

## Annex 10: TODIS NON-FUNCTIONAL SPECIFICATIONS

### General requirements and performance requirements

General system requirements and performance requirements are defined by the policies and strategies developed and adopted in the TCT Secretariat. It is worth mentioning that these acts are stemming from the industry best practices and comprise both organizational and technical measures. General system requirements specific for TODIS are defined in Table 10.1.

**Table 10.1. General system requirements specific for TODIS**

Section/ Requirement ID	Requirement Definition
NFR1.0	The system interface shall be in English with mechanism to add new language without reprogramming, through attachable resource files.
NFR1.1	The content of the database will be inputted in English.
NFR1.2	The user's Interface shall be optimized to 1360x768 resolution.
NFR1.3	TODIS shall have the possibility to adjust the user's interface (shall deliver a responsive interface) depending on the device used (notebook, netbook, desktop PC, tablet).
NFR1.4	The system offers an accessible and intuitive interface to human users.
NFR1.5	TODIS shall offer API interfaces to interact with external IT systems, such as: <ul style="list-style-type: none"><li>• DG MOVE - TEN-tec;</li><li>• European GNSS Agency – Galileo Green Lane;</li><li>• World Bank – CPMM System;</li><li>• EU Agency for Railways (ERA).</li><li>• Etc.</li></ul>
NFR1.6	TODIS will ensure compatibility with W3C XForms <sup>1</sup> standard.
NFR1.7	The IT system shall be optimized in the minimum data transfer between the client computer and server, having focused on avoiding the redundant requests as much as possible.
NFR1.8	TODIS shall have at its basis at least a three-level architecture (with a distinct level for data) based on Service Oriented Architecture (SOA).
NFR1.9	The TODIS potentially variable information (parameters, ways of data storage, ways of connection with external services, etc.) shall be configurable and would not require solution recompilation or direct interventions into the database.

<sup>1</sup> An XML markup for a new generation of forms and other applications on the Web – [https://www.w3.org/community/xformsusers/wiki/XForms\\_2.0](https://www.w3.org/community/xformsusers/wiki/XForms_2.0)

NFR1.10	The IT System shall use open standards for formats and communication protocols.
NFR1.11	The services exposed to the public by TODIS shall be technologically neutral in regard to operation system, web browsers etc.

Specific performance requirements of TODIS are defined in Table 10.2.

**Table 10.2. Performance requirements set for the IT System**

<b>Section/ Requirement ID</b>	<b>Requirement Definition</b>
NFR2.0	The average server reply time shall not exceed 3 seconds at system load. Reply time shall be logged for several time-consuming events. List of such events shall be elaborated at design stage with TCT Secretariat.
NFR2.1	The system must be capable to allow activity of over 100 authorized users of the predefined categories. Number of service consumers and appropriate load for each consumer will be defined at analytical and design stage with TCT Secretariat.
NFR2.2	The System shall enable the competing activity of at least 100 concurrent users and servicing of at least 300 simultaneous queries with constant response time.
NFR2.3	Prior to the delivery of IT solution, TODIS performance test shall occur.
NFR2.4	Performance testing shall include at least two components: system load testing and system stress testing. Test cases shall be elaborated by contractor in coordination with TCT Secretariat.

### **System's minimum operational and other parameters**

**Table 10.3. Requirements for TODIS System's minimum operational and other parameters**

<b>Section/ Requirement ID</b>	<b>Requirement Definition</b>
NFR3.0	The infrastructure shall be sufficient to support all the requirements, specified in the functional specifications.
NFR3.1	The infrastructure shall be sufficient to support all the requirements, specified in the non-functional specifications in terms of performance and security.
NFR3.2	The infrastructure shall support staging and production environment.
NFR3.3	The infrastructure shall support dedicated database/storage server(s) with minimum requirements of 16 core (24-32 thread), 128 GB RAM, 4 TB SSD or equivalent cloud solution, provided by the tenderer.

