

# Terms Of Reference

## Technical assistance for the further development of Road Asset Management System in Moldova (RAMS)

### 1. PURPOSE OF THE DOCUMENT

The National Road Administration (NRA) of Moldova with the financial support of World Bank (WB) seeks to procure a Consulting services (the Consultant) “Technical assistance for the further development of Road Asset Management System (RAMS)” and strengthen capacity building activities with the objective to operationalize RAMS within NRA (the Project).

The following document describes the background, objectives, tasks, deliverables and technical requirements of the Project.

Estimated Project duration is 9 months.

### 2. BACKGROUND

The Republic of Moldova, as an EU candidate country since June 2022, is aligning its transport infrastructure with the Trans-European Transport Network (TEN-T) requirements under Regulation (EU) 2024/1679, effective July 18, 2024. The Mobility Strategy 2030 (Strategy)<sup>1</sup>, approved by Government Decision No. 589/2024, targets to reflect the aspirations of ensuring citizen mobility through efficient, safe and multimodal transport systems, correlated with a reliable and developed road infrastructure, as well as bringing the Republic of Moldova closer to European standards and values, which would ensure a stable process of Moldova’s accession to the European Union.

The NRA manages Moldova’s app. 6 000 km of national roads, of which 1 000 km are part of TEN-T corridors. Based on the Strategy, the target till 2030 is to modernize at least 1200 km of republican and regional roads, reconstruct 9 bridges according to the EU and national standards and ensure stable maintenance for the rest of roads’ network (including bridges) network in satisfactory, good and very good technical conditions.

The 1<sup>st</sup> general objective of the Strategy is to **“Improve Road asset management, further rehabilitate and modernize the road network and support safe and sustainable road transport”**. The achievement of this objective is planned along the following priority directions:

- Improving the functional and institutional capacities of the subdivisions responsible for the development and promotion of public policies in the field of road infrastructure;
- Ensuring a sustainable contractual and financial framework for **road asset management**;
- Continuation of road infrastructure rehabilitation projects;
- **Development and implementation of the road asset management mechanism and project cycle standards within the framework of strategic asset management plans (SAMPs)**;
- **Ensuring access to intelligent transport systems (hereinafter – ITS) and accelerating the digitalization of the road transport system.**

To achieve the above-mentioned General Objective Targets, increase road sector management and investment efficiency and to make safe and comfortable movement for society, it is needed to ensure the stable, long-term funding, initiate output and performance-based road contracting and ensure cost-effective long-lasting road construction, rehabilitation and maintenance planning. In this light, Road Asset Management System (RAMS) becomes a basis for all mentioned activities. Furthermore, fully functioning RAMS, filled with good quality data, is a very valuable tool for integration with other public and private systems/platforms, such as road accidents’ database, land use and register, climate related data, etc.

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<sup>1</sup> [https://www.legis.md/cautare/getResults?doc\\_id=145139&lang=ro](https://www.legis.md/cautare/getResults?doc_id=145139&lang=ro)

### **The As-Is Road Asset Management System:**

From 2017, NRA, by implementing several projects, funded by European Bank of Reconstruction and Development (EBRD), World Bank (WB), local budget and other IFI's, developed the following RAMS related outputs:

- initiated and approved an asset management policy with strategic and management objectives, plans and process of monitoring and reporting;
- created and approved a multi-year upgrade plan for the regional roads network developed using multi-criteria identification and prioritization methodology and tool, based on MS Excel software;
- incorporated HDM-4 Roadwork Programming Analysis for the regional roads network methodology and tool, based on MS Excel software;
- approved a multiyear pavement management planning and pavement condition identification for the regional network methodology and criteria and started to use PAVER software;
- finally, prepared and approved Multi-Criteria Decision Making (MCDM) Methodology and developed tool for regional, national, and express roads networks, based on MS Excel software.

Some recent updates have been made by amending the Roads Law, where the regulation of the road assets is described more specifically. The amendments added such notions in the law as the land adjacent to the road, maximum admissible size, maximum admissible load, maximum admissible load on axis. The law has been complemented with a comprehensive list of elements which are considered part of a road. In parallel with the updated legislation, initiated methodologies, normatives and software/tools development, main data about roads' conditions, IRI, traffic volume, accidents and other parameters were collected and filled to the developed systems/platforms to ensure more sustainable and facts-based decision-making process for selecting the construction, rehabilitation and maintenance investment priorities. For the automated video and data collection, NRA still use an old laboratory and a vehicle equipped with lasers and video cameras. The basic information about roads' length, cross-sections and other parameters was digitalized from paper-based registers to the Q-GIS software-based system but lacks details.

From the capacity-building perspective, several specialists were trained to work with RAMS related processes and software, established dedicated department/group for data collection and maintaining the IT based systems/platforms and calculating initial prioritization of road section for investments.

For managing bridges' maintenance, NRA developed bridges management tool, based on MS Excel software, which is used to collect the main information about the conditions of the bridges, plan maintenance works, etc. The information for this tool is collected through manual visual inspections and then entered manually.

Additionally, NRA, under its own initiative, implemented several additional systems for national roads and junctions video monitoring (with dedicated special software and hardware), traffic volume counting system (with dedicated special software and hardware), weather monitoring system (with dedicated special software and hardware), GPS trackers for the road maintenance vehicles tracking (with dedicated special software and hardware), opened 24/7 working traffic information center at NRA premises.

In 2025 NRA prepared a list of urgently needed equipment, tools and software for further RAMS system development (see Annex 1). It is planned that part of the list could be funded by European Bank of Reconstruction and Development (EBRD).

However, despite the IT systems/tools already installed and started to be used, initial information is collected, the legal acts approved, and the prioritization system introduced, there are still many unresolved issues that prevent the proper use of the Moldavian RAMS as a key pillar for the further effective road investment and maintenance planning processes:

1. **Lack of integration/interoperability of sub systems:** Despite the RAMS is already launched and used, it is very complicated and require specific knowledge to use it. It happens because the existing RAMS consists of various separate tools and databases without any unification and integration. To address this, it is identified a lack of united user-friendly interface within the existing systems used by the NRA. This leads to the manual data transferring from one tool/database to another and which requires a lot of time, human resources and increase the possibility for errors. In parallel, during the last few years, NRA has implemented several additional monitoring and data collection solutions, e.g. video monitoring, weather information collection, traffic volume counting, etc., but most of these solutions usually have their own unique data transfer and exchange formats, own user interface, etc., and this hinders the effective exchange of data between deployed systems, blocks migration from one database to another and requires intensive manual work while compiling.
2. **Manual intensive data collection:** Most of the data, e.g. road parameters, road surface condition (IRI), etc. are still collected by doing visual or video inspections and later manually filling this information in the databases. For example, to determine and enter the road surface roughness index IRI into the PAVER program, a huge and time-consuming manual work is performed, i.e. by reviewing video material, a specialist manually selects the type and complexity of damage at each damage location and enters it into the system. This is not only huge time and human efforts consuming process but also creates possibilities for errors.
3. **Fragmentation of roles in RAMS related data collection and utilization:** The internal NRA processes documents stipulate that decisions should be made based on the information available in the RAMS, there are cases where other departments do not use this information. It is also important to note, that most often RAMS is used only for some investments planning and is used by a limited number of specialists. Some NRA departments still use information available in their own other systems, which does not necessarily coincide with the data from RAMS. Another problem is that some NRA departments do not provide or update the data in the RAMS. This creates the prerequisites for having different information within different departments. This also causes the problem that NRA, being as one organization, duplicates its available information, and this is not efficient, and often creates the probabilities for errors.
4. **Non-clear future alignment with the road register:** Nevertheless, that **basic data** about roads was digitalized from paper-based archives in upcoming years NRA is planning to develop, legalize and start to operate national roads register. The register will allow to collect following data, e.g. coordinates, ID number, road names, road axis lines, road lengths, data on the upper layers of road surface, etc. but it is still unclear how this register will be integrated between other existing databases owned by NRA and other institutions.
5. **Lack of the sufficient legal regulation:** During last few years a few legal and technical regulations were updated, allowing to introduce and use the RAMS for data collection and planning and prioritizing investments for road management. Despite this effort, there still exist gaps in legislation requiring RAMS to be the main source for the decision making. Changes shall be adopted to the Road Fund Law, Public Procurement Law, Law on road infrastructure safety management, Law on road traffic safety, Government Decree on Period adjustment of the value of the public procurement contracts with continuous performance, entered into for a period longer than a year, Government Decree on the public capital investment projects, Government Decree approving 2030 mobility strategy, Urbanism and Construction Code, in the matter of

financing, prioritization, and application in order to streamline the decision making process for a better management of the road assets.

### 3. OBJECTIVES

#### 3.1. Primary objective

The primary objective of this assignment is to lay the strategic, technical, institutional, and legal groundwork for the modernization of NRA's Road Asset Management System, so that Moldova's national road network can be managed efficiently, cost-effectively, and in line with European standards.

NRA's current RAMS consists of a fragmented set of disconnected tools, manual processes, and isolated databases that limit its effectiveness as a decision-support system. This assignment represents Phase 1 of NRA's RAMS modernization journey — a diagnostic and design phase that will produce the evidence base, recommendations, and roadmap needed to guide future implementation.

Specifically, the assignment will deliver a clear and actionable answer to the question: *what does a modern, fit-for-purpose RAMS look like for Moldova, and what is needed to get there?*

To answer this, the Consultant will assess the current state of NRA's RAMS — its organizational setup, business processes, IT tools, data quality, legal framework, and capacity — identify gaps against the requirements of a modern RAMS, and produce a set of concrete recommendations and specifications covering:

- the organizational and governance arrangements needed to embed RAMS across NRA as the single authoritative source of road asset information;
- the IT architecture, software, and hardware solutions required to replace the current fragmented toolset with an integrated, scalable system;
- the asset coverage, data standards, and collection methods appropriate for Moldova's network and institutional capacity;
- the legal and policy reforms needed to mandate RAMS as the primary basis for road investment planning and decision-making;
- the data governance framework needed to ensure data quality, ownership, and consistency across departments; and
- a phased, costed implementation roadmap that NRA and its partners can use to procure and deploy modernized RAMS in subsequent phases.

When the modernized RAMS envisaged by this roadmap is eventually implemented, it will enable NRA to maintain a continuously updated asset inventory, objectively assess network condition, optimize multi-year maintenance and rehabilitation programs, interface with related national systems such as road accident records, land registers, and climate data, and fulfil Moldova's commitments under the TEN-T Regulation (EU) 2024/1679 and the Mobility Strategy 2030. The system should be interlinked with meteorological data system and capture all climate resilience factors that can influence the performance of the network to allow to take a preventive action before the event. This will include incorporation of latest pavement designs and construction materials that are found to be more resilient to extreme weather conditions. This assignment sets the foundation for that future state.

#### 3.2. Specific objectives

Specific objectives include:

- Review and map the as-is business processes of the NRA and identify opportunities to streamline and enhance them to better support the integration and functionality of the Road Asset Management System (RAMS). The review should consider the long-term

viability of maintaining the system, aligned with the operational needs of effective road network management.

- Review existing IT based tools/databases' structures, technical capabilities and identify possibilities for the integration between each other for automatic data exchange and better user interface.
- Determine which road infrastructure elements (carriageways, shoulders, bridges, culverts, tunnels, signage, drainage systems, etc.) are to be included in the system, and propose appropriate methods for data collection, validation, and updating.
- Review the existing legislation related the RAMS and identify needed changes, identify legal gaps preventing RAMS from being mandated as the primary basis for decision-making, and prepare a prioritised list of documents requiring update or development with concrete recommendations.
- Review the datasets which are currently being collected and identify if there should be updates initiated.
- Review the existing NRA organizational structure, departmental responsibilities, and RAMS-related roles, identify coordination gaps and fragmented responsibilities, and recommend how RAMS functions should be governed across the organization, including a change management roadmap for the transition
- Support the strengthening of institutional and technical capacity building within NRA departments to manage RAMS more effectively.
- Initiate review of common data collection standards/protocols across all sensors and devices software and hardware equipment.

#### **4. TASKS AND ACTIVITIES**

The Consultant will work in close cooperation with NRA dedicated representatives and other relevant stakeholders and will provide comprehensive technical assistance and capacity building activities over a 9-month period, focusing on the following tasks and associated activities:

##### **4.1. Business processes review and recommendations for the improvements with the integration of RAMS preparation**

- Review existing NRA organizational structure, departments' responsibilities, identify areas of poor coordination, or fragmented responsibilities and recommend how RAMS should be introduced across organization and prepare the recommendations (roadmap) for the improvements.
- Conduct a diagnostic review of existing NRA business processes, by mapping the as-is RAMS workflow, identify gaps, redundancies and inefficiencies, perform interviews and identify processes which are/should be related with RAMS and prepare recommendations for improvements.
- Review existing decisions making practices at NRA and MIRD, perform GAP analysis by comparing with 2-3 other similar organizations in European Countries and prepare recommendations for the improvements;
- Conduct consultations with NRA departments, inspection teams, and other relevant stakeholders to assess current business processes and future needs.

##### **4.2. Review of existing IT based tools, software, databases, etc. architecture and integration within and recommendations for further improvement preparation**

- Review and map all existing NRA IT based tools, software, databases, platforms, and other digital solutions currently used for road asset data collection, storage, analysis, reporting and decision support, and identify their main functionalities, users, technical characteristics, input/output data, and interconnections,

- Conduct a diagnostic review of how existing IT based tools, databases, etc. support the existing business processes, identify existing gaps.
- Assess the current level of integration and interoperability between the existing systems, including data exchange formats, interfaces, dependencies on manual transfer, and compatibility between the various tools and databases already deployed by NRA,
- Identify gaps, overlaps, duplications, inconsistencies and technical constraints in the current IT landscape, including issues related to fragmented user interfaces, disconnected databases, non-standardized data exchange, limited automation, and system maintainability,
- Review the alignment of existing and planned IT based systems with the future national road register and other relevant internal and external systems, databases and platforms,
- Review the attached in annex 1 Indicative priority list of software and equipment, identify its rationale and, if needed, propose additional software and suitable data collection methods per asset type, including visual/manual inspections, mobile mapping, drones/UAV, LiDAR, smart sensors, and remote sensing, etc.

This task shall result in a clear as-is assessment of the current IT environment supporting RAMS and identify the key technical and interoperability issues that need to be addressed in the future modernization of the system.

### **4.3. Development of the Future RAMS Roadmap**

Building on the findings of the organizational, business process, IT, data, and legal diagnostics carried out under the preceding tasks, the Consultant shall develop a coherent roadmap for the future development of RAMS in Moldova.

In particular, the Consultant shall:

- define the target concept for a modern, integrated, and fit-for-purpose RAMS, including its organizational, operational, data, and technological dimensions;
- recommend the future organizational and governance arrangements needed to embed RAMS across NRA and support evidence-based planning, budgeting, maintenance, and investment decision-making;
- define the future functional scope of RAMS, including asset coverage, key datasets, data governance principles, and interoperability requirements with the national road register and other relevant internal and external systems;
- identify the legal, regulatory, and policy changes required to support the effective institutionalization and use of RAMS;
- develop the future RAMS architecture concept and implementation approach, including key modules, integrations, and indicative sequencing of priorities;
- prepare a phased implementation roadmap, including short-, medium-, and long-term actions, indicative timelines, institutional prerequisites, and broad investment needs; and
- validate the proposed roadmap with NRA, MIRD, and other relevant stakeholders.

The output of this task shall provide NRA with a clear and actionable roadmap for moving from the current fragmented system to a modern and integrated RAMS.

### **4.4. Asset Inventory and Data Governance Framework**

Building on the findings of the preceding tasks, the Consultant shall define the asset inventory scope and data governance framework required for the future RAMS

In particular, the Consultant shall:

- review the asset types and datasets currently used across NRA and assess their completeness, consistency, and relevance;
- define the future asset coverage of RAMS, including the main road infrastructure elements to be included at different stages of implementation;
- propose the core datasets, key attributes, and classification structure required for each asset category;
- recommend suitable methods for data collection, validation, updating, and quality assurance;
- define data governance arrangements, including data ownership, stewardship, update responsibilities, access rights, and quality control roles;
- define the principles for interoperability and data exchange between RAMS, the future road register, and other relevant systems; and
- validate the proposed framework with NRA, MIRD, and other relevant stakeholders.

The output of this task shall provide NRA with a clear framework for what data the future RAMS should contain, how it should be maintained, and who should be responsible for it.

#### **4.5. Policy Framework Development**

- Review relevant national documentation, standards, and existing data sources related to road infrastructure management in Moldova;
- Conduct a diagnostic review of Moldova's roads management and funding practices, legal frameworks, and compliance gaps related to full integration RAMS in the processes.
- Prepare a list of needed to update legal and technical documents with the recommendations for RAMS deployment.
- Present the framework to NRA, MIRD and other related stakeholders for validation.

#### **4.6. Capacity Building**

- Develop a training program for at least 70 NRA, MIRD, other public and private sectors specialists on RAMS importance, efficiency and processes improvement while onboarding the RAMS, investments and prioritization planning based on RAMS, road data collection methods and tools, datasets and formats, integration possibilities between RAMS and other public databases, basic principles of RAMS and performance monitoring.
- Conduct at least 2 in-person workshops covering mentioned above topics.
- Conduct at least 2 in person workshops presenting the recommendations for the NRA processes improvement, further RAMS development vision and architecture, legal improvements and roadmaps.
- Organize at least 2 consultations with other identified public institutions (e.g. road police), local contractors, etc. to align expectations and address concerns.
- Recommend practical steps for institutional coordination, capacity-building, and gradual scaling of data collection to full network coverage;
- Disseminate lessons learned through a closing workshop and a report shared with all stakeholders.

