



AGÊNCIA DE TRANSPORTE DO ESTADO DE SÃO PAULO

Appendix F – Rodoanel Norte Lot

Sheet 1 of 14

APPENDIX F

DIGITAL SYSTEMS

SPONSORED CONCESSION OF PUBLIC SERVICES OF OPERATION, MAINTENANCE AND MAKING OF THE INVESTMENTS NECESSARY FOR THE EXPLORATION OF THE ROAD SYSTEM CALLED RODOANEL NORTE LOT



AGÊNCIA DE TRANSPORTE DO ESTADO DE SÃO PAULO

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1. INTRODUCTION

- 1.1. In this APPENDIX, the digital systems and the respective details for their implementation and operation by the CONCESSIONAIRE are provided, without prejudice to the provisions set forth in the AGREEMENT and ANNEXES.
- 1.2. For all systems implemented, future integration with ARTESP's information systems should be foreseen, observing the speed, secrecy, guarantee, integrity, reliability of information security, in terms aligned and updated with the best market practices, and the approval of ARTESP is essential in all aspects in the text observed here.
 - 1.2.1. Annually, the CONCESSIONAIRE must perform an independent audit, with the delivery of the respective report to ARTESP, on digital systems that involve the determination of QPI or that are a source of information for the inspection performed by ARTESP. The audit must be performed by a specialized enterprise and previously approved by ARTESP.
- 1.3. Digital systems must comply with the following mandatory conditions:
 - (i) portal with access via web and / or mobile app at the discretion of ARTESP, with availability of user / password pairs for ARTESP for consultation and eventual *download* of files and information, validation of information, registration of comments and upload of documents in defined formats by ARTESP;
 - (ii) export 100% of the registered information to editable documents and standards and / or format defined by ARTESP. According to legal parameters and defined by ARTESP, the confidentiality of users' personal information must be guaranteed;
 - (iii) integration with ARTESP's electronic documents and information systems for the same purposes;
 - (iv) systemic integration and data architecture aligned with the ICC and compatible with the technologies defined and adopted by ARTESP, which supports all existing and future demands, if any;
 - (v) delivery and return, at the end of the CONCESSION AGREEMENT, of all digital content in high-capacity electronic media, as well as backup of all stored contractual data, including databases in current and performance formats, image bank, digital collections, historical collections, together with all the transfer of technology to developed software;
 - (vi) approval of ARTESP's technical area (s) for each module developed;
 - (vii) in case of systems development, the following must be delivered: source codes, requirements documentation, as well as functional and procedural workflow of all computerized systems implemented by the CONCESSIONAIRE or by third parties contracted by it, as long as the licenses applicable to the systems allow;
 - (viii) for systems that depend on valid licenses, the CONCESSIONAIRE must ensure at least 2 (two) years of licenses after the termination of the CONCESSION AGREEMENT;
 - (ix) issuing management reports in spreadsheet format or another format defined by ARTESP;
 - (x) initial implementation until the end of the first year of CONCESSION with expansion and improvement plans for the remaining years;
 - (xi) exchange of information between the different systems, when applicable;
 - (xii) integration of information with databases of CONCESSION BIM models, generated from EXECUTIVE PROJECTS related to expansion works (except for the completion works of

the Rodoanel Norte, if the Concessionaire uses the project approved by DERSA), prepared by CONCESSIONAIRE during the AGREEMENT, as well as models generated from the work of restoring the highway in BIM modeling, as provided in the APPENDIX to ANNEXES 5, 6 and 7;

- (xiii) integration and synchronization of information, whenever possible in real time, with SIGGIS - which should act as the main management system for CONCESSION information;
 - (xiv) possibility of automatic determination of the Concession's QPI, in accordance with the rules established by ARTESP in the REQUEST FOR BIDS, the AGREEMENT and other regulations on the subject;
 - (xv) basic linked register of location information (highway, type of road, direction of the lane, roadway, elements coordinates, etc.), including for the purposes of registering elements, in addition to research and consultation;
 - (xvi) full compatibility with the SIRGAS2000 coordinate system or another that ARTESP will eventually adopt.
- 1.3.1. The CONCESSIONAIRE may propose, at its discretion, the development of a single platform to meet the requirements provided for in the REQUEST FOR BIDS, provided that a modular development architecture is maintained (modules basically independent from each other for the purposes of implementation and operation).
- 1.4. The stages of development, testing, implantation and effective functioning of SISPROJ, SISQUALI, SISSOND and SISDEMANDA must be described by the CONCESSIONAIRE in its POI.
- 1.5. Notwithstanding the sharing of data and documents in a virtual manner, through SISPROJ, SISQUALI and SISSOND, the CONCESSIONAIRE must respect the deadlines and file, if requested by ARTESP, the deliveries in a physical copy to ARTESP for the purpose of instrumentalizing the physical administrative processes corresponding.
- 1.6. Failure to meet the requirements set out in this APPENDIX subjects the CONCESSIONAIRE to the penalties foreseen in ANNEX 11.
- 1.7. The CONCESSIONAIRE must present, within 120 (one hundred and twenty) days from the signing of the AGREEMENT, a detailed schedule for the implementation and operation of the systems, for approval by ARTESP.