NFR3.4	The infrastructure shall support dedicated application (map) server(s) with minimum requirement of 16 core (32 thread), 128 GB RAM, 1 TB SSD or equivalent cloud solution, provided by the tenderer.
NFR3.5	The infrastructure shall support additional front end web servers if needed, with application load balancer.
NFR3.6	The application load balancer shall be configured with auto-scaling groups which will monitor the performance of the servers (application /map servers and front-end web servers if needed) – at times of high load it will bring in additional servers to meet demand.
NFR3.7	All infrastructure shall be provided by the Contractor for the minimum duration of the project and the maintenance period. Any hardware infrastructure shall be transferred to TCT Secretariat prior to the acceptance tests. In case of cloud infrastructure, the Contractor shall provide a follow up offer for cloud hosting after the end of the maintenance period.

### **Security and protection requirements**

The System shall comply with the technical requirements imposed on Information Systems by the standard ISO/IEC 27001:2013<sup>2</sup> Information technology — Security techniques — Information security management systems — Requirements.

TODIS shall comply with requirements for the assurance of personal data security during their processing within information systems of personal data as per the relevant EU policy<sup>3</sup>.

The IT solution shall comply in full with the security requirements defined in Table 10.4.

**Table 10.4. Requirements for TODIS security and protection**

<b>Section/ Requirement ID</b>	<b>Requirement Definition</b>
NFR4.0	The IT System guarantees full storage and integrity of TODIS database content.
NFR4.1	Access to functions granted to unauthorized and non-authenticated users shall be monitored using protection means against overstressing the service by one or several network hubs.
NFR4.2	The Security subsystem shall provide functionality for single sign on, users' rights, password registry, etc. for all users of the system. The sub-system is also available for all other subsystems to check in the system for authorization rights.
NFR4.3	TODIS shall include a comprehensive security framework.
NFR4.4	TODIS shall include security related data transmission, including: <ul style="list-style-type: none"> <li>• Service endpoint (respondent) authentication;</li> </ul>

<sup>2</sup> <https://www.iso.org/standard/54534.html>

<sup>3</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02016R0679-20160504&qid=1532348683434>

	<ul style="list-style-type: none"> <li>• Client principal (initiator) authentication;</li> <li>• Message integrity;</li> <li>• Message confidentiality;</li> <li>• Replay detection.</li> </ul>
NFR4.5	TODIS shall adopt means which will make possible the encryption of data in database, messages, and communication channels.
NFR4.6	TODIS shall provide monitoring functions based on unified methods to monitor user interactions regarding use of services and data manipulation.
NFR4.7	TODIS shall ensure a regular review of user information on access (at least every 6 months). Security unit reviews information on access to disclose any unauthorized access or data leaking.
NFR4.8	TODIS shall include a mechanism for restoring lost passwords.
NFR4.9	TODIS working session regarding registers and personal data shall be logout automatically after more than 15 minutes of user inactivity, which prevents any further access until the user unlocks the session by repeating the procedure of identification and authentication.
NFR4.10	The System shall be secured against OWASP <sup>4</sup> Top 10 vulnerabilities.
NFR4.11	The System shall ensure confidentiality of data transmitted-received via communications channels. System data exchange is done only via secure channels.
NFR4.12	Interaction with IT Systems shall be performed through an authentication procedure using digital certificate.
NFR4.13	The System will deliver strong mechanisms (i.e. security questions, captcha, etc.) to secure the procedure safety for users' authentication and authorization.
NFR4.14	All users' actions shall be recorded into electronic logs (see FR5.14).
NFR4.15	The System shall make a periodic signal that confirms its functional status.

### Software license and communication requirements

Table 8.5. contains the requirements for software license and communications technology requirements for TODIS.

**Table 8.5. Requirements for software license**

<sup>4</sup> Open Web Application Security Project – <https://owasp.org/www-project-top-ten/>