## **5. DELIVERABLES**

The Consultancy will deliver the following, in Romanian and English:

1. **Inception Report** (Month 2): work plan, methodology, stakeholder engagement plan initial analysis, risk register, and any early observations from the document review and initial consultations,
2. **Organizational And Business Processes As-Is Assessment Report** (Month 5): mapping and assessment of the existing organizational setup, departmental responsibilities, RAMS-related roles, and business processes relevant to road asset management; identified gaps, inefficiencies, overlaps, and recommendations for organizational and business process improvements.
3. **IT Tools, Systems and Interoperability As-Is Assessment Report:** (Month 5): as-is analysis, map of existing tools/databases/software, datasets, formats, identified interoperability another gaps and comparison with the processes, vision, architecture and roadmap.
4. **Asset Inventory and Data Governance Framework-** (Month 5): defined RAMS asset coverage, asset classification structure, key datasets and attributes, recommended methods for data collection, validation, updating and quality assurance, data governance arrangements, and interoperability principles for data exchange with the future road register and other relevant systems.
5. **Future RAMS Roadmap** (Month 8): Target concept for the future RAMS, including its functional scope, organizational and governance implications, interoperability requirements, future architecture concept, phased implementation approach, indicative timelines, and broad investment needs.
6. **Technical specification for the Future RAMS software** (Month 9): Technical requirements, architecture requirements, integration requirements, deployment requirements, hardware requirements and other drafts of needed procurement documents.
7. **RAMS Policy Framework** (Month 6): as-is analysis, draft list of needed to be updated legal and technical documents with the recommendations.
8. **Training Needs Assessment and Design Training Program** (Month 5-9): Training needs assessment, training plan, training materials, workshop records, consultation summaries, and recommendations for continued institutional capacity building related to RAMS development and use.
9. **Final Report** (Month 9): Consolidated summary of the assignment, including key findings, validated recommendations, final outputs, implementation considerations, lessons learned, and next steps for subsequent RAMS modernization phases.

## 6. QUALIFICATIONS AND EXPERTISE

The Consultancy team must demonstrate:

### 6.1. Experience

At least 10 years of experience in business processes analysis and improvement related with RAMS and/or ITS implementation, with proven success in at least 2 similar Projects.

### 6.2. Technical Expertise

Expertise in RAMS and/or road sector management, business processes, IT and legal analysis, IT architecture/integration, Asset Inventory design, in at least 2 similar scope project.

### 6.3. Capacity Building

Track record of training public sector staff (minimum 50 trainees across Projects) on RAMS.

### 6.4. Regional Knowledge

Familiarity with Moldova's road sector management will be considered advantage.

Familiarity with legal frameworks and RAMS and/or ITS related IT systems/tools will be considered an added advantage.

#### **6.5. Team Composition**

- **Data / asset management specialist (Team Leader):** 15+ years of experience in RAMS development/implementation, with project management skills demonstrated in at least 2 similar scope projects.
- **Business processes analyst:** 10+ years of experience of organizational level business processes analysis and improvement. Business processes analysis in RAMS will be as an asset.
- **IT specialist:** 10+ years of IT analysis and experience of drafting technical specifications for the IT software development. Experience in drafting technical specifications for the RAMS and/or ITS systems and/or evaluating bids/proposals for such equipment will be as an asset.
- **Training Expert:** 5+ years of experience in capacity building in RAMS, ITS for public sector clients.
- **Local Lawyer:** 10+ years of experience in legislation development/application.
- **Local Procurement Specialist:** 5+ years of experience in procurement for IT based solutions.
- **Local technical Expert:** 5+ years of experience in Moldova's road sector asset management.

#### **6.6. Language:**

All experts should fluently speak and write in English. Local experts should fluently speak in Romanian.

### **7. TIMELINE AND DURATION**

The assignment will span 9 months, (tentatively from January 2027 to September 2027).

**Annex 1. Priority list of software and equipment for further RAMS development to be procured by NRA under a separate contract, funded by EBRD.**

| Equipment |                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                |                                                                                       |        |                              |                             | Initial<br>Prioritization | Training | CUMULATIVE<br>PRICE | LOT |
|-----------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------|------------------------------|-----------------------------|---------------------------|----------|---------------------|-----|
| No<br>.   | Equipment type                                                                                          | Equipment specifications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Equipment description                                                                                                                                                                                                                                                                                                                          | Photo                                                                                 | Pieces | Estimated<br>price per piece | Total<br>estimated<br>price |                           |          |                     |     |
| 1         | Road Asset Management solution (e.g. Logiroad)                                                          | Road maintenance<br>Road damage assessment<br>Audit report / Road database<br>L²R Base is a road database which makes it possible to control, store and update data according to a road reference system (crossroads, etc.) and to display requests on a maps based interface (Google Earth, Openstreetmap...).<br>-Structures assessment<br>-Structures pathologies, classification...<br>-Assessment and rating of road infrastructure<br>The optimized maintenance planning<br>Optimize maintenance policies thanks to the innovative algorithms of L²R Program to design a multi-year maintenance program for road infrastructures. All constraints are considered. Models and algorithms have been developed within several theses in collaboration with several top-level French laboratories.<br><br>-Decision rules & priority laws<br>-Evolution law (estimating the time life of the road according to a precise set of parameters)<br>-Consideration of already planned maintenance<br>-Consideration of n-years budget |                                                                                                                                                                                                                                                                                                                                                |                                                                                       | 1      | 120,000.00<br>EUR            | 120,000.00<br>EUR           | 1                         | yes      | 120,000.00 EUR      | A   |
| 2         | GIS software for the systematization, record keeping, analysis of the road infrastructure (e.g. ArcGIS) | <b>ArcGIS Enterprise Advanced</b> license (4 cores) (includes ArcGIS Portal + 50 Creator Users<br>+ unlimited Viewer Users+ ArcGIS Notebook Server Standard).Also includes extensions: ArcGIS Network Analyst, ArcGIS Spatial Analyst, ArcGIS 3D Analyst (working with lidar data), ArcGIS Schematics, ArcGIS Geostatistical Analyst, <b>ArcGIS Network Analyst extension for ArcGIS Enterprise, ArcGIS Desktop</b> GIS Professional Standard User type for ArcGIS Enterprise (includes * Essential Apps Bundle * ArcGIS Pro Standard * Office Apps Bundle * Field Apps Bundle * Utility Network Extension * Trace Network Extension * Parcel Fabric Extension * GeoBIM Extension), free apps ArcGIS Companion Lite, ArcGIS Explorer, ArcGIS Earth, ArcGIS for AutoCAD, ArcGIS Maps for Adobe Creative Cloud                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                |   | 1      | 81,000.00 EUR                | 81,000.00 EUR               | 2                         | yes      | 201,000.00 EUR      | A   |
| 3         | Vehicle laboratory for collecting RAMS data (e.g. VIAPIX)                                               | Viapix-LCMS<br>Functional characteristics of the road:<br>• Degradation of the surface (cracks, pits, tears, deformations,)<br>• Transverse profile<br>• Macro texture<br>• Uni longitudinal (IRI)<br>• Slope and inclination<br>High-resolution readings with high-efficiency<br>Viapix-Service<br>Processing of data in the field<br>• Creation of the database<br>• The absolute reference<br>• Reading and measuring according to the image<br>• Cartography                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | VIAPIX System is a company specialized in the design and integration of solutions of high technological value, for the inventory, digitization and diagnosis of transport infrastructures. VIAPIX System, leader in its field in France, is a provider of technology and solutions dedicated to the digitization of transport infrastructures. |  | 1      | 1,200,000.00<br>EUR          | 1,200,000.00<br>EUR         | 3                         | yes      | 1,401,000.00<br>EUR | A   |

|   |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                          |                                                                                       |                   |                   |                   |     |                             |                             |   |
|---|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------|-------------------|-------------------|-----|-----------------------------|-----------------------------|---|
|   |                           | <ul style="list-style-type: none"><li>• Import/Export S.I.G.</li><li>• Online viewer</li><li>• Immersive views</li><li>• Measurement and localization</li><li>• Web mapping link</li></ul> INTELLIGENT PROCESSING<br>Automatic processing, recognition and coding applications and services.<br>Automatic inventory of vertical signs (SV): <ul style="list-style-type: none"><li>• The police</li><li>• Direction</li><li>• Traffic lights</li><li>• Road beacons</li></ul> Equipment warranty 8 years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                          |                                                                                       |                   |                   |                   |     |                             |                             |   |
| 4 | ROADSCAN SYSTEM           | <p>The RoadScan system uses air-launched horn antennas, providing a method of collecting data at highway speeds and eliminating the need for lane closures. It is now possible for road specialists to collect hundreds of kilometers of pavement thickness data in a single day. Provides engineers and road departments with an effective road survey tool for evaluating base and subbase layers with data collection densities that cannot be obtained by other labor-intensive methods such as coring. Construction workers, engineers and road departments can identify and delineate voids below the surface with ground-penetrating radar (GPR). Thus, with the FLB 250 antenna, the foundation of the road structure can be investigated up to a depth of 6m, with the FLB 500 antenna, the road structure can be investigated in detail up to an investigation depth of 1.5m, highlighting the building networks, and with the HA 2000 antenna the asphalt/concrete structure can be scanned in very high detail up to a depth of 0.5m highlighting reinforcement, water retaining areas, cracks, asphalt mat thickness, continuity or degree of compaction.</p> |   | 1                                                                                     | 250,000.00<br>EUR | 250,000.00<br>EUR | 5                 | yes | <b>1,651,000.00<br/>EUR</b> | B                           |   |
| 5 | PRIMAX<br>2500<br>TRAILER | <ul style="list-style-type: none"><li>-Two axles trailer</li><li>-2,5 m geophone beam</li><li>-Automatic transport locks</li><li>-White color (RAL9010)</li><li>-Hard cover for protection</li><li>-Warning lights (FLASH type)</li><li>-Recording equipment (24 volts)</li><li>-Software and hardware for data collection</li><li>-DMI integrated in the software</li><li>-Integrated GPS interface</li><li>-PC calculator (Windows operating system included)</li><li>-Manuals in English language (2 copies)</li><li>-24 month warranty for HWD parts</li><li>-6 months warranty for PC</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -                                                                                                                                                                        |  | 1                 | 228,000.00<br>EUR | 228,000.00<br>EUR | 6   | yes                         | <b>1,879,000.00<br/>EUR</b> | B |

|   |                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                      |   |                   |                   |    |     |                             |                     |
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| 6 | MK2 GRIPTESTER ROADBASE                       | <ul style="list-style-type: none"> <li>- Drawbar</li> <li>- Calibration kit/tools</li> <li>- Cable: Grip Tester - data collection computer</li> <li>- Drawbar</li> <li>- Calibration kit/tools</li> <li>- Cable: Grip Tester - data collection computer</li> <li>- Laptop with ROADBASE software installed</li> <li>- Real time monitoring/generator</li> <li>- Proximity sensor and 7m cable</li> <li>- Customized 800L tank, pump, pipes, electronic valve and flow meter</li> <li>- GPS system</li> </ul>                                                                                                                                                                                                                                                                 | <p>The GripTester MK2 is the world's number one trailer-based continuous roughness measurement equipment. It works on a principle of measuring the skid resistance of a surface by rolling a sliding or skidding measuring wheel against two drive tires. The GripTester is a three-wheel trailer with a 85 kilograms weight. The single measuring wheel is braked by 15% and the load and resistance on this wheel is continuously measured. The coefficient of friction (load/drag), known as GripNumber, is sent to a data collection computer in the cab of the towing vehicle.</p> |   | 1 | 141,000.00<br>EUR | 141,000.00<br>EUR | 7  | yes | <b>2,020,000.00<br/>EUR</b> | B                   |
| 7 | SENSOR DE RETROREFLECTIE ZEHNTNER ZDR 6020 RL | <p>ZDR 6020 measuring head with removable sunshade, mounting adapters (left/right) for measuring head mounting, power supply unit (car box), ruggedized touchscreen tablet with installed ZDR 6020, „RetroGrabber“ software and microphone, tablet mount, calibration unit with calibration standard, GPS unit with DR for improved precision also in tunnels, mapping and data analysis software „MappingTools“, camera, tool kit including spare parts (6 Allen tools (1.5mm), 2mm, 2.5mm, 3mm, 4mm, 5mm), 1 M4 hex screw, 2 spanners (10mm, 19mm – 1 each), 1 spanner screwdriver 5 mm hex, 2 halogen lamps, 1 set of fuses, 2 protective glasses for measuring head), certificate of manufacturer, certificate of calibration, installation of the measuring system;</p> | <p>Vehicle-mounted retroreflectometer for safe and efficient continuous measurements<br/>Vehicle-mounted with accurate 300 measurements per second<br/>Handheld precision at up to 150 km/h (93 mph)<br/>Industrial grade touchscreen tablet</p>                                                                                                                                                                                                                                                                                                                                        |  | 1 | 167,482.00<br>EUR | 167,482.00<br>EUR | 12 | yes | <b>2,187,482.00<br/>EUR</b> | B<br>(optional<br>) |

|    |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                     |   |               |               |    |     |                         |               |
|----|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---|---------------|---------------|----|-----|-------------------------|---------------|
| 8  | RETRO SIGN GRX 3 - RETROREFLECTOMETR U                                                       | <p>A built-in digital camera makes it possible to take pictures of signs as well as scan barcodes and QR codes for asset management purpose.</p> <p>The man-machine user interface is through a large 5” WVGA colour touch display clearly visible even in bright sunshine.</p> <p>The working range of the instrument is 0 – 2.000 cd x lx-1 x m-2.</p>                                                                                                                                                                                                                                                                                                                                                  | <p>RetroSign GRX is the most advanced retroreflectometer available on the market currently for measuring retroreflection of road traffic signs, high visibility clothing, license plates and reflective tapes.</p> <p>RetroSign GRX is built in accordance with existing standards to allow for retroreflection measurement of various colours and all type of retroreflective materials including fluorescence types.</p> <p>RetroSign GRX uses advanced sensor technology to allow for measurement of up to seven observation angles in addition to automatic colour recognition. The angles available to the user are: 0.2°, 0.33°, 0.5°, 0.7°, 1.0°, 1.5°, 2.0°</p> |  | 3 | 12,100.00 EUR | 36,300.00 EUR | 13 | yes | <b>2,223,782.00 EUR</b> | B (optional ) |
| 9  | Software for designing roads, bridgesAllplan Bridge Modeler 2023"Allplan Bridge Modeler 2023 | <p>"Software package - Allplan Bridge Modeler 2023Interface, 3D Modeling, 2D Drawing, Visualization, BIM Easy Content Package, Reinforcement, Design and Detailing of Prefabricated Elements, Steel Connections, Plan Element, Quantities and Costs, Terrain Modeling, Embankments, Urban Design, Landscaping, Roads, Sewerage Networks and utilities, Modeling Bridges, Preparation of site organization plans, Predefined language and country settings, Share, Bimplus Pro, AutoConverter, "+ Alize(mechanical analysis with back-calculation option)</p>                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                     | 1 | 18,786.00 EUR | 18,786.00 EUR | 8  | yes | <b>2,242,568.00 EUR</b> | C             |
| 10 | Asset Management, Bridge Management System                                                   | <p>Bridge Management System is a world class bridge asset management package used both in the UK and internationally. It gives all the tools you and your organisation need to maintain a stock of bridges, retaining walls, signs, tunnels or any other asset you can think of.</p> <p>The software is highly customisable, extendable and translatable, containing the latest in GIS technology and supporting all industry standard data formats and more, e.g., ESRI, MapInfo, Intergraph, Bentley, Lizard Tech, ERMapper etc.</p> <p>Data collection and inspections are made easy with Mobile application for all portable devices including any Windows Laptop, Tablet, Android or iOS device.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                     | 1 | 50,000.00 EUR | 50,000.00 EUR | 4  | yes | <b>2,292,568.00 EUR</b> | C             |

|    |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                      |                                                                                       |    |               |               |    |     |                         |   |
|----|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----|---------------|---------------|----|-----|-------------------------|---|
| 11 | System for monitoring/establishing the intensity of road traffic on national roads | <p>The project includes the purchase of <b>15 units</b> of video analysis for monitoring objects (transport units) and evaluating their trajectories in real time using the RTSP camera stream, with H264 or H265 video encoding, together with the Software that allows remote control and configuration of the unit. The unit must process two-way traffic using real-time camera feed. All calculations that are related to the extraction of traffic data from the images and their interpretation must take place inside the unit (locally); after connecting the camera, the unit works as an independent system - a configurable traffic sensor.</p>                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                      |    | 15 | 5,400.00 EUR  | 81,000.00 EUR | 10 | no  | <b>2,373,568.00 EUR</b> | C |
| 12 | APARAT FRAASS AUTOMAT                                                              | <ul style="list-style-type: none"> <li>- Resolution 10mN</li> <li>- Temp.: min -45°C - max +60°C</li> <li>Programs:</li> <li>- Standard- Program;</li> <li>- Fast- Program;</li> <li>- Search-Mode;</li> <li>- USER-Definable-Program;</li> <li>- Complete with 10 test boards</li> </ul> <p>ADDITIONAL ELEMENTS<br/>REQUIRED AUTOMATIC FRAAS DEVICE</p> <ul style="list-style-type: none"> <li>- COOLER WITH TANK</li> <li>- Display resolution:0.1°</li> <li>- Filling volume: 1.4 L</li> <li>- Cooling capacity: 300W at +15°C</li> <li>- Pump pressure capacity: 14L/min, 250 mbar</li> <li>- Pump suction capacity: 10.5L/min, 170 mbar</li> <li>- Hose connection (bars): M16 x 1 male for hose d = 8 or 12 mm</li> <li>POLISHED MAGNETIC BLOCK</li> <li>METAL PLATE PLIERS</li> <li>MELTING APPARATUS BPM 5</li> <li>DRAIN TRAY, 80ML</li> <li>PRINTER.</li> </ul> | <p>The automatic breaking point tester determines the brittle behavior of bitumen at low temperatures. The Fraass breaking point is the temperature at which the first crack appears in the shell of a thin, flat steel plate, bent at low temperatures.</p>                                                                         |    | 1  | 55,900.00 EUR | 55,900.00 EUR | 11 | yes | <b>2,429,468.00 EUR</b> | D |
| 13 | Laboratory equipment- Aphalpt mix analyzer                                         | <ul style="list-style-type: none"> <li>- Automatic closed loop system</li> <li>- According to EN 12697-1</li> <li>- Maximum sample weight: 3.5 kg</li> <li>- Centrifugal rotation speed: 8000 rpm</li> <li>- Scale: 10kg, 0.1g res</li> <li>- Cup dimensions: Ø120mm x H200mm</li> <li>- Extraction time: less than an hour depending on type of tested mixture (includes time drying)</li> <li>- The solvent can be reused for more tests</li> <li>- Power: 230V, 50Hz</li> <li>- Dimensions: 1400x750x1500 mm</li> <li>- Weight: approx. 240 kg</li> </ul> <p>WASHING DRUM, FABRIC<br/>0.063MM<br/>WASHER DRUM COVER</p>                                                                                                                                                                                                                                                | <p>The Asphalt Mix Analyzer (AMA) is an innovative device capable of combining all the processes associated with bitumen extraction and recovery. The unit has been designed for the purpose of determining the bitumen content in asphalt mixture and it is the best solution to analyze and characterize the properties of the</p> |  | 1  | 54,577.76 EUR | 54,577.76 EUR | 9  | yes | <b>2,484,045.76 EUR</b> | D |

|  |                                          |                                                                                                                                                                                                                                                                                                                     |                                      |  |  |  |                     |  |  |  |  |  |
|--|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--|--|--|---------------------|--|--|--|--|--|
|  |                                          | CUP CENTRIFUGE 120 MM DIA.<br>CAPACITY 300G<br>CENTRIFUGE CUP PAPER SET<br>100 PCS<br>- Sun. 370x200mm;<br>- package 100 pcs.<br>BALANCE WORKTOP<br>SOLVENT STABILIZER<br>SOLVENT PUMPING DEVICE<br>CUP EXTRACTION DEVICE<br>QUICK CONNECTION OF THE<br>ROTARY EVAPORATOR<br>WATER COOLING SYSTEM, 400V<br>3PH 50HZ | reclaimed asphalt<br>pavement (RAP). |  |  |  |                     |  |  |  |  |  |
|  | *The indicated prices do not include VAT |                                                                                                                                                                                                                                                                                                                     |                                      |  |  |  | 2,484,045.76<br>EUR |  |  |  |  |  |

|       |                                      |                       |                  |
|-------|--------------------------------------|-----------------------|------------------|
| LOT A | Critical RAMS workflow<br>components | Must have             | 1,401,000.00 EUR |
| LOT B | Additional measuring equipment       | Strongly like to have | 822,782.00 EUR   |
| LOT C | Additional software                  | Nice to have          | 149,786.00 EUR   |
| LOT D | Asphalt lab equipment                | Nice to have          | 110,477.76 EUR   |
|       |                                      |                       | 2,484,045.76 EUR |

**ADDITIONAL CONSIDERATIONS:**  
Vehicle laboratory has to include vehicle by default  
Vehicle for measuring equipment (has to be included) under LOT B  
Vehicles have to be resistant to low quality roads  
Extended warranty of **5 years** is required for all software and equipment.

