accessibility requirements (2.6.5.1 and 2.6.5.2),</li> <li>– multilingual support in accordance with requirements 2.6.5.6 and 2.6.5.7.</li> </ul> |

### 3 Project phases & timeline

The estimated plan for the project is outlined below.



Picture 3: Project Phases and Planning (draw)

#### 3.1 Design

During this phase, the vendor will be responsible for the following tasks, including but not limited to:

- Collecting system requirements from the Contracting Authority, including network architecture and communication infrastructure, if required (depending on the selected hosting option).
- Preparing a comprehensive plan for Production Transition, Migration, and Integration, which must:
  - Demonstrate the feasibility and scalability of the proposed solution for production deployment.
  - Include approaches, timelines, prerequisites, and conditions for transitioning the production referential, performing migration activities, and integrating with other system components.
- Submitting a detailed migration plan as part of the RFP response, which should include, but is not limited to:
  - Data Migration Checklist
  - Data Migration Strategy
  - Functional and Non-Functional Testing Strategy for Data Migration
  - Functional and Non-Functional Testing Report for Data Migration
- Defining Operational and Maintenance Support, which should be documented and include:
  - Post-deployment operations and maintenance services to be provided by the vendor
  - Operational guidelines
  - Training materials
  - Support terms and service levels
- Organizing or participating in design workshops (as needed) with the Contracting Authority.

All deliveries will be subject to review, evaluation, and approval by the Contracting Authority.

## 3.2 Production Deployment

During this phase, the vendor shall install and configure in the production environment all software and hardware components under his scope in a carefully planned manner. The vendor shall provide a detailed deployment plan as part of the Design phase deliverables that should be reviewed and approved by Contracting Authority. The deployment plan must include contingency plans for any known deployment risks, as well as a rollback plan.

The deployment plan must be coordinated with all the involved PTOs. All required application components shall be set up and operational prior to the launch of the solution to the public.

## 3.3 User Acceptance Testing

This testing shall occur after Factory Acceptance Testing and can start as soon as a complete system has been delivered. The expected deliverables from the Vendor are as follows, but are not limited to:

- Hardware (if any) and Software representative of production.
- Installation, Commissioning and Operational Manuals of the testing system, the test environment shall be installed on dedicated platforms, separated from the production instance, and configured in a production-like setup (at least one test environments will be required). The Test labs can be installed at the hosting provider of the TTM system.
- Operational Training for Contracting Authority staff and third parties appointed by Contracting Authority to conduct the testing.
- Release Notes, Documentation and Licensing Information of the Software.
- Reference data needed to run all required test activities (integration, performance, stress, security, UAT)
- Any other deliverable necessary to test the Solution.

In addition, the vendors shall provide support for:

- Test Support: The vendor must provide full-time test support during the Contracting Authority test phase. The test support must be provided by live persons on-site or remote.
- Root cause analysis of the issues detected during testing.
- Bug-fix software releases to fix any issue detected during testing.

Contracting Authority expects the solution to be ready for production deployment at the end of the PTA Test Lab testing phase. The vendor is responsible for providing, working with, and recommending to PTA the adequate testing program to verify that the new system can effectively operate with PTOs' software.

## 3.4 Referential Migration

During this phase, the vendor shall proceed with relevant database migration and integration with 3rd party's referential as per the Production migration plan agreed upon in the Design phase.

The vendor shall document the migration process and demonstrate the success of migration using dedicated test procedures. Detailed reports of operations execution, including test results, shall be provided to Contracting Authority for review and validation.

## 3.5 Post Launch

After the production launch, Contracting Authority expects the vendors to provide the following services:

- System Operation, Support and Maintenance: during and after the Public Launch, the Vendor shall support Contracting Authority, monitor the production environment, provide operational support, answer queries related to the solution, update configurations, and provide fixes for issues when necessary. The Post Public Launch support shall be executed based on the terms of the warranty period and of service agreement levels. On-site support, in combination with remote support, shall be available to guarantee the expected service level.
- Additional development: subject to agreement with Contracting Authority, the vendors shall provide support for the implementation of new functionalities/use cases/services.
- Any other support based on the requirements listed in this RFP.

After a period of 270 days of production performance observation and all deficiencies being rectified and accepted, Contracting Authority will grant Final System Acceptance for the system.

## 4 Common Requirements of Solution

### 4.1 General Requirements

The following requirements are demanded for the solution offered by winning vendor additional to Section 2 requirements.