<b>Section/ Requirement ID</b>	<b>Requirement Definition</b>
NFR5.0	The System shall have the possibility to be installed on both dedicated servers and on virtual solutions (on premise or cloud based).
NFR5.1	If the software platform used to develop and operate the TODIS is based on commercial IT solutions, requiring license procurement, the Contractor will include in the price offer the delivery of all licenses required for TODIS development and operation (the Contractor shall purchase on behalf of the Transport Community Permanent Secretariat all licenses required for the development and operation of the IT System) and will pay any subscription for the entire contract duration (TODIS development and maintenance) .
NFR5.2	All software must be provided with an unlimited number of concurrent users (e.g., Web based)
NFR5.3	All software must be provided for an unlimited number of users for any infrastructure component (i.e., application server, plug-in, etc.) needed for full operation.
NFR5.4	The system shall have a modular architecture, which shall follow n-layer architectural pattern with clear separation between layers. System components shall be loosely coupled and have clear communication interfaces.
NFR5.5	The system shall expose its functionality as API through Web Services. The API shall be clearly and comprehensively documented.
NFR5.6	The system shall be logically decoupled through abstract interfaces from modules implementing functionalities such as logging, notifications, authentication, scheduling if such modules are in scope of current system.
NFR5.7	The system must be highly configurable and shall not be tied in any way to specific physical resources, such as locations on disks or types of devices. The configuration shall allow changes of important parameters preferably without the need to restart the running system
NFR5.8	The Contractor must license all software to the TCT Secretariat allowing designated personnel to perform diagnostics, installation, update/ upgrade, and repair/ debug activities without any external assistance. TCT Secretariat should receive support for three years from Contractor in any part of the system.
NFR5.9	The System shall be tolerant to errors by offering support for clustering and fail over for the whole platform and own components.
NFR5.10	It is advisable to ensure that the service parts exposed to the public are technologically neutral.
NFR5.11	The System shall be compatible with at least 2 of the most recent versions of all the following WEB browsers: Microsoft Edge, Mozilla Firefox, Google Chrome, Safari and Opera.
NFR5.12	The System shall include configurable means for technical logging (see FR5.14).

NFR5.13	The Contractor shall list the means to be used for system troubleshooting.
NFR5.14	The System shall operate in Transmission Control Protocol (TCP)/ Internet Protocol (IP) networks and, especially, in Hypertext Transfer Protocol Secure (HTTPS).

### **Spatial data infrastructure requirements**

The requirements set for Spatial Data Infrastructure implemented in TODIS are defined in Table 10.6.

**Table 10.6. Requirements for SDI**

<b>Section/ Requirement ID</b>	<b>Requirement Definition</b>
NFR6.0	Spatial Data Infrastructure (SDI) of TODIS must support ISO19139:2007 metadata dataset collections profile compatible with the INSPIRE Metadata Implementing Rules guidance based on ISO 19115 / ISO 19119.
NFR6.1	TODIS must support SDI services, as defined by the Open Geospatial Consortium (OGC) Standards with support for minimum: <ul style="list-style-type: none"> <li>• Web Map Service (WMS) v1.1.1 (or later);</li> <li>• Web Feature Service (WFS) v1.1.0 (or later);</li> <li>• Web Coverage Service (WCS) v1.0.0 (or later);</li> <li>• Catalog Service Web Profile (CSW) v2.0.0 (or later).</li> </ul>
NFR6.2	TODIS must provide a password-protected access to WMS and WFS for desktop-based or web-based GIS software clients.
NFR6.3	TODIS must support SDI services web-based management interface with min support for: <ul style="list-style-type: none"> <li>• Setting up different levels of access for different categories of users for CSW service;</li> <li>• On-line editing of metadata and uploading of metadata files in XML format for Catalogue Service for the Web (CSW) service;</li> <li>• On-line metadata search and discovery by using an attribute (search) query interface and spatial query (web map search interface) for CSW service;</li> <li>• On-line set-up and configuration of WMS, WFS and WCS services;</li> <li>• On-line preview and retrieval of SDI datasets in the form of GIS data files (for WMS, WFS and WCS) with support for min SHP and GML as vector layer(s) file formats and min GeoTIF as raster layer(s) file formats.</li> </ul>
NFR6.4	TODIS must support Web Map Publishing (WMP) with min support for:

	<ul style="list-style-type: none"> <li>• Managing and portrayal of Serial digital interface (SDI) services and datasets with support for standard web technologies (e.g. JavaScript, XML, etc.);</li> <li>• Authentication and authorization services with user, group and service administration capabilities using web-based user interfaces;</li> <li>• Web-based management interface for web mapping content and design of customized web mapping applications.</li> </ul>
NFR6.5	SDI of TODIS must provide services for integration with other external systems, such as: <ul style="list-style-type: none"> <li>• DG MOVE - TEN-tec;</li> <li>• European GNSS Agency – Galileo Green Lane;</li> <li>• World Bank – CPMM System;</li> <li>• EU Agency for Railways (ERA).</li> <li>• Etc.</li> </ul>

### **RDBMS requirements**

The requirements set for Relational Data Base Management System used for TODIS are defined in Table 10.7.