## TECHNICAL SPECIFICATIONS

for further RAMS development procured by NRA under a separate contract, funded by EBRD.

### Equivalence of Standards, Codes and Products

Wherever reference is made in the Technical Specifications to specific standards and codes to be met by the Goods or materials to be furnished or tested, the provisions of the latest current edition or revision of the relevant standards or codes in effect shall apply, unless otherwise expressly stated in the Technical Specifications. Where such standards and codes are national or related to a particular country or region, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be acceptable.

Wherever reference is made in the Technical Specifications to specific brand names, trademarks, patents, copyrights, designs or other designations, other Goods of equivalent or higher quality will be acceptable.

| LOT 1          |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1.1</b>     | <b>Specification for Road Asset Management solution</b>                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>1.1.1</b>   | <b>General Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| a)             | Road Assets Management solution should be an advanced road infrastructure management system designed to streamline the assessment, planning, and maintenance of road networks. Size of the road network is 6.000 km.                                                                                                                                                                                                                                        |
| b)             | By integrating cutting-edge technologies such as 360° immersive imaging, automated pavement degradation analysis, and interactive GIS-based mapping, the platform should provide road managers with comprehensive insights into the condition of roadways, signage, and markings.                                                                                                                                                                           |
| c)             | Key functionalities should include real-time visualization of road conditions, detailed inventory tracking, and long-term roadworks planning.                                                                                                                                                                                                                                                                                                               |
| d)             | The system should support compliance with international standards (e.g., French LCPC N°38-2 or similar), ensuring accurate and reliable evaluations.                                                                                                                                                                                                                                                                                                        |
| e)             | Additionally, the platform should facilitate efficient decision-making through robust reporting tools, customizable dashboards, and role-based user management.                                                                                                                                                                                                                                                                                             |
| f)             | Designed with scalability and accessibility in mind, it should empower public agency to optimize road safety, maintenance, and budgeting, enhancing the longevity and quality of transportation infrastructure.                                                                                                                                                                                                                                             |
| g)             | The RAMS can be offered as a desktop or web or hybrid solution.                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>1.1.2</b>   | <b>Functional Requirements</b>                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>1.1.2.1</b> | <b>Road Data Collection and Visualization Support</b>                                                                                                                                                                                                                                                                                                                                                                                                       |
| a)             | 360° Immersive Imaging Support: <ul style="list-style-type: none"><li>System must support import of images from devices that capture high definition images at 30 FPS (frames per second) with geotagging.</li><li>System must be able to show images/video in the platform's viewer (see 2.1.2.5).</li></ul>                                                                                                                                               |
| b)             | Data Upload: <ul style="list-style-type: none"><li>Users must be able to upload bulk road data (images, metadata) via a web interface.</li><li>Upload validation should check for supported formats, file sizes (max 2 GB per file), and metadata consistency.</li></ul>                                                                                                                                                                                    |
| <b>1.1.2.2</b> | <b>Pavement Degradation Assessment</b>                                                                                                                                                                                                                                                                                                                                                                                                                      |
| a)             | Assessment Standards: <ul style="list-style-type: none"><li>Implement degradation standard (e.g. French standard LCPC N°38-2 or similar), with degradation types such as:<ul style="list-style-type: none"><li>✓ Longitudinal cracks</li><li>✓ Potholes</li><li>✓ Raveling</li></ul></li><li>Allow configuration for alternative standards, e.g., EN or ASTM.</li></ul>                                                                                     |
| b)             | Automatic Assessment: <ul style="list-style-type: none"><li>AI/ML integration to classify pavement defects using uploaded images. <i>(This is not envisioned as a service, rather as a functionality system has to have in order to accept the data gathered by vehicle laboratory.)</i></li><li>Provide an accuracy metric (target: &gt;90% for defect detection).</li></ul>                                                                               |
| c)             | Report Generation: <ul style="list-style-type: none"><li>Generate automated reports summarizing pavement conditions, including:<ul style="list-style-type: none"><li>✓ Percentage area affected;</li><li>✓ Severity levels (Low, Medium, High).</li></ul></li></ul>                                                                                                                                                                                         |
| <b>1.1.2.3</b> | <b>Interactive Map Features</b>                                                                                                                                                                                                                                                                                                                                                                                                                             |
| a)             | Condition Ratings Display: <ul style="list-style-type: none"><li>Use a multi-layer map system (e.g., Google Maps API or OpenStreetMap) with three rating types:<ul style="list-style-type: none"><li>✓ Surface Condition: Rated Poor/Moderate/Good.</li><li>✓ Structural Condition: Based on subsurface layer assessments.</li><li>✓ Overall Condition: Aggregated score.</li></ul></li><li>Ratings displayed as heatmaps or color-coded markers.</li></ul> |
| b)             | Filtering Options: <ul style="list-style-type: none"><li>Filter map layers by:<ul style="list-style-type: none"><li>✓ Pavement defect type (e.g., cracks, rutting).</li><li>✓ Condition rating (Poor/Moderate/Good).</li><li>✓ Geographic area (e.g., radius search or administrative boundary).</li></ul></li></ul>                                                                                                                                        |
| c)             | User Interaction: <ul style="list-style-type: none"><li>Enable zoom, pan, and drill-down features.</li><li>Click markers to view associated data (e.g., 360° images, defect details).</li></ul>                                                                                                                                                                                                                                                             |
| <b>1.1.2.4</b> | <b>Roadworks Management</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| a)             | Roadworks Planning: <ul style="list-style-type: none"><li>Allow users to add roadwork entries with fields:<ul style="list-style-type: none"><li>✓ Location (geotagged or drawn polygon).</li><li>✓ Work type (resurfacing, patching, etc.).</li><li>✓ Schedule (start and end dates).</li><li>✓ Estimated cost.</li></ul></li><li>Entries are editable for authorized users.</li></ul>                                                                      |
| b)             | Completion Tracking: <ul style="list-style-type: none"><li>Road managers can mark roadworks as "Completed," prompting:<ul style="list-style-type: none"><li>✓ Timestamp logging.</li><li>✓ Notification updates to stakeholders.</li></ul></li></ul>                                                                                                                                                                                                        |
| c)             | Roadworks Visualization: <ul style="list-style-type: none"><li>Dedicated map layer for roadworks, color-coded by:<ul style="list-style-type: none"><li>✓ Status (Planned/Ongoing/Completed).</li><li>✓ Time horizon (e.g., ≤1 year, 1–3 years, 3–6 years).</li></ul></li></ul>                                                                                                                                                                              |
| <b>1.1.2.5</b> | <b>360° Immersive Picture Viewer</b>                                                                                                                                                                                                                                                                                                                                                                                                                        |

|                |                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a)             | <b>Image Navigation:</b> <ul style="list-style-type: none"> <li>Interactive controls for: <ul style="list-style-type: none"> <li>✓ Pan (drag to rotate view).</li> <li>✓ Zoom (2x–10x magnification).</li> <li>✓ Orientation reset.</li> </ul> </li> </ul>                                                                                                                                             |
| b)             | <b>Map Synchronization:</b> Clicking on a geolocation in the map auto-opens the corresponding image.                                                                                                                                                                                                                                                                                                   |
| c)             | <b>Annotations:</b> Users can add annotations (text or icons) to mark defects or points of interest in images.                                                                                                                                                                                                                                                                                         |
| <b>1.1.2.6</b> | <b>Street Signage and Road Markings Inventory</b>                                                                                                                                                                                                                                                                                                                                                      |
| a)             | <b>Data Capture:</b> <ul style="list-style-type: none"> <li>Inventory data should include: <ul style="list-style-type: none"> <li>✓ Type (e.g., Stop Sign, Pedestrian Crossing).</li> <li>✓ Location (geotagged coordinates).</li> <li>✓ Condition (Poor/Average/Good).</li> </ul> </li> <li>Integration with road audit data collection devices.</li> </ul>                                           |
| b)             | <b>Interactive Map Integration:</b> <ul style="list-style-type: none"> <li>Visual representation of signage and markings using icons.</li> <li>Filter options: <ul style="list-style-type: none"> <li>✓ Type (e.g., regulatory signs, warning signs).</li> <li>✓ Condition (Poor/Average/Good).</li> </ul> </li> </ul>                                                                                 |
| c)             | <b>Rating Updates:</b> Road managers can manually update condition ratings via the platform.                                                                                                                                                                                                                                                                                                           |
| <b>1.1.2.7</b> | <b>Reporting and Dashboards</b>                                                                                                                                                                                                                                                                                                                                                                        |
| a)             | Customizable Reports: <ul style="list-style-type: none"> <li>Report types: <ul style="list-style-type: none"> <li>✓ Pavement Condition Summary.</li> <li>✓ Roadworks Status Report.</li> <li>✓ Signage Inventory Condition.</li> </ul> </li> <li>Export formats: PDF, CSV, and Excel.</li> </ul>                                                                                                       |
| b)             | Performance Dashboards: <ul style="list-style-type: none"> <li>Key metrics displayed on a dashboard: <ul style="list-style-type: none"> <li>✓ % of road network rated Poor/Moderate/Good.</li> <li>✓ Number of planned vs. completed roadworks.</li> <li>✓ Cost analysis of roadworks.</li> </ul> </li> </ul>                                                                                          |
| <b>1.1.3</b>   | <b>Non-Functional Requirements</b>                                                                                                                                                                                                                                                                                                                                                                     |
| <b>1.1.3.1</b> | <b>User Management and Security</b>                                                                                                                                                                                                                                                                                                                                                                    |
| a)             | <b>Role-Based Access Control (RBAC):</b> <ul style="list-style-type: none"> <li>Roles: Admin, Manager, Auditor, Viewer.</li> <li>Each role defines specific permissions (e.g., Add/Edit/Delete/Read).</li> </ul>                                                                                                                                                                                       |
| b)             | <b>Authentication:</b> Optional multi-factor authentication (MFA) via email or SMS.                                                                                                                                                                                                                                                                                                                    |
| c)             | <b>Data Security:</b> Optional encryption for data at rest (AES-256) and in transit (TLS 1.3).                                                                                                                                                                                                                                                                                                         |
| d)             | <b>Audit Trail:</b> Log all user actions (e.g., data uploads, edits, roadworks updates).                                                                                                                                                                                                                                                                                                               |
| <b>1.1.3.2</b> | <b>Technical and Integration Requirements</b>                                                                                                                                                                                                                                                                                                                                                          |
| a)             | API Integration <ul style="list-style-type: none"> <li>RESTful APIs for data import/export.</li> <li>Support for third-party systems (e.g., GIS tools, ERP software).</li> </ul>                                                                                                                                                                                                                       |
| b)             | Scalability <ul style="list-style-type: none"> <li>Must handle up to 100 simultaneous users and 1 TB of road data storage.</li> <li>User classification estimation: 3 Administrators, up to 25 Standard Users, up to 75 Read-Only Users</li> </ul>                                                                                                                                                     |
| c)             | Hosting <ul style="list-style-type: none"> <li>Cloud On Governmental M-Cloud platform and/or on-premises deployment options.</li> </ul>                                                                                                                                                                                                                                                                |
| <b>1.1.3.3</b> | <b>Platform Design and Accessibility</b>                                                                                                                                                                                                                                                                                                                                                               |
| a)             | Responsive Design: <ul style="list-style-type: none"> <li>The platform must automatically adapt its layout and components to different screen sizes (desktop, tablet, mobile).</li> <li>Minimum supported screen resolutions: <ul style="list-style-type: none"> <li>✓ Desktop: 1920x1080</li> <li>✓ Tablet: 1280x800</li> <li>✓ Mobile: 375x667</li> </ul> </li> </ul>                                |
| b)             | User Interface (UI): <ul style="list-style-type: none"> <li>UI components must be built using modern frameworks (e.g., React.js, Angular, or Vue.js).</li> <li>Use clear typography, intuitive navigation, and consistent icons/buttons across devices.</li> </ul>                                                                                                                                     |
| <b>1.1.4</b>   | <b>Other Requirements</b>                                                                                                                                                                                                                                                                                                                                                                              |
| <b>1.1.4.1</b> | <b>Support and Maintenance</b>                                                                                                                                                                                                                                                                                                                                                                         |
| a)             | Free software updates and patches for a minimum of 5 years (in line with general requirements for 5-year extended warranty).                                                                                                                                                                                                                                                                           |
| b)             | Access to a dedicated support team (email, phone, live chat).                                                                                                                                                                                                                                                                                                                                          |
| c)             | Comprehensive documentation, tutorials, and user guides.                                                                                                                                                                                                                                                                                                                                               |
| d)             | The Supplier must provide integration services and prove that Road Asset Management solution (under this paragraph) and Vehicle laboratory equipment (under para.1.3 below) are compatible and can work in unison. This requirement presumes that data collected with the Vehicle laboratory equipment can be loaded through semi-automated simplified procedures into Road Asset Management solution. |
| e)             | 5 (five) year extended warranty / maintenance period (to be included in price of the item).                                                                                                                                                                                                                                                                                                            |
| <b>1.1.4.2</b> | <b>Training and Onboarding</b>                                                                                                                                                                                                                                                                                                                                                                         |
| a)             | Initial training sessions for up to 10 users (on-site). Train-the-trainer concept should be supported which includes establishment of training archive (recordings of training / on-screen guides). Optional annual training (paid separately) per Client request.                                                                                                                                     |
| b)             | Customizable training materials.                                                                                                                                                                                                                                                                                                                                                                       |
| c)             | All training, manuals and booklets for regular maintenance and use shall be in Romanian and English language.                                                                                                                                                                                                                                                                                          |
| <b>1.2</b>     | <b>Specification for GIS software for the systematization, record keeping, analysis of the road infrastructure</b>                                                                                                                                                                                                                                                                                     |
| <b>1.2.1</b>   | <b>Functional Requirements</b>                                                                                                                                                                                                                                                                                                                                                                         |
| <b>1.2.1.1</b> | <b>Data Management</b>                                                                                                                                                                                                                                                                                                                                                                                 |
| a)             | Support for vector (e.g., SHP, GeoJSON, KML) and raster (e.g., GeoTIFF, JPEG2000) data formats.                                                                                                                                                                                                                                                                                                        |
| b)             | Ability to import, export, and convert geospatial data between formats.                                                                                                                                                                                                                                                                                                                                |
| c)             | Support for managing spatial databases such as PostGIS or SQLite/Spatialite.                                                                                                                                                                                                                                                                                                                           |
| d)             | Advanced metadata management for datasets, including creation, editing, and version control.                                                                                                                                                                                                                                                                                                           |
| <b>1.2.1.2</b> | <b>Geospatial Analysis</b>                                                                                                                                                                                                                                                                                                                                                                             |
| a)             | Tools for spatial analysis, including buffer, overlay, and proximity analysis.                                                                                                                                                                                                                                                                                                                         |
| b)             | Network analysis capabilities (e.g., shortest path calculation, route optimization, service area delineation).                                                                                                                                                                                                                                                                                         |
| c)             | Advanced road condition analysis, such as surface quality, traffic density, and congestion mapping.                                                                                                                                                                                                                                                                                                    |
| d)             | Terrain analysis tools (e.g., slope, elevation profiles, and visibility).                                                                                                                                                                                                                                                                                                                              |
| <b>1.2.1.3</b> | <b>Visualization and Mapping</b>                                                                                                                                                                                                                                                                                                                                                                       |
| a)             | Interactive map rendering with support for customizable symbology and labelling.                                                                                                                                                                                                                                                                                                                       |
| b)             | Layer styling with attributes, classifications, and rule-based rendering.                                                                                                                                                                                                                                                                                                                              |
| c)             | Thematic mapping for road classification, traffic patterns, and maintenance status.                                                                                                                                                                                                                                                                                                                    |
| d)             | Support for 2D and 3D visualization of infrastructure data.                                                                                                                                                                                                                                                                                                                                            |