#### 4.1.1 Integration capability & requirements

The system should be scalable to satisfy all integration needs expected of the various systems and functionalities in scope. The detailed assessment and requirements gathering of the integration needs must be carried out by the winning vendors. Generally, all integrations should go through secured web services using Contracting Authority Enterprise Service Bus (technology will be announced later) and SOA-based web services. Deviations (e.g. with other API solutions), are to be discussed on a case-by-case basis. The winning vendors should do an assessment of the Contracting Authority existing infrastructure to ensure that the proposed solution will fit into the Contracting Authority existing environment. Any changes to the existing Contracting Authority technology architecture as part of this project shall be justified and approved.

Integrations within the scope are described in the Functional Specification part of this RFP.

#### 4.1.2 Required Services

##### Documentation

The vendors shall provide high-quality documentation in compliance with the Documentation requirements provided in section Functional Requirements and all other relevant subsections of the present RFPs. The documents will include, but not be limited to, the specification of installation requirements and operating and maintenance manuals, which should meet the standards of each specific PTO. The documentation may be provided in either English or Slovenian.

##### Training

The vendors shall provide training in compliance with the Training requirements provided in the Functional Requirements section and all other relevant subsections of the present RFP.

## Warranty & Service Agreement

The vendors shall comply with the Warranty and Service Agreement requirements provided in section Functional Requirements and all other relevant subsections of the present RFP.

## Operation

The vendors shall comply with the system operation requirements provided in the Functional Requirements section and all other relevant subsections of the present RFP.

### 4.1.3 Maintainability

The provided solution should be easily maintainable. Therefore, the status and faults should be easily analysed, and necessary changes (like extensions) should be conducted based on a documented process. A maintenance procedure and strategy (e.g. using a staging process) should be proposed by the solution provider.

### 4.1.4 Data & Systems Integrity

Data and systems integrity is defined as the time when the system and the data possessed and shared with the systems are in a consistent, desired, and valid state. It is required that data and systems integrity is provided under all circumstances, be it hardware or software failures or attacks by technical means like transactions, constraints, exception handling or backups.

### 4.1.5 Data Correctness

Data Correctness is defined by the ability of the system to avoid violations of data and system integrity caused by defects. The winning vendors must deliver a very high degree of correctness by conducting certain activities and measures, such as applying state-of-the-art and impactful development methodologies and tools and/or establishing profound quality assurance processes like testing.

The provided system shall ensure transactions are 100% complete and no transactions are lost. To achieve this, it may be necessary to manually extract transaction data from out-of-service devices. The provided system should be able to import such manually extracted transaction data.

### 4.1.6 System & data confidentiality

System and data confidentiality are defined by the system's ability to protect against every unintended or unauthorized access under all forms of attacks. It is required to deliver the tendered service in a manner that ensures the highest fulfilment of requirements on data and systems confidentiality. This especially includes the design of all systems and their implementation accordingly. Therefore, state-of-the-art means and measures are required to provide for systems and data confidentiality.

#### 4.1.7 Extendibility for New Stakeholders

The system should be easily expandable in a way that allows adding new stakeholders (new third-party user groups) and exporting channels for those stakeholders such as:

- Cities PTOs and local or regional Public Transport Authorities (PTAs),,
- third party mobility providers,
- government agencies,
- corporations.
- New stakeholders, including additional PTAs, must be configurable as separate organizational domains with their own users, access rights, data sets and reporting scope. DUJPP will define what part of functionality PTA will get.

#### 4.1.8 Languages & Localization

All user interface applications (web portals, mobile applications...) shall have multilingual support. The solution shall be designed and developed to support multiple languages through internationalization, allowing natural languages to be added to the software through localization without the need for engineering changes to the software of the Portal or application, and to allow for the use of Unicode.

#### 4.1.9 User management & Access rights

The solution must have an interface to conduct user management activities for account provisioning as well as granting and revoking access rights for various system areas, reports, modules, etc. This should be in line with the Access Control Guidelines as mentioned in the RFP; the solution should consider integrating with PTA's (and later DUJPP's) Identity & Access Management System (IAM) for Identity and Access Management enabling SSO. If the solution requires interaction with external users, user registration and access must happen through PTA's Portal.

The system should support the use of groups and roles to facilitate account access administration. User groups and responsibility templates (default list) must be defined, and the system administrator should be able to amend or modify the same.

##### Administrator reports

Aside from the business reports that are requested as part of the functional requirements, the system should allow the administrator to generate reports on:

- Users, roles, and groups permissions,
- accounts status,
- system usability & last login.

The system should allow users to export selected information (e.g. results of reports) in standard formats. This includes MS Excel, CSV, MS Word, PDF and other standard formats.

#### 4.1.10 User Interface & Experience

The system must be easy to use and user-friendly. Moreover, the user should be able to find information with minimal navigation clicks. The vendor should develop a Unified Human-Machine Interface (HMI) and implement it across all operators.

#### 4.1.11 Training & Knowledge Transfer

##### User Manuals

Training must be provided to all key users and should be supplied with a User Manual in both main languages, Slovene & English. User Manuals can be a blend of documents (e.g. Word Processing based, or Presentation based) and multimedia (e.g. videos).