**Table 10.7. Requirements for RDBMS**

<b>Section/ Requirement ID</b>	<b>Requirement Definition</b>
NFR7.0	RDBMS must be delivered under open-source license (GNU Public License or similar), which must also apply to all database custom code (SQL scripts, types, functions, triggers, packages etc.) provided during supply delivery and created during customization and integration.
NFR7.1	RDBMS must support remote connectivity options (connectors, drivers, etc.) for direct read/write access by external desktop-based or web-based software client(s).
NFR7.2	Native 64-bit RDBMS version supporting native 64-bit Server OS environment must be installed.
NFR7.3	RDBMS must support a full-scale automatic replication.
NFR7.4	RDBMS must support full-scale back up/recovery capabilities using standard Structured Query Language (SQL) data format(s) as well within native internal functionality.
NFR7.5	RDBMS must support full-scale self-maintenance capabilities with min support for automatic re-indexing, clean-up of temporary records and recovery of storage space.
NFR7.6	RDBMS native GIS application extension compliant with the OGC Simple Features Specifications for Structured Query Language (SQL) must be installed.

NFR7.7	RDBMS and RDBMS native GIS application extension must provide a back-end support for the introduction and implementation of the SDI, supporting min CSW, WMS and WFS services.
NFR7.8	RDBMS must support cauterization with load balancing.
NFR7.9	RDBMS must support internal audit capabilities to manage and control users' actions and use of privileges.
NFR7.10	RDBMS must support data protection capabilities such as Secure Sockets Layer (SSL) or Transport Layer Security (TLS) and data encryption. In some cases, data encryption equivalent shall be supplied by Contractor.

### **Documentation requirements of the IT System**

The IT solution shall be accompanied by a full package of documentation of the IT system comprising the sections included in Table 10.8.

Such provisions shall be read together with the relevant parts of the Technical Specifications describing deliverables to be prepared under the Contract.

**Table 10.8. Documentation requirements of TODIS**

<b>Section/ Requirement ID</b>	<b>Requirement Definition</b>
NFR8.0	Documentation shall be handed over in two hard copies and electronic editable format.
NFR8.1	The Contractor shall prepare and publish interactive guidance materials included in the user's Interface of the TODIS.
NFR8.2	The Contractor shall prepare and deliver the IT System Technical Design (Software requirements specification and Software Design Description).
NFR8.3	The Contractor shall prepare and deliver a report on imported and quality assured data.
NFR8.4	The Contractor shall prepare and deliver elaborate training protocols and materials (training plan, training data, step by step exercises relevant to the various system roles).
NFR8.5	The Contractor shall prepare and deliver the Guide on system installation and configuration (to include at least guidelines and build scripts for code compilation, installation of application, hardware and software requirements, platform description and configuration, application configuring, and disaster recovery procedures).
NFR8.6	The Contractor shall prepare and deliver the System Architecture Documentation with the description of models in UML (Unified Modelling Language) language, to include a sufficient level of details in terms of

	Architecture in several cross-sections (including the data logical and physical model).
NFR8.7	The Contractor shall prepare and deliver API documentation exposed to be integrated with other IT Systems.
NFR8.8	The Contractor shall deliver all electronic mediums necessary to describe and validate the interfaces in Web Service Definition Language (WSDL).
NFR8.9	The Contractor shall deliver the source code for applications and components developed under the Project.
NFR8.10	The Contractor shall deliver the Administrator' Manual that describes administration functions, including the functions exposed directly from the system, as well as the manual procedures necessary to maintain and secure proper functioning of the IT application.
NFR8.11	The Contractor shall deliver the user's Manual that describes the IT solution parts exposed for different roles of human users.
NFR8.12	The Contractor shall deliver interfaces for automatic interoperation with external systems specified (technically) and documented (in human text).
NFR8.13	The Contractor shall prepare and deliver monthly reports with all issues, bug fixes and maintenance activities, as well as Final Maintenance Summary with all issues, bug fixes and maintenance activities and recommendation for next steps of the system life-cycle maintenance.
NFR8.14	All documentation must be in English

### **Maintenance requirements of the IT System**

The Contractor shall ensure post-delivery maintenance period and technical support comprising the sections included in Table 8.9.