|                |                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a)             | Integration with real-time traffic feeds (e.g., OpenTraffic, ITS systems).                                                                                                                                                                                                                                              |
| <b>1.2.1.4</b> | <b>Data Collection and Integration</b>                                                                                                                                                                                                                                                                                  |
| a)             | Compatibility with field data collection tools and mobile GIS apps.                                                                                                                                                                                                                                                     |
| b)             | Import and synchronization capabilities with existing infrastructure databases and CAD systems.                                                                                                                                                                                                                         |
| c)             | Import and synchronization capabilities with existing infrastructure databases and CAD systems.                                                                                                                                                                                                                         |
| d)             | Import and synchronization capabilities with existing infrastructure databases and CAD systems.                                                                                                                                                                                                                         |
| <b>1.2.1.5</b> | <b>Record Keeping and Maintenance</b>                                                                                                                                                                                                                                                                                   |
| a)             | Asset inventory management for road segments, bridges, intersections, and ancillary structures.                                                                                                                                                                                                                         |
| b)             | Maintenance scheduling, tracking, and reporting.                                                                                                                                                                                                                                                                        |
| c)             | Support for attaching documents, images, and multimedia to road features.                                                                                                                                                                                                                                               |
| d)             | Historical data archiving and retrieval.                                                                                                                                                                                                                                                                                |
| <b>1.2.1.6</b> | <b>Interoperability</b>                                                                                                                                                                                                                                                                                                 |
| a)             | Adherence to OGC (Open Geospatial Consortium) standards for spatial data and web services.                                                                                                                                                                                                                              |
| b)             | API support for third-party integration and customization (e.g., REST, GraphQL).                                                                                                                                                                                                                                        |
| c)             | Plug-in architecture to allow for additional functionalities by third-party developers.                                                                                                                                                                                                                                 |
| <b>1.2.2</b>   | <b>Non-Functional Requirements</b>                                                                                                                                                                                                                                                                                      |
| <b>1.2.2.1</b> | <b>Usability</b>                                                                                                                                                                                                                                                                                                        |
| a)             | Intuitive user interface designed for non-GIS professionals and technical users.                                                                                                                                                                                                                                        |
| b)             | Multi-language support.                                                                                                                                                                                                                                                                                                 |
| c)             | Accessibility features compliant with WCAG standards.                                                                                                                                                                                                                                                                   |
| <b>1.2.2.2</b> | <b>Performance</b>                                                                                                                                                                                                                                                                                                      |
| a)             | Scalability to handle large datasets with millions of features.                                                                                                                                                                                                                                                         |
| b)             | High-performance rendering and analysis for real-time applications.                                                                                                                                                                                                                                                     |
| c)             | Cloud and/or on-premises deployment options.                                                                                                                                                                                                                                                                            |
| <b>1.2.2.3</b> | <b>Security</b>                                                                                                                                                                                                                                                                                                         |
| a)             | Role-based access control and user authentication.                                                                                                                                                                                                                                                                      |
| b)             | Support for secure communication protocols (e.g., HTTPS, SSL/TLS).                                                                                                                                                                                                                                                      |
| c)             | Regular software updates and vulnerability patches                                                                                                                                                                                                                                                                      |
| <b>1.2.2.4</b> | <b>Reliability</b>                                                                                                                                                                                                                                                                                                      |
| a)             | Fault-tolerant architecture to minimize downtime.                                                                                                                                                                                                                                                                       |
| b)             | Automatic data backup and disaster recovery mechanisms.                                                                                                                                                                                                                                                                 |
| <b>1.2.2.5</b> | <b>Extensibility</b>                                                                                                                                                                                                                                                                                                    |
| a)             | Modular design to accommodate future enhancements                                                                                                                                                                                                                                                                       |
| b)             | Compatibility with open-source libraries and frameworks.                                                                                                                                                                                                                                                                |
| <b>1.2.3</b>   | <b>System Architecture</b>                                                                                                                                                                                                                                                                                              |
| <b>1.2.3.1</b> | <b>Data Storage</b>                                                                                                                                                                                                                                                                                                     |
| a)             | Spatial database (e.g., PostgreSQL with PostGIS) for efficient storage and querying.                                                                                                                                                                                                                                    |
| b)             | File-based data handling for temporary or lightweight operations.                                                                                                                                                                                                                                                       |
| <b>1.2.3.2</b> | <b>User Interface</b>                                                                                                                                                                                                                                                                                                   |
| a)             | Web-based client for cross-platform accessibility.                                                                                                                                                                                                                                                                      |
| b)             | Desktop application for offline and advanced operations                                                                                                                                                                                                                                                                 |
| <b>1.2.3.3</b> | <b>Integration</b>                                                                                                                                                                                                                                                                                                      |
| a)             | Interoperability with existing ERP and asset management systems.                                                                                                                                                                                                                                                        |
| b)             | API/SDK for building custom workflows and applications.                                                                                                                                                                                                                                                                 |
| <b>1.2.4</b>   | <b>Other Requirements</b>                                                                                                                                                                                                                                                                                               |
| <b>1.2.4.1</b> | <b>Support and Maintenance</b>                                                                                                                                                                                                                                                                                          |
| a)             | Free software updates and patches for a minimum of 5 years (in line with general requirements for 5-year extended warranty).                                                                                                                                                                                            |
| b)             | Access to a dedicated support team (email, phone, live chat).                                                                                                                                                                                                                                                           |
| c)             | Comprehensive documentation, tutorials, and user guides.                                                                                                                                                                                                                                                                |
| d)             | 5 (five) year extended warranty / maintenance period (to be included in price of the item).                                                                                                                                                                                                                             |
| <b>1.2.4.2</b> | <b>Training and Onboarding</b>                                                                                                                                                                                                                                                                                          |
| a)             | Initial training sessions for up to 10 users (on-site). Train-the-trainer concept should be supported which includes establishment of training archive (recordings of training / on-screen guides). Optional annual training (paid separately) per Client request.                                                      |
| b)             | Customizable training materials.                                                                                                                                                                                                                                                                                        |
| c)             | All training, manuals and booklets for regular maintenance and use shall be in Romanian and English language.                                                                                                                                                                                                           |
| <b>1.2.4.3</b> | <b>Compliance and Standards</b>                                                                                                                                                                                                                                                                                         |
| a)             | Compliance with ISO 19115 for geospatial metadata.                                                                                                                                                                                                                                                                      |
| b)             | Adherence to INSPIRE and national geospatial data infrastructure (NSDI) standards.                                                                                                                                                                                                                                      |
| c)             | Compliance with environmental and urban planning regulations.                                                                                                                                                                                                                                                           |
| <b>1.3</b>     | <b>Specification for Vehicle laboratory for collecting RAMS data</b>                                                                                                                                                                                                                                                    |
|                | To efficiently handle a Road Asset Management System (RAMS), an equipment laboratory vehicle must be equipped with tools and technologies capable of collecting, analysing, and reporting data related to road assets and conditions. The Vehicle laboratory for collecting RAMS data thus consist of three components: |
| a)             | Data collection equipment                                                                                                                                                                                                                                                                                               |
| b)             | Vehicle                                                                                                                                                                                                                                                                                                                 |
| c)             | Software for processing measured data                                                                                                                                                                                                                                                                                   |
| <b>1.3.1</b>   | <b>Technical specification of Data collection equipment</b>                                                                                                                                                                                                                                                             |
|                | Each piece of equipment should be modular and compatible with industry-standard software for seamless integration into the overall RAMS framework defined under 2.1.                                                                                                                                                    |
| <b>1.3.1.1</b> | <b>High-Resolution Cameras</b>                                                                                                                                                                                                                                                                                          |
| a)             | <b>Resolution:</b> Minimum 12 MP (megapixels), recommended 20 MP or higher.                                                                                                                                                                                                                                             |
| b)             | <b>Frame Rate:</b> 60 fps (frames per second) for video recording to capture fast-moving environments.                                                                                                                                                                                                                  |
| c)             | <b>Field of View (FOV):</b> Adjustable wide-angle, 90°–120°.                                                                                                                                                                                                                                                            |
| d)             | <b>Mounting:</b> Stabilized gimbal or vibration-damping mounts.                                                                                                                                                                                                                                                         |
| e)             | <b>Storage Format:</b> Supports RAW and compressed formats like JPEG, MP4, or H.264/H.265                                                                                                                                                                                                                               |
| f)             | <b>Connectivity:</b> Wi-Fi, USB, or Ethernet for real-time data transfer.                                                                                                                                                                                                                                               |
| g)             | <b>Weather Resistance:</b> IP67 or higher for durability in extreme conditions.                                                                                                                                                                                                                                         |
| <b>1.3.1.2</b> | <b>Laser Scanners or LiDAR</b>                                                                                                                                                                                                                                                                                          |
| a)             | <b>Range:</b> 100–200 meters (short to medium range) or up to 1000 meters for longrange applications.                                                                                                                                                                                                                   |
| b)             | <b>Accuracy:</b> ±2 mm for high-precision measurements.                                                                                                                                                                                                                                                                 |
| c)             | <b>Resolution:</b> Minimum 300,000 points per second; higher for detailed 3D mapping                                                                                                                                                                                                                                    |
| d)             | <b>Scan Frequency:</b> 10–100 Hz.                                                                                                                                                                                                                                                                                       |
| e)             | <b>Field of View:</b> 360° horizontal, 30°–90° vertical (depending on the application).                                                                                                                                                                                                                                 |
| f)             | <b>Power Supply:</b> 12–24V DC.                                                                                                                                                                                                                                                                                         |
| g)             | <b>Data Output:</b> Standard formats such as LAS, PLY, or XYZ.                                                                                                                                                                                                                                                          |
| h)             | <b>Environmental Rating:</b> IP65 or higher.                                                                                                                                                                                                                                                                            |
| <b>1.3.1.3</b> | <b>Road Profilers</b>                                                                                                                                                                                                                                                                                                   |
| a)             | <b>Type:</b> Inertial or laser-based road profiling systems.                                                                                                                                                                                                                                                            |
| b)             | <b>Accuracy:</b> ±1 mm for surface roughness (IRI) measurements.                                                                                                                                                                                                                                                        |

|         |                                                                                                                                                                                                                                      |
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| c)      | <b>Operating Speed:</b> 10–100 km/h for use in dynamic environments.                                                                                                                                                                 |
| d)      | <b>Vertical Range:</b> 0–100 mm (for rutting and deformation measurements).                                                                                                                                                          |
| e)      | <b>Sampling Rate:</b> 16 kHz or higher.                                                                                                                                                                                              |
| f)      | <b>Data Output:</b> Compatible with RAMS software formats (CSV, XML, or custom).                                                                                                                                                     |
| g)      | <b>Environmental Protection:</b> Sealed housing for dust and water resistance (IP65 or above).                                                                                                                                       |
| 1.3.1.4 | <b>GPS and GNSS Systems</b>                                                                                                                                                                                                          |
| a)      | <b>Positioning Accuracy:</b> Sub-meter to centimeter-level using RTK (Real-Time Kinematic) corrections.                                                                                                                              |
| b)      | <b>Channels:</b> Minimum 72-channel tracking for GPS, GLONASS, Galileo, and BeiDou.                                                                                                                                                  |
| c)      | <b>Update Rate:</b> 1–10 Hz.                                                                                                                                                                                                         |
| d)      | <b>Power Supply:</b> 5–12V DC.                                                                                                                                                                                                       |
| e)      | <b>Data Interface:</b> RS-232, USB, or Bluetooth.                                                                                                                                                                                    |
| f)      | <b>Antenna Type:</b> Multi-band with low-noise amplifiers for enhanced signal reception.                                                                                                                                             |
| g)      | <b>Durability:</b> Rugged and weatherproof (IP67).                                                                                                                                                                                   |
| 1.3.1.5 | <b>Automatic Road Crack Detection Systems</b>                                                                                                                                                                                        |
| a)      | <b>Resolution:</b> Minimum 0.1 mm crack width detection.                                                                                                                                                                             |
| b)      | <b>Detection Speed:</b> Real-time processing at 100 frames per second or higher.                                                                                                                                                     |
| c)      | <b>Software Integration:</b> AI-enabled algorithms for crack classification and measurement                                                                                                                                          |
| d)      | <b>Lighting:</b> Integrated LED illumination for consistent imaging under varying light conditions.                                                                                                                                  |
| e)      | <b>Output Formats:</b> Exportable images and defect logs in standard formats (e.g., CSV, JSON).                                                                                                                                      |
| f)      | <b>Camera Integration:</b> Compatible with high-resolution cameras (2.3.1.1) for seamless operation.                                                                                                                                 |
| 1.3.1.6 | <b>Traffic and Signage Recognition Cameras</b>                                                                                                                                                                                       |
| a)      | <b>Resolution:</b> 12+ MP for clear image capture.                                                                                                                                                                                   |
| b)      | <b>Frame Rate:</b> Minimum 30 fps.                                                                                                                                                                                                   |
| c)      | <b>Recognition Capability:</b> Supports optical character recognition (OCR) and AI-based object recognition for traffic signs, road markings, etc                                                                                    |
| d)      | <b>Field of View:</b> Adjustable wide-angle, 100°–120°.                                                                                                                                                                              |
| e)      | <b>Software:</b> Machine learning algorithms for real-time detection and classification.                                                                                                                                             |
| f)      | <b>Output Formats:</b> Standard JSON or XML.                                                                                                                                                                                         |
| g)      | <b>Can be integrated/substituted with 1.3.1.1 (<i>High-Resolution Cameras</i>)</b>                                                                                                                                                   |
| 1.3.1.7 | <b>Onboard Data Integration Hub</b>                                                                                                                                                                                                  |
| a)      | <b>Processor:</b> Intel i7/i9 or equivalent for high-speed data processing.                                                                                                                                                          |
| b)      | <b>RAM:</b> Minimum 16 GB, recommended 32 GB.                                                                                                                                                                                        |
| c)      | <b>Storage:</b> At least 1 TB SSD, with RAID backup.                                                                                                                                                                                 |
| d)      | <b>Connectivity:</b> Ethernet, USB 3.0, and Wi-Fi for simultaneous data integration from multiple sources.                                                                                                                           |
| 1.3.2   | <b>Vehicle Specifications</b>                                                                                                                                                                                                        |
| a)      | A van-type vehicle capable of accommodating all the specified data collection equipment and operating effectively on poor roads is required here.                                                                                    |
| b)      | The base vehicle shall be of a model, which has an official dealership in the Republic of Moldova.                                                                                                                                   |
| 1.3.2.1 | <b>Chassis and Body</b>                                                                                                                                                                                                              |
| a)      | <b>Type:</b> High-roof, extended-wheelbase van.                                                                                                                                                                                      |
| b)      | <b>Model Examples:</b> Mercedes-Benz Sprinter 4x4, Ford Transit AWD, or similar.                                                                                                                                                     |
| c)      | <b>Dimensions:</b> <ul style="list-style-type: none"><li>Length: 6.0–7.0 meters (20–23 feet)</li><li>Width: 2.0–2.5 meters (6.5–8 feet)</li><li>Height: 2.5–3.0 meters (8–10 feet)</li></ul>                                         |
| d)      | <b>Load Capacity:</b> Minimum 1,200–1,800 kg (2,645–3,968 lbs) payload.                                                                                                                                                              |
| e)      | <b>Body Structure:</b> Reinforced frame to withstand rugged terrain                                                                                                                                                                  |
| f)      | <b>Doors:</b> Sliding side doors and double rear doors for easy equipment access and loading.                                                                                                                                        |
| 1.3.2.2 | <b>Engine and Drivetrain</b>                                                                                                                                                                                                         |
| a)      | <b>Engine:</b> Turbocharged diesel engine. <ul style="list-style-type: none"><li>Power: 150–200 hp.</li><li>Torque: 350–450 Nm.</li></ul>                                                                                            |
| b)      | <b>Drivetrain:</b> All-Wheel Drive (AWD) or 4x4 for poor road conditions.                                                                                                                                                            |
| c)      | <b>Transmission:</b> Automatic or manual with at least 6 speeds.                                                                                                                                                                     |
| d)      | <b>Fuel Tank Capacity:</b> 75–100 liters for long-range operations.                                                                                                                                                                  |
| e)      | <b>Fuel Economy:</b> 8–10 km/l (18–23 mpg) depending on terrain.                                                                                                                                                                     |
| 1.3.2.3 | <b>Suspension and Tires</b>                                                                                                                                                                                                          |
| a)      | <b>Suspension:</b> Heavy-duty suspension system. <ul style="list-style-type: none"><li>Front: Independent coil spring or MacPherson strut.</li><li>Rear: Leaf springs or air suspension for load stability.</li></ul>                |
| b)      | <b>Ground Clearance:</b> Minimum 200–250 mm (8–10 inches) for off-road capabilities.                                                                                                                                                 |
| c)      | <b>Tires:</b> All-terrain or mud-terrain tires. <ul style="list-style-type: none"><li>Size: 16–18 inches.</li><li>Load Rating: E-rated or higher.</li><li>Spare Tire: Full-sized, mounted externally or under the chassis.</li></ul> |
| 1.3.2.4 | <b>Electrical System</b>                                                                                                                                                                                                             |
| a)      | Alternator: High-output (200–300 amps) to support multiple electronic devices                                                                                                                                                        |
| b)      | Battery: Dual-battery system with one auxiliary battery for powering equipment.                                                                                                                                                      |
| c)      | <b>Power Outlets:</b> <ul style="list-style-type: none"><li>Multiple 12V DC and 230/110V AC outlets.</li><li>Inverter: 2,000–3,000W pure sine wave for sensitive equipment.</li></ul>                                                |
| 1.3.2.5 | <b>Interior Features</b>                                                                                                                                                                                                             |
| a)      | <b>Workspace:</b> <ul style="list-style-type: none"><li>Ergonomic desk/workbench for operating computers and data processing units.</li><li>Adjustable seating with safety harnesses.</li></ul>                                      |
| b)      | <b>Cabin Climate Control:</b> Dual-zone air conditioning and heating for equipment and personnel comfort.                                                                                                                            |
| c)      | <b>Lighting:</b> <ul style="list-style-type: none"><li>LED overhead lights for interior workspace.</li><li>External floodlights for night operations.</li></ul>                                                                      |
| d)      | <b>Noise Insulation:</b> Acoustic panels to reduce equipment noise and improve operator focus.                                                                                                                                       |
| 1.3.2.6 | <b>Equipment Mounting and Storage</b>                                                                                                                                                                                                |
| a)      | <b>Racks and Mounts:</b> <ul style="list-style-type: none"><li>Modular equipment racks with shock-absorbing mounts for cameras, LiDAR, and other sensitive devices.</li><li>Roof rack for antennas and external equipment</li></ul>  |
| b)      | <b>Storage Compartments:</b> Secure, lockable cabinets for storing tools, spare parts, and accessories.                                                                                                                              |
| c)      | <b>Flooring:</b> Reinforced anti-slip flooring with mounting points for heavy equipment.                                                                                                                                             |
| 1.3.2.7 | <b>Safety Features</b>                                                                                                                                                                                                               |
| a)      | <b>Brakes:</b> Anti-lock braking system (ABS) with Electronic Brake-force Distribution (EBD).                                                                                                                                        |
| b)      | <b>Safety Features:</b> Electronic Stability Control (ESC), hill descent control, and traction control.                                                                                                                              |