The System Administration Training must be conducted in accordance with the principal vendor's official training curriculum and material if the vendors are implementing a COTS (Commercial of The Shelf)-based solution.

The vendor is responsible for configuring a training facility with all required hardware, software, and communications. Contracting Authority training or test facilities can be used. However, the vendor must forward a request to Contracting Authority. The vendor is responsible for the establishment and all materials required for the training.

The End User Manuals should reflect what is implemented at Contracting Authority and not standard manuals provided by principal vendors. However, the Training Manuals (different from the End User Manuals) should be based on the official training curriculum from the principal vendor.

As for presentations, and when they are required to be presented to certain stakeholders (e.g. top management), there may be requirements to translate their contents into Slovenian by the winning Vendor.

All user manuals must be provided as a document. All training conducted must be documented with staff attendance and a log of all queries and concerns. Each query and concern must be responded to and acted upon by the vendor with a documented implementation date.

##### Training style

The training is expected to be classroom-based training, with adequate material as well as hands-on training..

##### Technology/architecture training

The vendor shall provide training in compliance with the Training requirements provided in section Solution Requirements and all other relevant subsections of the present RFP. The training shall cover functional, technical, and operational aspects of the provided solution. Namely, the winning Vendor must provide technical training that enables super users and admins to perform configuration/customization changes.

##### Knowledge transfer

Transfer of knowledge is also required to selected staff in Contracting Authority to ensure that they, in return, share their knowledge and skills obtained to other potential users across Contracting Authority internally. Thus, full training programs and materials shall be delivered, together with "train-the-trainer"

sessions, especially for those roles where high staff turnover is expected (e.g. bus drivers, customer service agents, etc.).

#### 4.1.12 System online support features

It is important that the solution provides an Online Support feature that helps users navigate around the system and use its functionalities. These, as an example, can be in the form, but not limited to, System Help files, Screens Tool Tips, functionalities description, etc...). This should NOT be confused with the system support model to log issues and incidents.

### 4.2 System environment requirements

Contracting Authority is expected the vendors to host - at least - two environments: Staging (or Testing/UAT) and Production. Although Contracting Authority expects that the staging and UAT environment should be an exact replica of the production environment. The staging and production environments must be completely segregated. It is important to note that NO End-User machine is allowed to be used as a server for staging/testing.

To ensure the required availability and criticality of the solution, disaster recovery (DR) environment setup shall be included as part of the whole solution. The Vendor shall include in the proposal the list of resources provided as part of the solution and any prerequisites required from Contracting Authority for the complete setup.

#### 4.2.1 Hardware requirements & setup

Vendors shall include or propose the following options in their proposal, depending on the selected hosting option:

- Hardware and software provided by the vendor (compute, backup and storage should be part of the vendor proposal).
- Supply, Installation, configuration, management, and support will be the responsibility of the Vendor.
- As the hardware/infrastructure components are proposed to be supplied by the vendor, they should be enterprise-class aligned to Industry standards and Contracting Authority standards.
- Deployment should be aligned with industry best practices.
- Contracting Authority reserves the right to approve the set-up. Vendors are expected to include component-level details in Technical & commercial proposals.
- Specific prerequisites from Contracting Authority, if any, in terms of network, infrastructure, efforts and licenses to be provided in advance (during the initial design phase and no later than that).
- It is the responsibility of the winning vendor to propose/design the solution in a way that Contracting Authority availability requirements are met and without causing any impact to Contracting Authority's existing environment.
- Vendor to ensure that the proposed licenses are mapped to RFP requirements, and vendor shall be responsible if any of the features proposed/presented are missed due to non-availability of licenses.
- As the proposed solution will be hosted in the cloud (private or public), the winning vendor should take complete responsibility for installation, configuration, backup, storage, management and support for these systems or the cloud.
- All servers proposed as part of the solution should be highly available unless the impact is minimal or not in case of server failure.



- Monitoring for the proposed solution will be the winning vendor's responsibility, and appropriate monitoring tools will be included if the entire solution is operated and managed from the vendor side.
- An assessment report is to be provided by the vendor prior to solution architecture, and this report should include the AS-IS state, gaps, and TO-BE states.

### 4.3 Minimum Reference Requirements for the Offered TTM Solution

The Tenderer shall demonstrate that the solution offered has been successfully implemented and is currently in operational use by no fewer than two (2) public transport authorities (PTAs). Each of the referenced PTAs must meet all the following criteria:

- They must use the solution offered to create, modify, and manage timetables as well as vehicle and driver duties for a minimum of four (4) bus operators.
- The TTM system must include rail-based timetables (e.g. railway, tram, metro), which are used to coordinate multimodal public transport services, including bus services.
- The PTA must manage a public transport system that achieves a minimum of fifty (50) million validations per year.