**Table 8.9. Maintenance period and technical support of TODIS**

<b>Section/ Requirement ID</b>	<b>Requirement Definition</b>
NFR9.0	The Contractor shall offer maintenance and technical support for three years following the successful implementation and put into operation of TODIS, after the system commissioning.
NFR9.1	Support covers system software, hardware, infrastructure, and database issues.
NFR9.2	The maintenance period and technical support for the warranty period shall meet the Standard ISO/IEC 14764:2006 Software Engineering — Software Life Cycle Processes — Maintenance <sup>5</sup> .

<sup>5</sup> <https://www.iso.org/standard/39064.html>

NFR9.3	The Contractor shall provide the TCT Secretariat with a Help Desk service available in all business days throughout the year and responding in English.
NFR9.4	The TCT Secretariat shall report all technical issues that could occur through a ticketing mechanism, E-mail, or instant message in an environment setup and provided by the Contractor. Phone reports shall be also accepted.
NFR9.5	The Contractor shall document the technical issues and their traceability for the TCT Secretariat.
NFR9.6	Help Desk shall be implemented via three-level support regime: <ul style="list-style-type: none"> <li>• 1st level support, by a super-user, who can give rapid help to users at TODIS who experience a problem with the system. This requires a person who has exceptionally good knowledge of the system, who can understand the problem and give advice on what to do;</li> <li>• 2nd level support by an analyst, who can analyse problems that cannot be solved by the experienced user, or analyse the need for improved functionality in depth and prepare related specifications for subsequent changes to the source code;</li> <li>• 3rd level support by a Contractor, who can make changes to the source code for correction of errors and for new functionality.</li> </ul>
NFR9.7	The remediation period shall not exceed 1 working day for critical issues and 3 working days for non-critical issues. The maximum downtime when upgrading is 8 hours, during non-office/non-working days.

### **Acceptance requirements of the IT System**

The IT solution shall be accompanied by a full package of acceptance testing requirements of the IT system comprising the sections included in Table 10.10.

**Table 10.10. Acceptance testing requirements of TODIS**

NFR10.0	The Contractor shall prepare an acceptance testing plan (including as a minimum use cases description, testing sequence, scope/ functionality, testing resources and acceptance criteria), and deliver Acceptance testing protocols (testing deliverables with confirmation of full compliance with ToR requirements, including functional and non-functional specifications).
NFR10.1	The Contractor shall prepare functional requirements testing, including as a minimum: <p>- purpose of the test case: specific requirements ID, description of the sequence of activities if any, input data, processing, and outcome.</p> <p>- execution: execution of every use case, use case diagram or functionality, with valid and invalid data, with proper notification for invalid data and compliance that all the business rules have been applied correctly.</p>

	- acceptance criteria: all tests are executed, and all deviations are reflected correctly.
NFR10.2	The Contractor shall prepare non-functional requirements testing, including compliance checks for all items specified in the ToR.
NFR10.3	The Contractor shall prepare user interface testing for all workflows diagrams, specified in the test plan, with detail checks on all windows, forms, menus, pop ups, with their size, behavior, positions, according to requirements and common usability criteria.
NFR10.4	The Contractor shall prepare performance testing, including system response time and number of transactions, based on user's workflow functionality and data.
NFR10.5	The Contractor shall prepare load testing, including maximum users simulation, bulk usage of different functionality with different data, to identify that the system is performing well, beyond the minimum requirements, based on full system hardware resources.
NFR10.6	The Contractor shall prepare stress testing, including maximum users simulation, bulk usage of the same functionality with the same data, worst case scenario for transactions load, to identify the maximum load beyond which the system cannot function properly, based on predefined limited system hardware resources (limited RAM, storage, processors) to identify system defects due to limited resources.
NFR10.7	The Contractor shall prepare regression testing and shall maintain a test management system to ensure regression testing consistency for any changes and updates of the system functionality.
NFR10.8	The Contractor shall prepare security testing on all the public end points.
NFR10.9	The Contractor shall prepare and perform penetration testing for the underlying infrastructure (e.g., network devices, operating systems, database management system, web servers) and the application (custom development).