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| c)             | <b>Airbags:</b> Driver, passenger, and side-curtain airbags.                                                                                                                                                                                                                                                                                                                                           |
| d)             | <b>Fire Suppression System:</b> Integrated for engine and equipment areas.                                                                                                                                                                                                                                                                                                                             |
| e)             | <b>Emergency Equipment:</b> First aid kit, fire extinguisher, reflective triangles.                                                                                                                                                                                                                                                                                                                    |
| <b>1.3.2.8</b> | <b>External Features</b>                                                                                                                                                                                                                                                                                                                                                                               |
| a)             | <b>Roof Mounts:</b> <ul style="list-style-type: none"> <li>Antennas for GNSS, LiDAR, and communication systems.</li> <li>Space for solar panels (optional) to supplement power.</li> </ul>                                                                                                                                                                                                             |
| b)             | <b>External Lights:</b> High-powered LED floodlights for night-time data collection.                                                                                                                                                                                                                                                                                                                   |
| c)             | <b>Paint and Coating:</b> Corrosion-resistant paint with optional custom branding or decals.                                                                                                                                                                                                                                                                                                           |
| d)             | <b>Winch:</b> Front-mounted winch with a 5,000–10,000 lbs capacity for off-road recovery.                                                                                                                                                                                                                                                                                                              |
| <b>1.3.2.9</b> | <b>Warranty</b>                                                                                                                                                                                                                                                                                                                                                                                        |
|                | Five-years of official standard maintenance included                                                                                                                                                                                                                                                                                                                                                   |
| <b>1.3.3</b>   | <b>Functional specifications for Software package for processing measured data</b>                                                                                                                                                                                                                                                                                                                     |
| <b>1.3.3.1</b> | <b>Module for Orthophoto Plan Generation</b>                                                                                                                                                                                                                                                                                                                                                           |
|                | The data collection system should include a dedicated software solution capable of generating orthophoto plans from captured data. The system must provide:                                                                                                                                                                                                                                            |
| a)             | Georeferenced Image Processing: Ability to stitch captured images from high-resolution cameras into precise orthophoto maps with integrated GPS data.                                                                                                                                                                                                                                                  |
| b)             | Orthorectification Tools: Ensure image distortion corrections for accurate scale and positioning.                                                                                                                                                                                                                                                                                                      |
| c)             | Output Formats: Support for exporting data in common geospatial formats such as GeoTIFF, JPEG2000, and KML for integration with GIS platforms.                                                                                                                                                                                                                                                         |
| d)             | Recommended Software Compatibility: The system should support industry-standard solutions such as Pix4Dmapper, Agisoft Metashape, DroneDeploy or any other equivalent in terms of functionality.                                                                                                                                                                                                       |
| <b>1.3.3.2</b> | <b>Module for Processing Measured Data</b>                                                                                                                                                                                                                                                                                                                                                             |
|                | In addition to standard data export formats (CSV, XML, JSON), the system must include specialized software to manage and analyze measured data effectively. The software must provide:                                                                                                                                                                                                                 |
| a)             | Data Cleaning and Enhancement: Automatic filtering of noise and outlier data to ensure measurement accuracy.                                                                                                                                                                                                                                                                                           |
| b)             | 3D Point Cloud Processing: The ability to convert LiDAR and laser-scanned data into interactive 3D models for pavement profiling and road surface visualization.                                                                                                                                                                                                                                       |
| c)             | GIS Integration: Seamless import and export features for platforms such as QGIS, ArcGIS Pro, or similar geospatial solutions.                                                                                                                                                                                                                                                                          |
| d)             | Automated Report Generation: Generate structured reports summarizing defects, pavement conditions, and inventory data                                                                                                                                                                                                                                                                                  |
| e)             | Recommended Software Solutions: The system should integrate with recognized platforms such as Trimble Business Center, Leica Cyclone, or Bentley ContextCapture or any other equivalent in terms of functionality.                                                                                                                                                                                     |
| <b>1.3.3.3</b> | <b>AI Integration for Data Processing</b>                                                                                                                                                                                                                                                                                                                                                              |
|                | To enhance data collection efficiency and ensure the identification of road defects and other critical features, the system must include AI-driven capabilities:                                                                                                                                                                                                                                       |
| a)             | Automated Defect Recognition: Integrate AI/ML algorithms capable of detecting common pavement issues such as: <ul style="list-style-type: none"> <li>Cracks (longitudinal, transverse, block, etc.)</li> <li>Potholes and Raveling</li> <li>Rutting and Deformation</li> </ul>                                                                                                                         |
| b)             | Accuracy and Performance: The system should achieve a defect detection accuracy rate of at least 90% in controlled environments                                                                                                                                                                                                                                                                        |
| c)             | Integration of Deep Learning Frameworks: The system must support AI models developed using frameworks such as TensorFlow, PyTorch, or YOLO (You Only Look Once) or equivalent                                                                                                                                                                                                                          |
| d)             | Real-Time Data Processing: The system should provide real-time alerts for detected defects during data collection.                                                                                                                                                                                                                                                                                     |
| <b>1.3.3.4</b> | <b>Integration and Workflow</b>                                                                                                                                                                                                                                                                                                                                                                        |
| a)             | To ensure seamless operation, all additional software tools for orthophoto generation, data processing, and AI analysis must be integrated into the RAMS platform with:                                                                                                                                                                                                                                |
| b)             | Automated Data Transfer: Collected data should automatically synchronize with the RAMS database using secure transfer protocols.                                                                                                                                                                                                                                                                       |
| c)             | User Interface Enhancements: Interactive dashboards must provide visualization options for orthophoto maps, defect detection outcomes, and GIS layers.                                                                                                                                                                                                                                                 |
| d)             | The Supplier must provide integration services and prove that Road Asset Management solution (under para.1.1 above) and Vehicle laboratory equipment (under this paragraph) are compatible and can work in unison. This requirement presumes that data collected with the Vehicle laboratory equipment can be loaded through semi-automated simplified procedures into Road Asset Management solution. |
| e)             | 5 (five) year extended warranty / maintenance period (to be included in price of the item).                                                                                                                                                                                                                                                                                                            |

| LOT 2   |                                                                                                                                                                                                                      |
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| 2.1     | Specification for Ground Penetrating Radar Equipment                                                                                                                                                                 |
| 2.1.1   | General Description                                                                                                                                                                                                  |
| a)      | The Ground Penetrating Radar (GPR) system is required for the assessment, analysis, and inspection of road structures, including the detection of voids, layer thickness measurement, and material characterization. |
| b)      | The system must be non-destructive, portable, and capable of delivering high resolution subsurface imaging at highway speeds.                                                                                        |
| 2.1.2   | System Components                                                                                                                                                                                                    |
| 2.1.2.1 | Antennas                                                                                                                                                                                                             |
| a)      | Air-launched or ground-coupled antennas.                                                                                                                                                                             |
| b)      | Frequency range: Dual-frequency operation, 1 GHz and 2 GHz, or equivalent.                                                                                                                                           |
| c)      | Adjustable to accommodate varying penetration depths and resolutions or provide multiple predefined antennas instead                                                                                                 |
| d)      | Compatible with multiple configurations (e.g., single antenna, array setup).                                                                                                                                         |
| 2.1.2.2 | Control Unit                                                                                                                                                                                                         |
| a)      | Based on advanced GPR control hardware.                                                                                                                                                                              |
| b)      | Capable of operating with multiple channels (minimum of 4 channels simultaneously).                                                                                                                                  |
| c)      | Real-time data acquisition and processing capabilities.                                                                                                                                                              |
| 2.1.2.3 | Mounting and Mobility                                                                                                                                                                                                |
| a)      | Vehicle-mounted system for high-speed data collection.                                                                                                                                                               |
| b)      | Optional trailer mount or standalone configuration for varied operational needs.                                                                                                                                     |
| c)      | Distance Measuring Instrument (DMI) integrated for precise geolocation.                                                                                                                                              |
| 2.1.3   | Performance Specifications                                                                                                                                                                                           |
| 2.1.3.1 | Data Acquisition                                                                                                                                                                                                     |
| a)      | Scan rate: Adjustable up to 16,384 scans per second                                                                                                                                                                  |
| b)      | Time range: Selectable, up to 20,000 nanoseconds.                                                                                                                                                                    |
| c)      | Sampling resolution: Minimum 512 samples per scan, extendable up to 16,384.                                                                                                                                          |
| 2.1.3.2 | Data Storage and Transfer                                                                                                                                                                                            |
| a)      | Internal storage: Minimum 750 GB capacity.                                                                                                                                                                           |
| b)      | Data export formats: ASCII, .kml (Google Earth), and proprietary formats for advanced processing.                                                                                                                    |
| c)      | Connectivity: USB, Ethernet, or Wi-Fi for data transfer.                                                                                                                                                             |
| 2.1.3.3 | Imaging and Detection                                                                                                                                                                                                |
| a)      | Subsurface imaging depth: Minimum 2 meters (depending on material properties).                                                                                                                                       |
| b)      | Layer thickness accuracy: ±2 mm for asphalt and concrete layers.                                                                                                                                                     |
| c)      | Capability to detect voids, moisture content, and material degradation.                                                                                                                                              |
| 2.1.4   | Operational Features                                                                                                                                                                                                 |
| 2.1.4.1 | Real-Time Operation                                                                                                                                                                                                  |
| a)      | Real-time subsurface imaging display during data collection.                                                                                                                                                         |
| b)      | GPS integration for accurate georeferencing                                                                                                                                                                          |
| c)      | Automatic detection of road layers and anomalies using onboard algorithms                                                                                                                                            |
| 2.1.4.2 | Environmental Tolerance                                                                                                                                                                                              |
| a)      | Operating temperature: -10°C to 50°C.                                                                                                                                                                                |
| b)      | Weatherproof and ruggedized for outdoor conditions.                                                                                                                                                                  |
| 2.1.5   | Software and Processing                                                                                                                                                                                              |
| a)      | Compatible software for data acquisition and post-processing.                                                                                                                                                        |
| b)      | Advanced analysis tools for: <ul style="list-style-type: none"> <li>Automatic layer detection.</li> <li>3D subsurface modelling.</li> <li>Longitudinal and cross-sectional profiling.</li> </ul>                     |
| c)      | Visualization of survey results on GIS platforms.                                                                                                                                                                    |
| 2.1.6   | Safety and Compliance                                                                                                                                                                                                |
| a)      | The system must comply with FCC and CE standards for electromagnetic equipment.                                                                                                                                      |
| b)      | Operable without interfering with nearby communication or navigation systems.                                                                                                                                        |
| 2.1.7   | Delivery and Installation                                                                                                                                                                                            |
| a)      | Installation and calibration at the purchaser's site.                                                                                                                                                                |
| b)      | 5 (five) year extended warranty / maintenance period (to be included in price of the item).                                                                                                                          |
| 2.2     | Specification for Heavy Weight Deflectometer                                                                                                                                                                         |
| 2.2.1   | General Description                                                                                                                                                                                                  |
| a)      | The Heavy Weight Deflectometer (HWD) is a trailer-mounted device designed to evaluate the structural capacity of road pavements, airport runways, and other paved surfaces.                                          |
| b)      | It simulates the impact of heavy wheel loads and measures the resulting deflection response of the pavement.                                                                                                         |
| c)      | The HWD provides critical data for pavement analysis, maintenance, and rehabilitation planning.                                                                                                                      |
| 2.2.2   | Functional Capabilities                                                                                                                                                                                              |
| 2.2.2.1 | Load Application:                                                                                                                                                                                                    |
| a)      | Load Range: 30 to 250 kN                                                                                                                                                                                             |
| b)      | Adjustable loading levels with high repeatability.                                                                                                                                                                   |
| c)      | Simulation of aircraft and heavy vehicle loads.                                                                                                                                                                      |
| 2.2.2.2 | Deflection Measurement                                                                                                                                                                                               |
| a)      | Deflection Sensors: Up to 9 geophones.                                                                                                                                                                               |
| b)      | Deflection Range: 0 to 2,000 microns.                                                                                                                                                                                |
| c)      | Sensor Accuracy: ±0.5% or better.                                                                                                                                                                                    |
| 2.2.2.3 | Control and Data Acquisition:                                                                                                                                                                                        |
| a)      | Integrated software for real-time control and analysis.                                                                                                                                                              |
| b)      | Wireless or wired communication options.                                                                                                                                                                             |
| c)      | High-speed data acquisition system with user-friendly interface.                                                                                                                                                     |
| d)      | Storage capacity for thousands of test points.                                                                                                                                                                       |
| 2.2.2.4 | Operating Conditions:                                                                                                                                                                                                |
| a)      | Operational Temperature Range: -10°C to +50°C.                                                                                                                                                                       |
| b)      | Weather Resistance: IP65 or equivalent rating for outdoor operations.                                                                                                                                                |
| 2.2.2.5 | Mobility                                                                                                                                                                                                             |
| a)      | Trailer-mounted with standard towing mechanism.                                                                                                                                                                      |
| b)      | Dimensions: Compact design for easy transport.                                                                                                                                                                       |
| c)      | Weight: Approx. 2,000 kg (depending on configuration).                                                                                                                                                               |
| 2.2.3   | Mechanical and Structural Features                                                                                                                                                                                   |
| 2.2.3.1 | Loading Mechanism:                                                                                                                                                                                                   |
| a)      | Hydraulic or servo-controlled system for precise load application.                                                                                                                                                   |
| b)      | Load plate diameter: 300 mm to 450 mm.                                                                                                                                                                               |
| c)      | Interchangeable load plates for specific testing needs.                                                                                                                                                              |