The Tenderer shall provide adequate evidence of compliance with the above requirements in the form of reference confirmations, including contact information of the respective clients, implementation details, and scope of use.

## 4.4 Support and Maintenance Scope

### 4.4.1 Support & Maintenance Engagement Objective

This engagement will shoulder the responsibility to manage and support the system in scope. Hence, all vendors are required to consider proposing services to manage & support the system in scope, its integrations with other systems and the customized services built on top of it based on the required SLA & as per requirements detailed in the RFP document.

### 4.4.2 General Support & Maintenance scope definition

#### General coverage

This engagement covers the removal of defects in the system. In addition, it entitles Contracting Authority to receive the latest updates, patches and any new minor or major upgrades/releases, and it is the responsibility of the winning Vendor to install/implement the new release/updates/upgrades as part of this engagement post obtaining approvals of engagement representatives from Contracting Authority. Especially when these are the means to fix a bug or overcome a problem that the systems at Contracting Authority are encountering, taking into consideration that such implementation plans must be done in coordination with engagement representatives from Contracting Authority after testing of these implementations is successfully completed. This includes the installation on all available environments (e.g. Production, Staging) in addition to ensuring that all customized services that have been built, as well as all integrations, are successfully operating after the upgrade. On the other hand, in the case of international genuine products (e.g. SAP, MS Dynamics), Contracting Authority understands that to receive the latest updates/upgrades, there is a possibility that it must have a valid maintenance agreement for its

products' licenses with the principal vendor of such products. In such cases, Contracting Authority will be responsible for ensuring that the necessary agreements are in place.

Assessing the existing license and their utilization will be part of this engagement. The winning vendor needs to have access to licenses and scope to find out if the procured licenses are fully utilized. If not, the winning Vendor will help Contracting Authority to upgrade and fully utilize the licenses.

It is the winning vendor's responsibility to make sure the system complies with the Technology controls and standards, Technology Quality Assurance controls as demanded in previous sections of this RFP, own recommendations, and internal audit findings (if any) as per approved corrective action plans.

### License maintenance

The vendor shall quote for the maintenance and support of the proposed software with a detailed scope of maintenance and support proposed. The vendor shall provide details below in the response to the RFP.

### Man-days reserve

The winning vendor is expected to cater for a total of 50 man/days of effort per year for customization and enhancement purposes on any of the modules included in this agreement. All vendors are to clearly identify and separate the cost for this item in their proposals for Contracting Authority to consider. Nevertheless, Contracting Authority will only be billed the amount due to utilizing the number of days it consumes from these man/days. For example, if Contracting Authority utilizes 30 men/days only, out of 50, then Contracting Authority will be billed for the 30 men/days only and will not be obliged to pay the amount for the remaining 20 men/days.

Contracting Authority engagement representatives can utilize the onsite resource in their skill sets during working hours only, taking into consideration that they will not be accountable for any SLAs for those special activities and that such activities will not hinder them from performing their original tasks and meeting their SLAs. These activities are not to be considered as part of the 50 man/days mentioned above.

### Technical specifications

The winning Vendors will support the solution, integrations with other systems, and the customized services built on top of it.

#### *Additional information about current systems*

The winning vendor should have certified engineers with development skills who are able to perform more than just the usual operational support of the system. Some of these activities may require customization, modification, and integration to have the required functionality.

The estimated number of users that use the system is up to 100 users; these users could be spread around various Contracting Authority offices. The winning vendor must precisely specify the cost of each additional user exceeding the estimated number of users defined in the tender documentation.

## Support & Maintenance Engagement Duration

The duration of this contract is for TEN Years, and it is expected to start by 01.09.2026.

### 4.4.3 Service window & severity levels

To support the project implementation, the Service Window defined is 24x7. Contracting Authority has defined four types of severity levels to be used in such engagements. They are referred to as Severity Level 1, Severity Level 2, Severity Level 3, and Service Requests. The definition for each of them is stated as follows:

#### Severity Level 1

This means a severe defect, problem and/or disturbance in the application, which is causing the application or a significant feature/module therein to become unavailable, severely disturbed, or frequently interrupted, or causing a severe performance degradation, service degradation or loss of capability in relation to such application or such major feature therein. Severity Level 1 also includes an Emergency Level defect, problem and/or disturbance, causing the entire application to be down.

#### Severity Level 2

This means a severe defect, problem and/or disturbance in the application, which is causing, or is likely to cause, the application or a significant feature therein to become disturbed or frequently interrupted or a moderate performance degradation, service degradation or loss of capability in relation to such application, or such significant feature therein. Such severe defects could also result in operation and maintenance affecting faults that prohibit proper operation or maintenance or result in a lower level of application performance that may result in customer complaints.