|         |                                                                                                                                                                                                          |
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| 2.2.3.2 | <b>Frame and Trailer:</b>                                                                                                                                                                                |
| a)      | Robust chassis with corrosion-resistant material                                                                                                                                                         |
| b)      | Shock absorbers to protect components during transport.                                                                                                                                                  |
| c)      | Standard lighting and reflectors for road safety compliance.                                                                                                                                             |
| 2.2.4   | <b>Power Requirements</b>                                                                                                                                                                                |
| 2.2.4.1 | <b>Power Supply:</b>                                                                                                                                                                                     |
| a)      | Onboard battery system or external AC power input.                                                                                                                                                       |
| b)      | Typical Voltage: 12V/24V DC or 220V AC.                                                                                                                                                                  |
| 2.2.4.2 | <b>Power Consumption:</b>                                                                                                                                                                                |
|         | Average operational consumption: 1.5 kW                                                                                                                                                                  |
| 2.2.5   | <b>Safety and Compliance</b>                                                                                                                                                                             |
| a)      | Emergency stop functionality.                                                                                                                                                                            |
| b)      | Compliance with CE or equivalent safety standards.                                                                                                                                                       |
| c)      | Equipped with safety locks and warning indicators.                                                                                                                                                       |
| 2.2.6   | <b>Accessories and Optional Features</b>                                                                                                                                                                 |
| a)      | GPS module for precise location tagging.                                                                                                                                                                 |
| b)      | Thermal printer for onsite report generation.                                                                                                                                                            |
| c)      | Extended deflection sensor arms for wider coverage                                                                                                                                                       |
| d)      | Calibration kits for periodic verification.                                                                                                                                                              |
| e)      | Protective enclosures for harsh environments.                                                                                                                                                            |
| 2.2.7   | <b>Deliverables</b>                                                                                                                                                                                      |
| a)      | Heavy Weight Deflectometer unit                                                                                                                                                                          |
| b)      | Control software with license.                                                                                                                                                                           |
| c)      | Calibration certificates.                                                                                                                                                                                |
| d)      | Operation and maintenance manuals.                                                                                                                                                                       |
| e)      | Warranty: Minimum 1 year.                                                                                                                                                                                |
| 2.2.8   | <b>Application Areas</b>                                                                                                                                                                                 |
| a)      | Road and highway structural evaluation.                                                                                                                                                                  |
| b)      | Airport runway bearing capacity testing.                                                                                                                                                                 |
| c)      | Pavement maintenance planning.                                                                                                                                                                           |
| d)      | Research and development in pavement engineering.                                                                                                                                                        |
| 2.2.9   | <b>Performance Standards</b>                                                                                                                                                                             |
|         | The HWD shall conform to international standards such as:                                                                                                                                                |
| a)      | CEN/TS 17059 or ASTM D4694 for deflection testing.                                                                                                                                                       |
| b)      | CEN/TS 17059 or AASHTO R32 for pavement evaluation                                                                                                                                                       |
| 2.2.10  | <b>Maintenance and Support</b>                                                                                                                                                                           |
| a)      | 5 (five) year extended warranty / maintenance period (to be included in price of the item).                                                                                                              |
| b)      | Annual calibration services. Calibration certificate to be issued by an accredited laboratory                                                                                                            |
| c)      | 24/7 technical support.                                                                                                                                                                                  |
| d)      | Availability of spare parts for 10+ years.                                                                                                                                                               |
| 2.3     | <b>Specification for Grip tester</b>                                                                                                                                                                     |
|         | The grip tester is used to measure surface friction on roads, runways, and other relevant surfaces to ensure safety and compliance with regulatory standards.                                            |
| 2.3.1   | <b>Functional Requirements</b>                                                                                                                                                                           |
| 2.3.1.1 | <b>Primary Function</b>                                                                                                                                                                                  |
| a)      | The grip tester must measure the coefficient of friction on various surfaces under different environmental conditions                                                                                    |
| b)      | It should provide reliable and repeatable results.                                                                                                                                                       |
| 2.3.1.2 | <b>Operating Conditions:</b>                                                                                                                                                                             |
| a)      | Suitable for operation on wet and dry surfaces.                                                                                                                                                          |
| b)      | Operable in a temperature range of -10°C to +50°C.                                                                                                                                                       |
| c)      | Resistant to adverse weather conditions, including rain and high humidity.                                                                                                                               |
| 2.3.1.3 | <b>Test Standards</b>                                                                                                                                                                                    |
| a)      | Compliant with recognized international testing standards such as EN 13036-4 or ASTM E1911 or equivalent.                                                                                                |
| b)      | Capable of providing results in standard friction units such as Skid Resistance Value (SRV).                                                                                                             |
| 2.3.2   | <b>Technical Specifications</b>                                                                                                                                                                          |
| 2.3.2.1 | <b>Performance Requirements:</b>                                                                                                                                                                         |
| a)      | Measurement Range: Coefficient of friction from 0.0 to 1.0.                                                                                                                                              |
| b)      | Accuracy: ±0.01 coefficient of friction units.                                                                                                                                                           |
| c)      | Resolution: Minimum 0.01.                                                                                                                                                                                |
| d)      | Sampling Rate: Adjustable, with a minimum of 100 samples per second.                                                                                                                                     |
| 2.3.2.2 | <b>Hardware Specifications</b>                                                                                                                                                                           |
| a)      | Chassis and Build: <ul style="list-style-type: none"> <li>Rugged and lightweight design for durability and portability.</li> <li>Corrosion-resistant materials for long-term use.</li> </ul>             |
| b)      | Test Wheel <ul style="list-style-type: none"> <li>Standardized test wheel conforming to CEN or ASTM or equivalent specifications.</li> <li>Replaceable and easily accessible for maintenance.</li> </ul> |
| c)      | Watering System <ul style="list-style-type: none"> <li>Integrated water delivery system for wet testing.</li> <li>Adjustable flow rate to simulate various conditions.</li> </ul>                        |
| d)      | Sensors <ul style="list-style-type: none"> <li>High-precision load sensors for accurate readings.</li> <li>Integrated GPS for geolocation tagging of measurements.</li> </ul>                            |
| e)      | Power Supply <ul style="list-style-type: none"> <li>Operable on standard 12V or 24V vehicle power supply.</li> <li>Battery backup for a minimum of 4 hours of standalone operation.</li> </ul>           |
| 2.3.2.3 | <b>Data Acquisition and Processing:</b>                                                                                                                                                                  |
| a)      | Real-time data collection and processing                                                                                                                                                                 |
| b)      | Compatibility with external data storage devices via USB or wireless transmission                                                                                                                        |
| c)      | Built-in data logger with a minimum capacity of 10,000 measurements                                                                                                                                      |
| d)      | Graphical user interface (GUI) for easy configuration and display of test results                                                                                                                        |
| e)      | Compatibility with PC software for advanced data analysis and reporting                                                                                                                                  |
| 2.3.2.4 | <b>Software Requirements:</b>                                                                                                                                                                            |
| a)      | User-friendly software with multi-language support                                                                                                                                                       |
| b)      | Features for data visualization, trend analysis, and reporting.                                                                                                                                          |
| c)      | Export functionality to standard formats such as CSV, PDF, and Excel.                                                                                                                                    |
| d)      | Regular software updates and support from the manufacturer.                                                                                                                                              |
| 2.3.3   | <b>Operational Requirements</b>                                                                                                                                                                          |
| 2.3.3.1 | <b>Ease of Use</b>                                                                                                                                                                                       |

|         |                                                                                                                                                                                              |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a)      | Simple calibration procedures.                                                                                                                                                               |
| b)      | Intuitive controls for operators.                                                                                                                                                            |
| 2.3.3.2 | <b>Safety Features</b>                                                                                                                                                                       |
| a)      | Emergency stop button                                                                                                                                                                        |
| b)      | Safety interlocks for critical components.                                                                                                                                                   |
| 2.3.4   | <b>Other Requirements</b>                                                                                                                                                                    |
| 2.3.4.1 | <b>Compliance and Standards</b>                                                                                                                                                              |
| a)      | CE Marking or equivalent certification. CE Marking should take precedence.                                                                                                                   |
| b)      | Compliance with relevant health and safety regulations.                                                                                                                                      |
| c)      | Environmental compliance, including RoHS and WEEE directives.                                                                                                                                |
| 2.3.4.2 | <b>Delivery and Installation</b>                                                                                                                                                             |
| a)      | On-site installation and commissioning by the supplier.                                                                                                                                      |
| b)      | Post-installation testing and calibration to verify performance.                                                                                                                             |
| 2.3.4.3 | <b>Support and Maintenance</b>                                                                                                                                                               |
| a)      | Free software updates and patches for a minimum of 5 years.                                                                                                                                  |
| b)      | 5 (five) year extended warranty / maintenance period (to be included in price of the item) for hardware.                                                                                     |
| c)      | Modular design for easy servicing and part replacement.                                                                                                                                      |
| d)      | Comprehensive maintenance manual with troubleshooting guidelines.                                                                                                                            |
| e)      | Availability of spare parts for a minimum of 10 years.                                                                                                                                       |
| 2.3.4.4 | <b>Documentation:</b>                                                                                                                                                                        |
| a)      | Detailed user manual and operational guide.                                                                                                                                                  |
| b)      | Maintenance and service manuals.                                                                                                                                                             |
| c)      | All manuals and booklets for regular maintenance and use shall be in Romanian and English language.                                                                                          |
| 2.4     | <b>Specification for Vehicle-mounted retro reflectometer</b>                                                                                                                                 |
| 2.4.1   | <b>General Overview</b>                                                                                                                                                                      |
| a)      | The specification for a vehicle-mounted reflectometer outlines the requirements for a precision instrument designed to measure the retroreflective properties of road markings and surfaces. |
| b)      | The system must ensure high accuracy, durability, and ease of integration with standard vehicles for efficient data collection and analysis.                                                 |
| 2.4.2   | <b>Key Features</b>                                                                                                                                                                          |
| 2.4.2.1 | <b>Measurement Capability:</b>                                                                                                                                                               |
| a)      | Retroreflective coefficient (RL) in mcd/m²/lx                                                                                                                                                |
| b)      | Measurement range: 0 to 2,000 mcd/m²/lx.                                                                                                                                                     |
| 2.4.2.2 | <b>Mounting and Integration:</b>                                                                                                                                                             |
| a)      | Vehicle-compatible mounting system with shock-absorbing brackets.                                                                                                                            |
| b)      | Designed for compatibility with standard vehicles or specialized road inspection vehicles.                                                                                                   |
| 2.4.2.3 | <b>Data Acquisition:</b>                                                                                                                                                                     |
| a)      | Continuous, real-time measurement at speeds up to 130 km/h.                                                                                                                                  |
| b)      | High-resolution data collection with adjustable intervals (e.g., 1 meter).                                                                                                                   |
| 2.4.2.4 | <b>Optical Geometry:</b>                                                                                                                                                                     |
| a)      | Observation angle: 1.05°                                                                                                                                                                     |
| b)      | Illumination angle: 88.76°.                                                                                                                                                                  |
| 2.4.2.5 | <b>Environmental Tolerance:</b>                                                                                                                                                              |
| a)      | Operating temperature range: 0°C to 50°C.                                                                                                                                                    |
| b)      | Weatherproof design compliant with IP65 or higher.                                                                                                                                           |
| 2.4.3   | <b>System Components</b>                                                                                                                                                                     |
| 2.4.3.1 | <b>Reflectometer Unit</b>                                                                                                                                                                    |
| a)      | High-intensity LED light source for illumination.                                                                                                                                            |
| b)      | Precision photodetector for retroreflection measurement.                                                                                                                                     |
| c)      | Integrated automatic calibration mechanism.                                                                                                                                                  |
| 2.4.3.2 | <b>Vehicle Mounting System</b>                                                                                                                                                               |
| a)      | Adjustable mounts for accurate alignment.                                                                                                                                                    |
| b)      | Anti-vibration and levelling features.                                                                                                                                                       |
| 2.4.3.3 | <b>Data Processing and Display</b>                                                                                                                                                           |
| a)      | Integrated computing unit with high-performance processor.                                                                                                                                   |
| b)      | Touchscreen interface for system control and data visualization.                                                                                                                             |
| c)      | GPS compatibility for precise location tagging.                                                                                                                                              |
| d)      | Wireless communication module (Wi-Fi/Bluetooth) for data transfer.                                                                                                                           |
| 2.4.3.4 | <b>Software</b>                                                                                                                                                                              |
| a)      | User-friendly interface for parameter configuration.                                                                                                                                         |
| b)      | Real-time visualization of retroreflectivity levels.                                                                                                                                         |
| c)      | Data export options: CSV, Excel, and GIS-compatible formats.                                                                                                                                 |
| 2.4.3.5 | <b>Power Supply</b>                                                                                                                                                                          |
| a)      | Vehicle-sourced power (12V/24V compatibility).                                                                                                                                               |
| b)      | Backup battery ensuring 4-hour operational autonomy.                                                                                                                                         |
| 2.4.4   | <b>Performance Specifications</b>                                                                                                                                                            |
| 2.4.4.1 | <b>Accuracy</b>                                                                                                                                                                              |
|         | Measurement accuracy: ±2% for RL values up to 1,500 mcd/m²/lx.                                                                                                                               |
| 2.4.4.2 | <b>Repeatability</b>                                                                                                                                                                         |
|         | ±2% under identical test conditions.                                                                                                                                                         |
| 2.4.4.3 | <b>Measurement Speed</b>                                                                                                                                                                     |
|         | Effective operation at speeds up to 130 km/h or more.                                                                                                                                        |
| 2.4.4.4 | <b>Field of View</b>                                                                                                                                                                         |
|         | Adjustable measurement width: 100-300 mm.                                                                                                                                                    |
| 2.4.5   | <b>Compliance and Standards</b>                                                                                                                                                              |
| a)      | ISO 13472: Retroreflectivity measurement standards.                                                                                                                                          |
| b)      | EN 1436 or ASTM E1710: Standards for RL measurement.                                                                                                                                         |
| c)      | CE and FCC compliance for electronic devices.                                                                                                                                                |
| 2.4.6   | <b>Other Requirements</b>                                                                                                                                                                    |
| 2.4.6.1 | <b>Calibration</b>                                                                                                                                                                           |
|         | Annual calibration service or on-site calibration kit. The calibration kit shall be 'standardized' (in Romanian 'etalonat').                                                                 |
| 2.4.6.2 | <b>Support and Maintenance</b>                                                                                                                                                               |
| a)      | Free software updates and patches for a minimum of 5 years.                                                                                                                                  |
| b)      | 5 (five) year extended warranty / maintenance period (to be included in price of the item) for hardware.                                                                                     |
| c)      | Access to a dedicated support team (email, phone, live chat).                                                                                                                                |
| 2.4.6.3 | <b>Documentation</b>                                                                                                                                                                         |
| a)      | Detailed user manual covering installation, operation, and maintenance.                                                                                                                      |
| b)      | Quick-start guide for immediate deployment.                                                                                                                                                  |
| c)      | Calibration and compliance certificates.                                                                                                                                                     |
| d)      | All manuals and booklets for regular maintenance and use shall be in Romanian and English language.                                                                                          |

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| <b>2.4.6.4</b> | <b>Training and Onboarding</b>                                                                                                                                                                                                                                     |
| a)             | Initial training sessions for up to 10 users (on-site). Train-the-trainer concept should be supported which includes establishment of training archive (recordings of training / on-screen guides). Optional annual training (paid separately) per Client request. |
| b)             | Customizable training materials.                                                                                                                                                                                                                                   |
| c)             | All training manuals and booklets shall be in Romanian and English language.                                                                                                                                                                                       |
| <b>2.5</b>     | <b>Specification for Hand-held retro reflectometer</b>                                                                                                                                                                                                             |
|                | The handheld reflectometer is required for precise measurement of retroreflective properties of traffic signs, road markings, and other reflective surfaces to ensure compliance with international standards and safety regulations.                              |
| <b>2.5.1</b>   | <b>General Requirements</b>                                                                                                                                                                                                                                        |
| a)             | The device must be handheld, lightweight, and portable for easy field operations.                                                                                                                                                                                  |
| b)             | It should be robust and durable to withstand outdoor environmental conditions, including dust, moisture, and temperature variations.                                                                                                                               |
| c)             | The instrument must conform to relevant international standards for retroreflectivity measurement, such as EN 12899-1 or ASTM E1709.                                                                                                                               |
| <b>2.5.2</b>   | <b>Technical Specifications</b>                                                                                                                                                                                                                                    |
| <b>2.5.2.1</b> | <b>Measurement Parameter</b>                                                                                                                                                                                                                                       |
| a)             | Observation Angle: Adjustable, with a range of at least 0.2° to 2.0°                                                                                                                                                                                               |
| b)             | Entrance Angle: Adjustable, covering at least -0.5° to +5°.                                                                                                                                                                                                        |
| c)             | Retroreflectivity Range: Capable of measuring retroreflectivity in the range of 0 to 2,000 cd/lx/m² or higher.                                                                                                                                                     |
| <b>2.5.2.2</b> | <b>Measurement Area</b>                                                                                                                                                                                                                                            |
|                | Measurement spot diameter should not exceed 30 mm to allow precise evaluation of small areas.                                                                                                                                                                      |
| <b>2.5.2.3</b> | <b>Data Storage and Connectivity</b>                                                                                                                                                                                                                               |
| a)             | Internal memory for storing at least 10,000 measurement records.                                                                                                                                                                                                   |
| b)             | Connectivity options: USB, Bluetooth, and Wi-Fi for seamless data transfer.                                                                                                                                                                                        |
| c)             | Compatibility with data analysis software or mobile applications for reporting and visualization.                                                                                                                                                                  |
| <b>2.5.2.4</b> | <b>Display</b>                                                                                                                                                                                                                                                     |
| a)             | A clear, backlit, and color 5-inch touch display for easy visibility in various lighting conditions.                                                                                                                                                               |
| b)             | Multilingual interface support, including English.                                                                                                                                                                                                                 |
| <b>2.5.2.5</b> | <b>Power Supply</b>                                                                                                                                                                                                                                                |
| a)             | Rechargeable lithium-ion battery with a minimum operational runtime of 8 hours.                                                                                                                                                                                    |
| b)             | Provision for USB or adapter-based charging.                                                                                                                                                                                                                       |
| <b>2.5.2.6</b> | <b>Environmental Specifications</b>                                                                                                                                                                                                                                |
| a)             | Operating Temperature Range: 0°C to +50°C                                                                                                                                                                                                                          |
| b)             | Storage Temperature Range: -20°C to +60°C.                                                                                                                                                                                                                         |
| c)             | Weatherproof design compliant with IP54 or higher standards.                                                                                                                                                                                                       |
| <b>2.5.2.7</b> | <b>Calibration and Accuracy</b>                                                                                                                                                                                                                                    |
| a)             | The device must include a calibration certificate from the manufacturer and an accredited calibration laboratory                                                                                                                                                   |
| b)             | Measurement accuracy: ±5% or better.                                                                                                                                                                                                                               |
| c)             | Provision for on-site calibration using reference standards.                                                                                                                                                                                                       |
| <b>2.5.2.8</b> | <b>Accessories</b>                                                                                                                                                                                                                                                 |
| a)             | Carrying case for secure transport.                                                                                                                                                                                                                                |
| b)             | Calibration tiles or plates.                                                                                                                                                                                                                                       |
| c)             | Battery charger.                                                                                                                                                                                                                                                   |
| <b>2.5.3</b>   | <b>Other Requirements</b>                                                                                                                                                                                                                                          |
| <b>2.5.3.1</b> | <b>Support and Maintenance</b>                                                                                                                                                                                                                                     |
| a)             | Free updates and patches for a minimum of 5 years.                                                                                                                                                                                                                 |
| b)             | 5 (five) year extended warranty / maintenance period (to be included in price of the item).                                                                                                                                                                        |
| c)             | Spare parts availability for a minimum of 5 years.                                                                                                                                                                                                                 |
| d)             | Access to a dedicated support team (email, phone, live chat).                                                                                                                                                                                                      |
| <b>2.5.3.2</b> | <b>Training and Onboarding</b>                                                                                                                                                                                                                                     |
| a)             | Initial training sessions for up to 10 users (on-site). Train-the-trainer concept should be supported which includes establishment of training archive (recordings of training / on-screen guides). Optional annual training (paid separately) per Client request. |
| b)             | Detailed technical manuals for operation and maintenance.                                                                                                                                                                                                          |
| c)             | All training, manuals and booklets for regular maintenance and use shall be in Romanian and English language.                                                                                                                                                      |
| <b>2.5.3.3</b> | <b>Compliance and Standards</b>                                                                                                                                                                                                                                    |
| a)             | CE or equivalent certification indicating compliance with safety and performance standards                                                                                                                                                                         |
| b)             | RoHS compliance to ensure the product meets environmental standards.                                                                                                                                                                                               |
| <b>2.6</b>     | <b>Specifications for Vehicle for the measuring equipment</b>                                                                                                                                                                                                      |
| a)             | A SUV vehicle capable of accommodating all the specified data collection equipment and operating effectively on poor roads is required here.                                                                                                                       |
| b)             | The base vehicle shall be of a model, which has an official dealership in the Republic of Moldova.                                                                                                                                                                 |
| <b>2.6.1</b>   | <b>Vehicle Type</b>                                                                                                                                                                                                                                                |
| a)             | Category: Mid-Sized or Full-Sized SUV                                                                                                                                                                                                                              |
| b)             | Configuration: 4x4 (Four-Wheel Drive) or AWD (All-Wheel Drive) for rough terrain.                                                                                                                                                                                  |
| c)             | Body Style: SUV or Utility Vehicle with a rear hitch for towing equipment trailers.                                                                                                                                                                                |
| <b>2.6.2</b>   | <b>Engine and Performance</b>                                                                                                                                                                                                                                      |
| a)             | Engine Type: Turbocharged Diesel or Petrol Engine (V6 or V8).                                                                                                                                                                                                      |
| b)             | Engine Displacement: 3.0L to 4.0L.                                                                                                                                                                                                                                 |
| c)             | Power Output: Minimum 250 HP.                                                                                                                                                                                                                                      |
| d)             | Torque: 400 Nm to 500 Nm.                                                                                                                                                                                                                                          |
| e)             | Transmission: 8-speed automatic or 6-speed manual.                                                                                                                                                                                                                 |
| f)             | Drivetrain: 4x4 (Four-Wheel Drive) or AWD (All-Wheel Drive)                                                                                                                                                                                                        |
| g)             | Fuel Tank Capacity: 75 – 100 liters.                                                                                                                                                                                                                               |
| <b>2.6.3</b>   | <b>Towing Capacity</b>                                                                                                                                                                                                                                             |
| a)             | Maximum Towing Capacity: 2,500 kg – 3,500 kg (5,500 lbs – 7,700 lbs).                                                                                                                                                                                              |
| b)             | Trailer Hitch: Factory-installed heavy-duty tow hitch.                                                                                                                                                                                                             |
| c)             | Trailer Brake Controller: Integrated brake controller for large equipment trailers.                                                                                                                                                                                |
| d)             | Rear Suspension: Reinforced suspension system for towing heavy loads.                                                                                                                                                                                              |
| <b>2.6.4</b>   | <b>Dimensions and Weight</b>                                                                                                                                                                                                                                       |
| a)             | Length: 4.8 – 5.2 meters (190 – 205 inches).                                                                                                                                                                                                                       |
| b)             | Width: 1.9 – 2.2 meters (75 – 85 inches).                                                                                                                                                                                                                          |
| c)             | Height: 1.8 – 2.0 meters (70 – 78 inches).                                                                                                                                                                                                                         |
| d)             | Ground Clearance: 200 – 250 mm (8 – 10 inches).                                                                                                                                                                                                                    |
| e)             | Curb Weight: 2,000 – 2,800 kg (4,400 – 6,200 lbs).                                                                                                                                                                                                                 |
| <b>2.6.5</b>   | <b>Suspension and Tires</b>                                                                                                                                                                                                                                        |
|                | Suspension Type: Independent front suspension and multi-link rear suspension for stability while towing.                                                                                                                                                           |
|                | Shock Absorbers: Heavy-duty gas-filled shock absorbers to handle rough terrain.                                                                                                                                                                                    |
|                | Tires: All-Terrain or Mud-Terrain tires for off-road and on-road use.                                                                                                                                                                                              |
|                | Wheel Size: 17-inch to 20-inch alloy wheels.                                                                                                                                                                                                                       |
|                | Spare Tire: Full-sized spare tire mounted externally for quick access.                                                                                                                                                                                             |
| <b>2.6.6</b>   | <b>Electrical System and Power</b>                                                                                                                                                                                                                                 |
| a)             | <b>Alternator:</b> High-output alternator (200 – 300 amps) to power onboard electronics and equipment                                                                                                                                                              |

|               |                                                                                                                                            |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| b)            | <b>Battery:</b> Dual-battery system with one auxiliary battery for powering additional devices.                                            |
| c)            | <b>Power Outlets:</b> Multiple 12V DC and 110/230V AC power outlets for running field equipment.                                           |
| d)            | <b>Inverter:</b> 1,000 – 2,000W inverter to convert DC power to AC for equipment use.                                                      |
| <b>2.6.7</b>  | <b>Interior Features</b>                                                                                                                   |
| a)            | <b>Seating Capacity:</b> 5 to 7 seats with comfortable, adjustable seating for operators.                                                  |
| b)            | <b>Upholstery:</b> Durable and easy-to-clean fabric or leather.                                                                            |
| c)            | <b>Infotainment System:</b> 8-inch touchscreen with GPS navigation and real-time vehicle data display.                                     |
| d)            | <b>Climate Control:</b> Dual-zone or tri-zone automatic climate control for comfort in all weather conditions.                             |
| e)            | <b>Storage Space:</b> Foldable rear seats to maximize cargo space when carrying additional equipment.                                      |
| <b>2.6.8</b>  | <b>Safety Features</b>                                                                                                                     |
| a)            | <b>Braking System:</b> Anti-lock Braking System (ABS) to prevent wheel lockup.                                                             |
| b)            | <b>Traction Control:</b> Traction Control System (TCS) and Electronic Stability Control (ESC) to maintain grip on rough or slippery roads. |
| c)            | <b>Airbags:</b> Front, side, and curtain airbags for enhanced safety.                                                                      |
| d)            | <b>Hill Descent Control:</b> Available feature to maintain control on steep downhill slopes.                                               |
| e)            | <b>Lane Departure Warning:</b> Optional feature to alert the driver if the vehicle drifts out of its lane.                                 |
| f)            | <b>Blind Spot Monitoring:</b> Optional feature to detect vehicles in the driver's blind spots.                                             |
| <b>2.6.9</b>  | <b>Exterior Features</b>                                                                                                                   |
| a)            | <b>Roof Rails:</b> Heavy-duty roof rails for carrying additional cargo or equipment.                                                       |
| b)            | <b>Running Boards:</b> Side steps for easy access to the vehicle, especially when carrying heavy gear                                      |
| c)            | <b>Tow Hooks:</b> Front and rear tow hooks for vehicle recovery in off-road situations.                                                    |
| d)            | <b>Lighting:</b> LED headlights, fog lights, and taillights for better visibility in poor weather conditions.                              |
| e)            | <b>Skid Plates:</b> Underbody protection to prevent damage to the engine and drivetrain when driving on rough terrain.                     |
| <b>2.6.10</b> | <b>Other Requirements</b>                                                                                                                  |
| a)            | 5 (five) year extended warranty / maintenance period (to be included in price of the item).                                                |
| b)            | The authorized service center for vehicle maintenance must be located within 100 km of the Client's site.                                  |

# LOT 3

|                |                                                                                                                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>3.1</b>     | <b>Specification for Software for designing roads, bridges</b>                                                                                                                                                                                                               |
| <b>3.1.1</b>   | <b>General Description</b>                                                                                                                                                                                                                                                   |
| a)             | The Purchaser seeks to acquire advanced bridge design software to facilitate the efficient, precise, and standards-compliant design of roads, bridges and related infrastructure.                                                                                            |
| b)             | The software should support Building Information Modelling (BIM) workflows and comply with national and international engineering standards.                                                                                                                                 |
| <b>3.1.2</b>   | <b>Functional Requirements</b>                                                                                                                                                                                                                                               |
| <b>3.1.2.1</b> | <b>Bridge Modelling</b>                                                                                                                                                                                                                                                      |
| a)             | Parametric and free-form 3D modelling                                                                                                                                                                                                                                        |
| b)             | Integration of volumetric primitives and Boolean operations for complex geometries.                                                                                                                                                                                          |
| c)             | Support for multi-span and multi-pier configurations.                                                                                                                                                                                                                        |
| <b>3.1.2.2</b> | <b>Design Standards Compliance</b>                                                                                                                                                                                                                                           |
| a)             | Compliance with Eurocodes and national annexes (DIN EN, NF EN, UNE EN, or equivalent).                                                                                                                                                                                       |
| b)             | Configurable settings for user-defined standards and annexes.                                                                                                                                                                                                                |
| <b>3.1.2.3</b> | <b>Structural Analysis</b>                                                                                                                                                                                                                                                   |
| a)             | Integrated linear and nonlinear analysis modules.                                                                                                                                                                                                                            |
| b)             | Fatigue analysis based on damage accumulation methods.                                                                                                                                                                                                                       |
| c)             | Seismic analysis via Response Spectrum Method with adjustable torsional stiffness.                                                                                                                                                                                           |
| <b>3.1.2.4</b> | <b>Dynamic Collaboration and Data Exchange</b>                                                                                                                                                                                                                               |
| a)             | Interoperability with BIM tools such as IFC, DWG, and other file formats.                                                                                                                                                                                                    |
| b)             | Seamless integration with CAD and structural analysis software.                                                                                                                                                                                                              |
| c)             | Cloud-based collaboration tools for multi-disciplinary projects.                                                                                                                                                                                                             |
| <b>3.1.2.5</b> | <b>Performance and Usability</b>                                                                                                                                                                                                                                             |
| a)             | Intuitive user interface for engineers and designers.                                                                                                                                                                                                                        |
| b)             | Optimized solver engine for large and complex projects.                                                                                                                                                                                                                      |
| c)             | Support for both desktop and cloud-based deployments.                                                                                                                                                                                                                        |
| <b>3.1.3.</b>  | <b>Licensing and Support Requirements</b>                                                                                                                                                                                                                                    |
| <b>3.1.3.1</b> | <b>Licensing Model</b>                                                                                                                                                                                                                                                       |
| a)             | Perpetual licensing options.                                                                                                                                                                                                                                                 |
| b)             | Concurrent user licensing for team collaboration (1 licence).                                                                                                                                                                                                                |
| <b>3.1.3.2</b> | <b>Support and Maintenance</b>                                                                                                                                                                                                                                               |
| a)             | Free updates and patches for a minimum of 5 years (in line with general requirements for 5-year extended warranty)                                                                                                                                                           |
| b)             | Access to a dedicated support team (email, phone, live chat)                                                                                                                                                                                                                 |
| c)             | Comprehensive online documentation and video tutorials.                                                                                                                                                                                                                      |
| <b>3.1.3.3</b> | <b>Training and Onboarding</b>                                                                                                                                                                                                                                               |
| a)             | Initial training sessions for up to 10 users (on-site or online). Train-the-trainer concept should be supported which includes establishment of training archive (recordings of training / on-screen guides). Optional annual training (paid separately) per Client request. |
| b)             | Customizable training materials and user manuals.                                                                                                                                                                                                                            |
| c)             | All training, manuals and booklets for regular maintenance and use shall be in Romanian and English language.                                                                                                                                                                |
| <b>3.1.3.4</b> | <b>Upgrades and Scalability</b>                                                                                                                                                                                                                                              |
| a)             | Option to scale licenses as project demands grow.                                                                                                                                                                                                                            |
| b)             | Availability of add-ons or plugins for additional functionalities.                                                                                                                                                                                                           |
| <b>3.2</b>     | <b>Specification for Software for Bridge Management System</b>                                                                                                                                                                                                               |
| <b>3.2.1</b>   | <b>General Description</b>                                                                                                                                                                                                                                                   |
| a)             | The system must be a comprehensive Bridge Management System (BMS) capable of managing bridges, retaining walls, signs, tunnels, and other related infrastructure assets. Size of the road network is 6.000 km.                                                               |
| b)             | It must support both single-user and multi-user environments for organizational scalability.                                                                                                                                                                                 |
| c)             | The system must comply with international standards for infrastructure asset management.                                                                                                                                                                                     |
| d)             | The BMS can be offered as a desktop or web or hybrid solution.                                                                                                                                                                                                               |
| <b>3.2.2</b>   | <b>Functional Requirements</b>                                                                                                                                                                                                                                               |
| <b>3.2.2.1</b> | <b>Asset Management</b>                                                                                                                                                                                                                                                      |
| a)             | Ability to create, store, and manage an inventory of assets (e.g., bridges, walls, tunnels).                                                                                                                                                                                 |
| b)             | Support for categorization by asset type, location, condition, and lifecycle stage.                                                                                                                                                                                          |
| <b>3.2.2.2</b> | <b>Inspection and Maintenance Planning</b>                                                                                                                                                                                                                                   |
| a)             | Tools for scheduling, recording, and tracking inspections.                                                                                                                                                                                                                   |
| b)             | Pre-configured and customizable inspection templates.                                                                                                                                                                                                                        |
| c)             | Deterioration modelling to forecast maintenance needs and costs.                                                                                                                                                                                                             |
| <b>3.2.2.3</b> | <b>Geographic Information System (GIS) Integration</b>                                                                                                                                                                                                                       |
| a)             | Seamless integration with GIS platforms (e.g., ESRI, MapInfo, Intergraph).                                                                                                                                                                                                   |
| b)             | Capability to visualize asset locations, attributes, and conditions on interactive maps                                                                                                                                                                                      |
| c)             | Support for importing/exporting geospatial data in industry-standard formats (e.g., ESRI Shapefile, GeoJSON).                                                                                                                                                                |
| <b>3.2.2.4</b> | <b>Data Collection and Mobile Accessibility</b>                                                                                                                                                                                                                              |
| a)             | Mobile application compatibility for iOS, Android, and Windows devices.                                                                                                                                                                                                      |
| b)             | Offline data collection functionality with automatic synchronization upon reconnection                                                                                                                                                                                       |
| c)             | Barcode/QR code scanning and image capture for inspections.                                                                                                                                                                                                                  |
| <b>3.2.2.5</b> | <b>Customizability and Extensibility</b>                                                                                                                                                                                                                                     |
| a)             | Ability to customize workflows, forms, and reports to meet organizational needs.                                                                                                                                                                                             |
| b)             | API support for integration with other systems (e.g., ERP, SCADA, or CMMS).                                                                                                                                                                                                  |
| <b>3.2.2.6</b> | <b>Reporting and Analytics</b>                                                                                                                                                                                                                                               |
| a)             | Tools for generating customizable reports (e.g., maintenance schedules, cost analysis).                                                                                                                                                                                      |
| b)             | Predictive analytics for asset deterioration and budget planning.                                                                                                                                                                                                            |
| c)             | Dashboards for visualizing key performance indicators (KPIs).                                                                                                                                                                                                                |
| <b>3.2.3</b>   | <b>Non-functional Requirements</b>                                                                                                                                                                                                                                           |
| <b>3.2.3.1</b> | <b>System Architecture</b>                                                                                                                                                                                                                                                   |
| a)             | Web-based architecture supporting cloud, on-premises, or hybrid deployment models.                                                                                                                                                                                           |
| b)             | Modular design allowing addition of new functionalities without disrupting existing operations.                                                                                                                                                                              |
| <b>3.2.3.2</b> | <b>Database Compatibility</b>                                                                                                                                                                                                                                                |
| a)             | Support for industry-standard databases (e.g., SQL Server, Oracle, PostgreSQL).                                                                                                                                                                                              |
| b)             | Secure storage and retrieval of asset and inspection data.                                                                                                                                                                                                                   |
| <b>3.2.3.3</b> | <b>Data Formats</b>                                                                                                                                                                                                                                                          |
| a)             | Support for all common industry data formats (e.g., ESRI, MapInfo, Intergraph, Bentley, Lizard Tech, ERMapper).                                                                                                                                                              |
| b)             | Compatibility with BIM (Building Information Modeling) standards such as IFC.                                                                                                                                                                                                |
| <b>3.2.3.4</b> | <b>Performance and Scalability</b>                                                                                                                                                                                                                                           |
| a)             | Capable of managing large datasets with minimal performance degradation.                                                                                                                                                                                                     |
| b)             | Scalable to accommodate increasing asset inventories and user numbers. Estimated user number by category: 1 Administrator, up to 10 Standard Users, up to 25 Read-Only Users.                                                                                                |