#### Severity Level 3

This means a minor defect, problem and/or disturbance in the application, not affecting the performance, service or operation and maintenance of the application but resulting in a deviation from the application specification or minor documentation errors not affecting the operation and maintenance of the application. It also includes inquiries about the features of the system functionalities and an explanation of how to perform various activities on it.

#### Service Requests

This may include any installation required by the application vendor, adding new users to the application, etc. In addition, this category covers the cosmetic changes on the application (e.g. logos, background color, etc.). Such activities will be treated as a Service Request, and their response time will be according to SLA type (explained in the next section). On the other hand, and if mutually agreed between Contracting Authority and the application vendor, the cosmetic changes can be managed by Contracting Authority by means of tools provided as part of the solution implemented, provided that Contracting Authority staff are properly trained on using these tools and that the application vendor submits all documentation related to these tools.

## Other SLA-related definitions

**Severity Level:** It is the level of the problem/issue/request communicated to the application vendor which may cause the application to behave in a way other than what it was designed for.

**Response Time:** It is the maximum time the application vendor must Contact Contracting Authority (mainly its IT Service Desk) informing Contracting Authority about its call/ticket reference number along with the name of the engineer that is responsible for that call/ticket. This will be considered the official "Call Acknowledgment" between Contracting Authority and the application vendor.

**Resolution Time:** It is the maximum time the application vendor must implement a permanent solution in order to eliminate the defect/problem. This is calculated from the Agreed Response Time, rather than the Actual Response Time. However, in certain circumstances, it may be agreed with the vendor to implement a workaround until a permanent fix is ready to be implemented. In such cases, the workaround will be considered as a resolution temporarily and the vendor will not be penalized for violating the SLA if the Permanent Resolution Implementation plan has been shared and approved by the Contracting Authority management.

Example: For application X, the Response Time has been agreed to be (1) hour, and the Resolution Time has been agreed to be (4) hours for Severity (1). If Contracting Authority logs a call at 12:00 under Severity (1), then the application vendor is expected to permanently fix the problem by 17:00, even if it responded with a ticket number at 15:00.

**Status Update:** It is the frequency of updating the in-charge party at Contracting Authority (mainly the IT Service Desk) about the status of the call/ticket logged until a permanent solution is implemented.

**Business day:** It is a day that the vendor is contracted to provide Application Support Services and is not related to Contracting Authority's business days and/or working hours.

Example: If the contract with the vendor states that it will provide DUJPP with Application Support Services from Saturday to Thursday, then the next business day of Thursday is Saturday (as per the contract) and not Sunday (as per Contracting Authority official working days/hours ).

**Service Window:** It is the period between a Start Time and an End Time of a business day during which the vendor is contracted to provide Application Support Services to Contracting Authority. The Service Window for any application support will purely depend on the business requirements set by the business users and the DUJPP management. It is represented by means of hours X days followed by start time and end time (eg 10x6 07:00-17:00).

**Time Elapsed:** It is the percentage of time that has elapsed to resolve/address a problem/issue/request with respect to the Resolution Time. For example, if the Time Passed is set to 100% for a Severity Level 1 problem in a gold contract, then this would mean that 8 hours have passed from the agreed Resolution Time, and the defect/problem has not been rectified yet.

### 4.4.4 Service Level Agreement (SLA) Type

Contracting Authority created four different SLA types of namely Platinum, Gold, Silver and Bronze. The Lead Times mentioned below are calculated from the moment the application vendor is officially contacted by a DUJPP user for a defect/problem/enquiry or service (ticket).

For the purpose of this engagement, the Vendor shall quote for 3 SLA options where Contracting Authority can choose the preferred option at the time of contracting: Platinum, Gold and Silver.

The four SLA types are elaborated as follows:

### Platinum SLA

Support coverage period: 24 hours a day, 7 days a week (24/7).

| Severity Level      | Response Time    | Resolution Time   | Status Update      |
|---------------------|------------------|-------------------|--------------------|
| 1                   | (15) minutes     | (2) hours         | Every (30) minutes |
| 2                   | (30) minutes     | (4) hours         | Every (2) hours    |
| 3                   | (4) hours        | (2) business days | Every (12) hours   |
| 4 (Service Request) | (1) business day | (3) business days | Every (12) hours   |

### Gold SLA

Support coverage period: 6:00–18:00 CET, 7 days a week.

| Severity Level      | Response Time     | Resolution Time   | Status Update          |
|---------------------|-------------------|-------------------|------------------------|
| 1                   | (30) minutes      | (4) hours         | Every (1) hour         |
| 2                   | (1) hour          | (6) hours         | Every (4) hours        |
| 3                   | (6) hours         | (4) business days | Every (1) business day |
| 4 (Service Request) | (2) business days | (5) business days | Every (1) business day |