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| <b>3.2.3.5</b> | <b>Security</b>                                                                                                                                                                                                                                                              |
| a)             | Role-based access control for user management.                                                                                                                                                                                                                               |
| b)             | Data encryption during transmission and at rest.                                                                                                                                                                                                                             |
| c)             | Compliance with data protection regulations (e.g., GDPR, ISO 27001).                                                                                                                                                                                                         |
| <b>3.2.4.</b>  | <b>Other Requirements</b>                                                                                                                                                                                                                                                    |
| <b>3.2.4.1</b> | <b>Support and Maintenance</b>                                                                                                                                                                                                                                               |
| a)             | Free updates and patches for a minimum of 5 years (in line with general requirements for 5-year extended warranty).                                                                                                                                                          |
| b)             | Access to a dedicated support team (email, phone, live chat).                                                                                                                                                                                                                |
| <b>3.2.4.2</b> | <b>Training and Onboarding</b>                                                                                                                                                                                                                                               |
| a)             | Initial training sessions for up to 10 users (on-site or online). Train-the-trainer concept should be supported which includes establishment of training archive (recordings of training / on-screen guides). Optional annual training (paid separately) per Client request. |
| b)             | Customizable training materials and user manuals including API references.                                                                                                                                                                                                   |
| c)             | All training, manuals and booklets for regular maintenance and use shall be in Romanian and English language.                                                                                                                                                                |
| d)             | Bridge inspection training – training that includes knowledge transfer process from establishing proper bridge inspection parameters to how-to transfer the collected data into BMS.                                                                                         |
| <b>3.2.4.3</b> | <b>Compliance and Standards</b>                                                                                                                                                                                                                                              |
| a)             | Compliance with relevant local and international standards for asset management, such as ISO 55000.                                                                                                                                                                          |
| b)             | Adherence to Open Data Standards for interoperability.                                                                                                                                                                                                                       |
| <b>3.3</b>     | <b>Specification for System for monitoring/establishing the intensity of road traffic on national roads (15 licenses)</b>                                                                                                                                                    |
| <b>3.3.1</b>   | <b>General Requirements</b>                                                                                                                                                                                                                                                  |
| a)             | The purchaser intends to acquire 15 units of video analysis systems designed for real-time monitoring of traffic objects (transport units) and evaluation of their trajectories using an RTSP camera stream.                                                                 |
| b)             | Each unit must operate as an independent and self-contained system capable of processing traffic data locally without reliance on external servers.                                                                                                                          |
| c)             | The system must support H264 and H265 video encoding standards.                                                                                                                                                                                                              |
| d)             | The system must be capable of processing two-way traffic streams in real time.                                                                                                                                                                                               |
| e)             | The system must include software for remote control and configuration of each unit.                                                                                                                                                                                          |
| f)             | The software interface must display real-time detection and classification of vehicles, along with their trajectories, on a graphical overlay of the video feed.                                                                                                             |
| g)             | The system must include categorized counts, lane-specific traffic flow data, and highlighted detections for ease of interpretation.                                                                                                                                          |
| <b>3.3.2</b>   | <b>Functional Requirements</b>                                                                                                                                                                                                                                               |
| <b>3.3.2.1</b> | <b>Real-Time Processing</b>                                                                                                                                                                                                                                                  |
|                | The unit must process and analyze RTSP camera streams in real time, extracting traffic data including, but not limited to:                                                                                                                                                   |
| a)             | Vehicle detection                                                                                                                                                                                                                                                            |
| b)             | Trajectory analysis                                                                                                                                                                                                                                                          |
| c)             | Speed estimation                                                                                                                                                                                                                                                             |
| d)             | Vehicle classification (e.g., cars, trucks, buses, motorcycles)                                                                                                                                                                                                              |
| e)             | Lane-specific vehicle tracking and counts                                                                                                                                                                                                                                    |
| <b>3.3.2.2</b> | <b>Local Data Processing</b>                                                                                                                                                                                                                                                 |
|                | All image processing and traffic data extraction must occur locally within the unit.                                                                                                                                                                                         |
| <b>3.3.2.3</b> | <b>Two-Way Traffic Monitoring</b>                                                                                                                                                                                                                                            |
|                | The system must support monitoring of traffic flows in both directions simultaneously, ensuring accurate detection and classification.                                                                                                                                       |
| <b>3.3.2.4</b> | <b>Graphical Interface</b>                                                                                                                                                                                                                                                   |
|                | The software must provide a graphical overlay on the live video feed showing:                                                                                                                                                                                                |
| a)             | Detected objects with bounding boxes and labels                                                                                                                                                                                                                              |
| b)             | Trajectory lines for tracked vehicles                                                                                                                                                                                                                                        |
| c)             | Lane demarcations and specific traffic flow indicators                                                                                                                                                                                                                       |
| d)             | Summary panels for lane-specific or overall traffic metrics                                                                                                                                                                                                                  |
| <b>3.3.2.5</b> | <b>Configurable Traffic Sensor</b>                                                                                                                                                                                                                                           |
|                | After initial setup and connection to the RTSP camera, the unit must function autonomously as a configurable traffic sensor.                                                                                                                                                 |
| <b>3.3.3</b>   | <b>Hardware Requirements</b>                                                                                                                                                                                                                                                 |
| <b>3.3.3.1</b> | <b>Processing Unit</b>                                                                                                                                                                                                                                                       |
| a)             | Embedded processor capable of handling high-resolution video streams (minimum Full HD 1920x1080 resolution).                                                                                                                                                                 |
| b)             | Integrated GPU or dedicated accelerator for AI-based image processing.                                                                                                                                                                                                       |
| <b>3.3.3.2</b> | <b>Memory</b>                                                                                                                                                                                                                                                                |
| a)             | Minimum 4 GB RAM.                                                                                                                                                                                                                                                            |
| b)             | Minimum 32 GB storage (expandable preferred).                                                                                                                                                                                                                                |
| <b>3.3.3.3</b> | <b>Connectivity</b>                                                                                                                                                                                                                                                          |
|                | Ethernet port (10/100/1000 Mbps) for connecting to the RTSP camera and the local network or support for wireless connectivity (Wi-Fi).                                                                                                                                       |
| <b>3.3.3.4</b> | <b>Video Input</b>                                                                                                                                                                                                                                                           |
| a)             | Support for RTSP protocol.                                                                                                                                                                                                                                                   |
| b)             | Compatibility with H264 and H265 video streams.                                                                                                                                                                                                                              |
| <b>3.3.3.5</b> | <b>Power Supply</b>                                                                                                                                                                                                                                                          |
| a)             | Standard AC adapter (100-240V) with 12V DC output.                                                                                                                                                                                                                           |
| b)             | Power consumption not exceeding 30W.                                                                                                                                                                                                                                         |
| <b>3.3.3.6</b> | <b>Enclosure</b>                                                                                                                                                                                                                                                             |
| a)             | Compact and durable design suitable for indoor and outdoor installation.                                                                                                                                                                                                     |
| b)             | Weatherproof rating (IP65 or higher) for outdoor installations.                                                                                                                                                                                                              |
| <b>3.3.4</b>   | <b>Software Requirements</b>                                                                                                                                                                                                                                                 |
| <b>3.3.4.1</b> | <b>Operating System</b>                                                                                                                                                                                                                                                      |
|                | The unit must run on a secure and stable operating system optimized for real-time video analysis (e.g., Linux-based).                                                                                                                                                        |
| <b>3.3.4.2</b> | <b>Traffic Analysis Software</b>                                                                                                                                                                                                                                             |
| a)             | Pre-installed software for video stream analysis.                                                                                                                                                                                                                            |
| b)             | Real-time object detection, classification, and trajectory calculation.                                                                                                                                                                                                      |
| c)             | Configurable parameters for sensitivity, detection zones, and data logging.                                                                                                                                                                                                  |
| d)             | Overlay display of real-time traffic metrics and graphical analysis tools.                                                                                                                                                                                                   |
| <b>3.3.4.3</b> | <b>Remote Management Software:</b>                                                                                                                                                                                                                                           |
| a)             | User-friendly interface for remote configuration and monitoring.                                                                                                                                                                                                             |
| b)             | Secure access via web browser or standalone application.                                                                                                                                                                                                                     |
| c)             | Support for updating firmware and software remotely.                                                                                                                                                                                                                         |
| <b>3.3.4.4</b> | <b>Data Output:</b>                                                                                                                                                                                                                                                          |
| a)             | Real-time data visualization on a remote client.                                                                                                                                                                                                                             |
| b)             | Exportable data formats (CSV, JSON, or XML) for integration with external systems.                                                                                                                                                                                           |
| <b>3.3.5</b>   | <b>Performance Requirements</b>                                                                                                                                                                                                                                              |
| <b>3.3.5.1</b> | <b>Detection Accuracy</b>                                                                                                                                                                                                                                                    |
| a)             | Vehicle detection accuracy: Minimum 95% under normal lighting conditions.                                                                                                                                                                                                    |
| b)             | Classification accuracy: Minimum 90% for standard vehicle categories.                                                                                                                                                                                                        |
| <b>3.3.5.2</b> | <b>Latency</b>                                                                                                                                                                                                                                                               |
|                | Maximum processing latency: 500 milliseconds from image capture to data output.                                                                                                                                                                                              |

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| <b>3.3.5.3</b> | <b>Environmental Performance</b>                                                                                                                                              |
| a)             | Operating temperature: -20°C to +50°C.                                                                                                                                        |
| b)             | Humidity tolerance: Up to 95% non-condensing.                                                                                                                                 |
| <b>3.3.6</b>   | <b>Other Requirements</b>                                                                                                                                                     |
| <b>3.3.6.1</b> | <b>Support and Maintenance</b>                                                                                                                                                |
| a)             | Free software updates and patches for a minimum of 5 years.                                                                                                                   |
| b)             | 5 (five) year extended warranty / maintenance period (to be included in price of the item) for hardware.                                                                      |
| c)             | Access to a dedicated support team (email, phone, live chat).                                                                                                                 |
| <b>3.3.6.2</b> | <b>Training and Onboarding</b>                                                                                                                                                |
| a)             | User manuals for installation, configuration, and operation as well as maintenance guide.                                                                                     |
| b)             | All manuals and booklets for regular maintenance and use shall be in Romanian and English language.                                                                           |
| <b>3.3.6.3</b> | <b>Compliance and Standards</b>                                                                                                                                               |
|                | The system must comply with relevant industry standards for safety, performance, and environmental impact.                                                                    |
|                | Certification requirements: <ul style="list-style-type: none"><li>• CE, FCC, or equivalent certification.</li><li>• IP65 or higher certification for outdoor units.</li></ul> |

# LOT 4

|         |                                                                                                                                                                                                                                                                    |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1     | Specification for Laboratory equipment - Asphalt mix analyser                                                                                                                                                                                                      |
| 4.1.1   | General Requirements                                                                                                                                                                                                                                               |
| a)      | The equipment shall be an Asphalt Mix Analyzer designed for the analysis of bituminous mixtures.                                                                                                                                                                   |
| b)      | It must be equipped with an automatic closed-loop system and comply with EN 12697-1 standards.                                                                                                                                                                     |
| c)      | The analyser must include all necessary components and accessories to ensure complete functionality and efficiency in operation.                                                                                                                                   |
| 4.1.2   | Technical Specifications                                                                                                                                                                                                                                           |
| 4.1.2.1 | Performance and Capacity                                                                                                                                                                                                                                           |
| a)      | Automatic closed-loop system for enhanced efficiency.                                                                                                                                                                                                              |
| b)      | Compliance with EN 12697-1 standards.                                                                                                                                                                                                                              |
| c)      | Maximum sample weight: 3.5 kg.                                                                                                                                                                                                                                     |
| d)      | Centrifugal rotation speed: 8000 rpm.                                                                                                                                                                                                                              |
| e)      | Extraction time: less than an hour, depending on the type of tested mixture (including drying time).                                                                                                                                                               |
| 4.1.2.2 | Measurement and Precision                                                                                                                                                                                                                                          |
|         | Integrated scale with a capacity of 10 kg and a resolution of 0.1 g.                                                                                                                                                                                               |
| 4.1.2.3 | Centrifuge Components                                                                                                                                                                                                                                              |
| a)      | Cup dimensions: Ø120 mm x H200 mm.                                                                                                                                                                                                                                 |
| b)      | Centrifuge cup capacity: 300 g.                                                                                                                                                                                                                                    |
| c)      | Centrifuge cup paper set: 100 pcs (Sun. 370 x 200 mm; package of 100 pcs).                                                                                                                                                                                         |
| 4.1.2.4 | Solvent Management                                                                                                                                                                                                                                                 |
| a)      | Solvent reuse capability for multiple tests.                                                                                                                                                                                                                       |
| b)      | Solvent stabilizer for enhanced operational safety.                                                                                                                                                                                                                |
| c)      | Solvent pumping device included for efficient handling.                                                                                                                                                                                                            |
| 4.1.2.5 | Additional Features                                                                                                                                                                                                                                                |
| a)      | Washing drum with fabric 0.063 mm for fine particle removal.                                                                                                                                                                                                       |
| b)      | Washer drum cover for secure operation.                                                                                                                                                                                                                            |
| c)      | Cup extraction device for easy removal.                                                                                                                                                                                                                            |
| d)      | Quick connection system for rotary evaporator integration.                                                                                                                                                                                                         |
| e)      | Water cooling system: 400V, 3PH, 50Hz.                                                                                                                                                                                                                             |
| 4.1.2.6 | Power Supply                                                                                                                                                                                                                                                       |
|         | Operating voltage: 230V, 50Hz.                                                                                                                                                                                                                                     |
| 4.1.2.7 | Physical Dimensions and Weight                                                                                                                                                                                                                                     |
| a)      | Overall dimensions (up to, with 10% tolerance): 1500 x 750 x 1500 mm.                                                                                                                                                                                              |
| b)      | Approximate weight (up to, with 10% tolerance): 250 kg.                                                                                                                                                                                                            |
| 4.1.2.8 | Worktop and Operational Accessories                                                                                                                                                                                                                                |
|         | Balance worktop for precise weighing operations.                                                                                                                                                                                                                   |
| 4.1.2.9 | Software                                                                                                                                                                                                                                                           |
|         | Should provide data export in CSV or Excel format.                                                                                                                                                                                                                 |
| 4.1.3   | Other Requirements                                                                                                                                                                                                                                                 |
| 4.1.3.1 | Support and Maintenance                                                                                                                                                                                                                                            |
| a)      | Maintenance for a minimum of 5 years (in line with general requirements for 5-year extended warranty).                                                                                                                                                             |
| b)      | Spare parts availability for a minimum of 5 years.                                                                                                                                                                                                                 |
| c)      | User manual and full technical documentation.                                                                                                                                                                                                                      |
| d)      | Access to a dedicated support team (email, phone, live chat).                                                                                                                                                                                                      |
| 4.1.3.2 | Training and Onboarding                                                                                                                                                                                                                                            |
| a)      | Initial training sessions for up to 10 users (on-site). Train-the-trainer concept should be supported which includes establishment of training archive (recordings of training / on-screen guides). Optional annual training (paid separately) per Client request. |
| b)      | Customizable training materials.                                                                                                                                                                                                                                   |
| c)      | All training, manuals and booklets for regular maintenance and use shall be in Romanian and English language.                                                                                                                                                      |
| 4.1.3.3 | Compliance and Standards                                                                                                                                                                                                                                           |
| a)      | Compliance with EN 12697-1 standards.                                                                                                                                                                                                                              |
| b)      | Adherence to Open Data Standards for interoperability.                                                                                                                                                                                                             |
| 4.2     | Specification for Automatic breaking point tester for bitumen                                                                                                                                                                                                      |
| 4.2.1   | General Description                                                                                                                                                                                                                                                |
|         | The Automatic breaking point tester for bitumen apparatus is used to determine the breaking point of bituminous materials by measuring the temperature at which a thin layer of bitumen cracks when subjected to a standardized bending process.                   |
| 4.2.2   | Equipment Components                                                                                                                                                                                                                                               |
|         | The apparatus shall consist of the following components:                                                                                                                                                                                                           |
| 4.2.2.1 | Metal Plate                                                                                                                                                                                                                                                        |
| a)      | Material: Stainless steel or equivalent corrosion-resistant material.                                                                                                                                                                                              |
| b)      | Dimensions: Approximately 41 mm x 20 mm x 0.15 mm, as per the standards.                                                                                                                                                                                           |
| 4.2.2.2 | Bending Device                                                                                                                                                                                                                                                     |
| a)      | Mechanism: A reliable, precision-controlled device to ensure consistent bending of the metal plate at specified increments.                                                                                                                                        |
| b)      | Bending Radius: Adjustable and compliant with standard testing conditions.                                                                                                                                                                                         |
| 4.2.2.3 | Cooling System                                                                                                                                                                                                                                                     |
| a)      | Capable of maintaining uniform and gradual cooling of the sample during testing.                                                                                                                                                                                   |
| b)      | Temperature Range: From ambient temperature to at least -40°C.                                                                                                                                                                                                     |
| c)      | Cooling Medium: Air or liquid cooling (refrigerated system preferred).                                                                                                                                                                                             |
| 4.2.2.4 | Temperature Control Unit                                                                                                                                                                                                                                           |
| a)      | Precision: ±0.5°C or better.                                                                                                                                                                                                                                       |
| b)      | Display: Digital display for accurate temperature reading.                                                                                                                                                                                                         |
| c)      | Sensors: High-accuracy thermocouple or equivalent for real-time monitoring.                                                                                                                                                                                        |
| 4.2.2.5 | Sample Preparation Tools                                                                                                                                                                                                                                           |
| a)      | Spatula: For applying a uniform layer of bitumen on the test plate.                                                                                                                                                                                                |
| b)      | Glass Plate: For ensuring even spreading of the sample.                                                                                                                                                                                                            |
| 4.2.2.6 | Observation Mechanism                                                                                                                                                                                                                                              |
|         | Optical or manual inspection system to detect cracking during the test.                                                                                                                                                                                            |
| 4.2.3   | Non-functional Requirements                                                                                                                                                                                                                                        |
| 4.2.3.1 | Operating Environment                                                                                                                                                                                                                                              |
| a)      | Ambient Temperature: 5°C to 40°C.                                                                                                                                                                                                                                  |
| b)      | Humidity: Up to 90% RH, non-condensing.                                                                                                                                                                                                                            |
| 4.2.3.2 | Material Durability                                                                                                                                                                                                                                                |
|         | All components must be made from corrosion-resistant materials suitable for laboratory use.                                                                                                                                                                        |
| 4.2.3.3 | Safety Features                                                                                                                                                                                                                                                    |
| a)      | Over-temperature protection.                                                                                                                                                                                                                                       |
| b)      | Insulated cooling system to prevent accidental freezing or burns.                                                                                                                                                                                                  |

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| <b>4.2.3.4</b> | <b>Power Requirements</b>                                                                                                                                                                                                                                          |
| a)             | Voltage: 220V-240V, 50/60 Hz (or as specified for the region).                                                                                                                                                                                                     |
| b)             | Energy Consumption: Optimized for energy efficiency.                                                                                                                                                                                                               |
| <b>4.2.4</b>   | <b>Other Requirements</b>                                                                                                                                                                                                                                          |
| <b>4.2.4.1</b> | <b>Accessories and Consumables</b>                                                                                                                                                                                                                                 |
|                | The supplier must provide the following:                                                                                                                                                                                                                           |
| a)             | Spare metal plates (minimum of 10).                                                                                                                                                                                                                                |
| b)             | Thermocouple sensors (2 spare units).                                                                                                                                                                                                                              |
| c)             | Software for automatic calibration.                                                                                                                                                                                                                                |
| <b>4.2.4.2</b> | <b>Documentation and Certifications</b>                                                                                                                                                                                                                            |
| a)             | Comprehensive user manual with operating and maintenance instructions.                                                                                                                                                                                             |
| b)             | Calibration and conformity certificates from an accredited laboratory for the temperature control unit.                                                                                                                                                            |
| c)             | Compliance with ISO 9001 for manufacturing quality.                                                                                                                                                                                                                |
| d)             | The equipment shall be compliant with relevant international standards such as EN 12593 or ASTM D3117.                                                                                                                                                             |
| <b>4.2.4.3</b> | <b>Support and Maintenance</b>                                                                                                                                                                                                                                     |
| a)             | Maintenance for a minimum of 5 years (in line with general requirements for 5-year extended warranty).                                                                                                                                                             |
| b)             | Spare parts availability for a minimum of 5 years.                                                                                                                                                                                                                 |
| c)             | Access to a dedicated support team (email, phone, live chat).                                                                                                                                                                                                      |
| <b>4.2.4.4</b> | <b>Training and Onboarding</b>                                                                                                                                                                                                                                     |
| a)             | Initial training sessions for up to 10 users (on-site). Train-the-trainer concept should be supported which includes establishment of training archive (recordings of training / on-screen guides). Optional annual training (paid separately) per Client request. |
| b)             | Customizable training materials.                                                                                                                                                                                                                                   |
| c)             | All training, manuals and booklets for regular maintenance and use shall be in Romanian and English language.                                                                                                                                                      |