### Silver Contract

Support coverage period: 6:00–18:00 CET, weekdays.

| Severity Level      | Response Time     | Resolution Time   | Status Update          |
|---------------------|-------------------|-------------------|------------------------|
| 1                   | (1) hour          | (5) hours         | Every (2) hours        |
| 2                   | (2) hours         | (8) hours         | Every (12) hours       |
| 3                   | (1) business day  | (6) business days | Every (1) business day |
| 4 (Service Request) | (3) business days | (7) business days | Every (1) business day |

### Bronze Contract

Support coverage period: 8:00–16:00 CET, weekdays.

| Severity Level      | Response Time     | Resolution Time    | Status Update          |
|---------------------|-------------------|--------------------|------------------------|
| 1                   | (2) hours         | (6) hours          | Every (4) hours        |
| 2                   | (4) hours         | (10) hours         | Every (1) business day |
| 3                   | (1) business day  | (8) business days  | Every (1) business day |
| 4 (Service Request) | (5) business days | (10) business days | Every (1) business day |

## 4.4.5 System availability

The service time is defined as the time when the system is available and shows the desired behaviour for all users.

The required service time per year is 24 hours/day, 7 days/week, 365 days/year. During this service time, the system shall be operational, except during agreed maintenance windows as defined below.

The system's availability is expressed as the percentage of **uptime** versus **service time**. Uptime is the time when the service is available with the desired behaviour for all users.

For the system in scope, the Vendor shall ensure a **minimum monthly availability of 99.5%**, measured over the agreed service time and excluding approved maintenance windows. This corresponds to a maximum unplanned downtime of approximately 44 hours per year.

The availability target applies to unplanned downtime attributable to the Vendor or its subcontractors. It does not include downtime caused by:

- force majeure events,
- failures of third-party infrastructure or services outside the Vendor's reasonable control (e.g. national telecom outages, power grid failures), or
- Contracting Authority actions that prevent normal operation (e.g. intentional shutdowns requested by the Contracting Authority).

The supplier shall design the solution in a modular manner, enabling different availability targets to be assigned to individual functionalities or subsystems based on their business and operational criticality, and allowing higher availability targets (e.g. 99.99%) to be achieved for selected functionalities without requiring a fundamental redesign of the system or infrastructure.

#### **Maintenance windows**

The Vendor shall propose procedures and a schedule for planned maintenance windows. No planned downtime shall be performed during Contracting Authority-specified public transport operating hours. Planned maintenance windows outside these hours, agreed in advance with the Contracting Authority, shall be excluded from the availability calculation, provided that:

- they are notified at least [x] days in advance, and
- their total duration does not exceed [y] hours per calendar month.

#### **4.4.6 Data maintenance & disaster recovery**

Given the large amount of data, sensible sharing and pre-processing strategies must be developed to be able to retrieve the necessary information in a timely manner. In addition to that, data deletion and archiving functions need to be implemented in accordance with legal regulations and corporate standards.

For disaster recovery and to avoid critical data losses through downtimes, backup strategies are to be established. Hereby, the recovery time is to be in line with the required system availability.

|                                   |  |
|-----------------------------------|--|
| Recovery Point Objective (RPO) is | Shall be 24 hours, meaning that no data older than 24 hours prior to the incident may be lost. |
| Recovery Time Objective (RTO) is  | Maximum 24 hours   |

#### 4.4.7 Application Environments & Documentation

All system changes, including those resulting from system upgrades, bug fixes and/or the addition of functionalities, modifications, or improvements, must be properly documented and formally submitted to the client's representatives so that they can be updated on the Business Architecture Portal (of the client DUJPP).

If these application changes require modifications to any documentation, the selected contractor must update all such documents (where applicable) and submit the new version to the client's representatives.

In addition, the selected contractor must comply with all documentation requirements in accordance with the client's standards (e.g. quality assurance and audit requirements, if applicable). Furthermore, the winning vendor must fulfil all documentation requirements per Contracting Authority standards (e.g. QA and audit requirements – if any).

#### 4.4.8 Roles & responsibilities among multiple parties

The client expects that the contractor and all its partners (including the contractors for Lots 2 and 3) will cooperate as a single team when addressing any potential issues. In addition, the roles and responsibilities of the client and the provider(s) will be clearly defined and documented in a document using a RACI structure or a similar format.

#### 4.4.9 Support & SLA communication

##### Phone Support

To officially report any complaints, the winning vendors should provide the Contracting Authority representatives with Slovenia-based landline support phone number and a support email address. Suppose the landline phone number is not a generic Helpline or Support Hotline number. In that case, the winning vendor should provide Contracting Authority with a premier contact person who will act as the sole point of contact between Contracting Authority and the application vendor, along with a secondary contact person who will serve as a backup for the premier contact in case the latter is not reachable. The winning vendor is responsible for communicating any changes in these two points of contact to Contracting Authority.

Support requests received via phone need to be documented by winning vendor support representatives by registering a ticket through [podpora@dujpp.si](mailto:podpora@dujpp.si); the same will be in the winning vendor's favour to record all requests/incidents that will measure the performance & the value of the engagement statistically.

Severity Level 1 critical incidents may also be reported directly via the emergency support telephone number. In such cases, the provider must ensure immediate call reception and registration of the request in the incident management system (ticketing system). After registration, the provider must provide the client with the reference number of the request in accordance with the provisions of this document.



## IT Service Desk, Incident Management and Support Process

In general, the IT Service Desk will be the focal point of logging calls with the winning vendor. It is reachable via phone at +386 (1) xxx xxx and via email at podpora@dujpp.si. The IT Service Desk will assign logged calls to the application vendor. It is the responsibility of the application vendor to contact the application owner or users to get the required details to resolve the defect/problem. The IT Service Desk will need to be notified of the progress as per the SLA. Once informed that a defect/problem is resolved, it will confirm this with the users. The IT Service Desk is also the focal point to monitor the application vendor's performance and identify the incidents when the application vendor violates its SLA.

### Status Update Notifications

Whenever a ticket is logged with the winning vendor under any severity level, a status update has to be communicated to the IT Service Desk in writing by email, as mentioned in the Status Update defined in the selected SLA. The winning vendor is responsible for updating the IT Service Desk, whereas the IT Service Desk will update the main stakeholders from the Contracting Authority endpoint.

### Escalation Scheme

When the winning vendor fails to meet the contracted SLA, Contracting Authority engagement representatives will use the following escalation matrix to rectify the situation and report the slippage in service delivery. Escalation indicates the persons from the winning vendor that Contracting Authority engagement representatives can contact, in sequence, when SLAs are violated, as these persons should ensure they bring ticket(s) to closure ASAP. This is unrelated to the winning vendor's internal problem-solving & internal escalation process.

The following scheme identifies the parties concerned with the different levels of escalation by Contracting Authority. The winning vendor must propose its parties per the same table, considering the persons at each escalation level and their peers from Contracting Authority (regarding ranking/position).

Sample Table:

| Escalation Level                           | 1st Level   | 2nd Level  | 3rd Level  |
|--|---|--|--|
| Time Passed                                | 100%  | 200%   | 300%   |
| <b>Escalate to (Contracting Authority)</b> | Head of IT Service Desk<br><br>Name and surname: TBA<br>(nn@dujpp.si)<br>+38640xxxx | Head of department<br><br>Name and surname: TBA<br>(nn@dujpp.si)<br>+38640xxxx | CEO, DUJPP<br><br>Name and surname: TBA<br>(nn@dujpp.si)<br>+38640xxxx |
| <b>Escalate to (Vendor)</b>                | Name:<br>Designation:<br>Email:<br>Phone:   | Name:<br>Designation:<br>Email:<br>Telephone:                                  | Name:<br>Designation:<br>Email:<br>Telephone:                          |

## Performance Monitoring & Reporting

To monitor operational performance, the selected provider(s) shall submit a monthly report (within an appropriate timeframe after the end of each month) detailing all service calls related to the systems within the scope of the contract, including the response time and resolution time for all reported incidents and

requests. The selected provider shall also identify cases where the defined Service Level Agreements (SLA) were not met.

Such reports may be compared with reports prepared by the Contracting Authority's Help Desk. The evaluation of operational performance shall be conducted on a monthly basis.

In the case of a service call that is opened in a given month and continues into the following month(s), the call shall be included in the report for the month in which it is closed, taking into account the total age of the call.

Representatives of the Contracting Authority may request that the findings from these reports be discussed during regular operational meetings, where the achieved service levels, applicable service level agreements, and potential opportunities for improving service delivery or removing obstacles encountered by either party in performing their activities or achieving their objectives may be reviewed.

The Key Performance Indicators (KPIs) monitored as part of the reporting are defined in the chapter 5, sections SLA KPI's – Service Level Agreement and SLO – Service Level Objectives.

The monthly report constitutes the formal basis for assessing compliance with contractual SLA indicators.

In addition to monthly reports, the Contracting Authority expects to have continuous visibility into service performance through analytical dashboards, enabling the monitoring of key performance indicators and service level compliance in near real time. The solution shall allow authorised representatives of the Contracting Authority to review open and closed incidents and requests, response times, resolution times, SLA compliance, and other relevant operational metrics, with the ability to filter and analyse data across different time periods.

#### 4.4.10 Service Charge and Penalty Scheme

##### Planned Monthly Service Charge

The penalty scheme is established to ensure that the representatives of the selected provider make their best efforts to meet their SLAs. Therefore, this scheme will apply in cases where the selected provider fails to comply with the agreed SLA terms.

SLA compliance is measured on a monthly basis. The SLA is considered fulfilled if the response times and resolution times are achieved for at least the minimum required proportion of incidents, as defined in the table below.

The monthly penalty amount will assign penalty points to the service provider's account each time the SLA agreement is breached, in accordance with the following table:

| Severity Level | Required SLA achievement | Percentage of the monthly invoice amount for exceeding the resolution time by 1 hour |
|----------------|--------------------------|--|
| 1              | 95%                      | 3%   |
| 2              | 95%                      | 2%   |
| 3              | 90%                      | 0,5%   |
| 4              | 90%                      | 0,1%   |

The maximum penalty amount is 50% of the monthly invoice and constitutes grounds for the potential termination of the contract with the service provider without the obligation to pay for the last month of services rendered.

## 5 Technology Quality Assurance (TQA) Requirements

### 5.1 Lifecycle & Deliverables

| # | Vnos                       | Faze           | Pripravnštvo za zagotavljanje kakovosti    | Rezultati   |
|---|----------------------------|----------------|--|---|
| 1 | Requirements/ RFC document | Implementation | • Test Planning/Design                     | • Functional Test Plan • Performance Test Plan (if applicable) • Test Cases |
| 2 | Software Release           | Implementation | • Test Execution (Vendor)                  | • Test Cases/Scripts • Release Sign off                                     |
| 3 | Release Signoff            | UAT            | • Contracting Authority Quality Assessment | • Contracting Authority Quality Assessment Report                           |
| 4 | Quality Assessment Report  | UAT            | • Business UAT                             | • UAT Signoff Report  |

### 5.2 Quality Assurance & Testing Scope

Based on the functional and non-functional requirements, the following are the kinds of testing that should be performed as part of the support & maintenance provided by the vendors:

- Functional Testing (System, Integration, Regression, Usability)
- Performance Testing (Load, Volume, Stress)
- Automation Testing

## 6 Application governance & Compliance scope

Referencing this document and Project description document, all vendors must address shared controls and compliance requirements as applicable & according to Contracting Authority requirements & submit filled-in technical proposal.

### 6.1 System key performance indicators (KPI)

Even under heavy load, the system shall perform well while using the appropriate resources. The vendor should conduct load and stress tests to find bottlenecks and improve performance. The system shall meet the following KPIs as minimum requirements; the vendor shall describe all expected performance criteria from external components and systems for it to achieve the KPIs.

#### 6.1.1 SLA (Service Level Agreement)

SLA KPIs represent contractually binding service quality indicators that are monitored periodically (usually monthly) and reflect the business availability, correctness, and timeliness of system operation.

These KPIs form the basis for assessing the fulfillment of contractual obligations and may be subject to contractual penalties or other contractual mechanisms.

KPIs for the entire system

| # | KPI  | Requirement   | Measurement period |
|---|--|---|--------------------|
| 1 | Availability of the TTM system                               | ≥ 99,5 %  | Monthly            |
| 2 | Availability of APIs for timetable distribution              | ≥ 99,9 %  | Monthly            |
| 3 | Integrity of timetable data                                  | 100% of data successfully validated after publication | Monthly            |
| 4 | Time to publish a new timetable                              | ≤ 5 minutes after publication confirmation            | When published     |
| 5 | Availability of timetable distribution to downstream systems | ≥ 99,5 %  | Monthly            |
| 6 | Accuracy of timetable versioning                             | 100 % correctly versioned data                        | Monthly            |
| 7 | Backup / recovery (RPO / RTO)                                | RPO ≤ 24h, RTO ≤ 24h                                  | Monthly            |

## 6.1.2 SLO (Service Level Objective) – Operational objectives

SLO KPIs are target operational indicators designed for real-time monitoring of system stability, efficiency, and quality of operation.

They are measured frequently (even daily) and serve to detect deviations early on and continuously improve system performance. They do not constitute a direct basis for contractual penalties.

KPIs for the entire system

| #  | KPI                                      | Requirement     | Measurement period              |
|----|--|-----------------|---------------------------------|
| 8  | NeTex / GTFS / planning data import time | < 2 min         | Upon each import                |
| 9  | Operational schedule generation time     | < 5 min         | Upon each generation            |
| 10 | Distribution of timetables to operators  | ≥ 99 % v 10 min | Upon each timetable publication |
| 11 | Validation time of a new timetable       | < 1 min         | Upon each import                |

## 7 Disclaimer

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## 8 Appendix A – Test scenarios

This section contains detailed description of test scenarios.