2. INTEGRATED DIGITAL SYSTEM FOR SOCIAL DEMAND MANAGEMENT - SISDEMANDA

- 2.1. In the first year of the CONCESSION, the CONCESSIONAIRE must implement the SISDEMANDA, which should allow the receipt of automatic communications, consultation, *download* of files and information, as well as registration of information, data and documents by the technical areas of ARTESP. The system must be able to store and manage the various claims and demands received from society and from the various public participation bodies (Public Administration, Local Government, Chambers, Associations, etc.).
- 2.2. It shall have a portal via the *web* and / or *mobile app* at the discretion of ARTESP, where the various sectors of society may register their users and subsequently register their respective demands, by filling out a form, with fields pre-defined by the CONCESSIONAIRE in conjunction with ARTESP - minimum information required for technical analysis of claims and socioeconomic justifications, including submission of preliminary draft of the required investment and eventual proof of payment of analysis fees, when ARTESP so determines.
- 2.3. In this portal, the other USERS will also be able to consult claims previously registered by other USERS in the portal by consulting the location (highway, kilometer, type of investment

- demanded, etc.) and, eventually, also contribute to the same pre-existing demand / claim with the possibility of attaching documents and justifications that corroborate the need to prioritize the investments demanded on the place.
- 2.4. SISDEMANDA should be able to synchronize basic information contained in the CONCESSIONAIRE's database about the places under study, such as current road geometry, existence of security elements (barriers, pedestrian flyover, etc.), average daily volumes, peak-hour volume, accident rates, regional socioeconomic growth rates (GDP, per capita income, population etc.), as well as assigning weights to these elements, according to rules pre-established by ARTESP, in order to define technical priorities for the demanded investments. In this system, there must be an option of correlating investment claim places with georeferencing for applications in latitude and longitude GEO system maps and in SIGGIS. ARTESP will define which information will be visible to the general public and which will be visible only to ARTESP and CONCESSIONAIRE.
 - 2.5. SISDEMANDA must also inform the user, at the time of registration, when the place of the demanded investment is located outside the CONTRACTOR'S district / administration area. All management must be done by the CONCESSIONAIRE and the steps of the process can be followed by all USERS. Integration with ARTESP digital systems should be provided for the same purposes.
 - 2.6. All third-party claims, as well as the inclusion of new investments not provided for in the POI and details of the relevant activities, related to the functions specified in ANNEX 5, must be registered and made available in SISDEMANDA, as per the rules established in the AGREEMENT and, especially, of according to the procedures described in ANNEX 7, observing the norms applicable to ORDINARY REVISIONS.
 - 2.7. SISDEMANDA shall facilitate and instrumentalize the processing of ORDINARY REVISIONS and have an exclusive service channel for local authorities. The Digital Platform, which is not to be confused with the ombudsman and citizen service system, should serve as the appropriate channel so that the authorities, USERS and other interested parties can present suggestions for improvements and new investments, the performance of which, if pertinent, should be included as an obligation of the CONCESSIONAIRE for the next years of the AGREEMENT. The CONCESSIONAIRE will ensure that ARTESP has access to all the information necessary for the proper knowledge of each suggestion submitted through the Digital Platform.
 - 2.8. The CONCESSIONAIRE must observe the specifications presented in this APPENDIX for the implementation of the SISDEMANDA Platform, through which it must manage the demands and, within up to one year before the ORDINARY REVISION, present a document containing the compilation of the investments, expansions and improvements, staggered justifiably to ARTESP, in degree of priority, for the improvement of the ROAD SYSTEM (Consolidation of Demands for Ordinary Revision), together with the related preliminary drafts and / or FUNCTIONAL PROJECTS that have been presented and received by the CONCESSIONAIRE via SISDEMANDA and / or already have been prepared by the CONCESSIONAIRE itself.
 - 2.8.1. The schedule presented in the Consolidation of Demands must present the justifications for the necessity of the contractual modification eventually resulting from the demand received, as well as elements that demonstrate the advantage for the Administration and the interest of the USERS.

3. INTEGRATED DIGITAL SYSTEM FOR DIGITAL PROJECT MANAGEMENT - SISPROJ

- 3.1. In the first year of the CONCESSION, the CONCESSIONAIRE must implement the SISPROJ with access via web and / or mobile app at the discretion of ARTESP. *BIM* projects and models must be made available in the system with each delivery. Once made available, there will be no possibility of changing versions in the system by the CONCESSIONAIRE without the proper registration and versioning control activated through alert, warning, communication and / or knowledge *workflow* for registered users by ARTESP. The coding standards (work id) of work / service items and coding of the project document in force and defined by ARTESP must be maintained.
- 3.2. For the performance of any services specified in ANNEXES 5, 6 and 7 in which it is necessary to present engineering projects, they must be fed into SISPROJ.
- 3.2.1. The CONCESSIONAIRE must insert, within 12 (twelve) months after the implementation of SISPROJ, all engineering projects previously submitted to ARTESP.
- 3.3. If it is necessary to send projects related to obtaining ACCESS authorization for neighboring to the RIGHT-OF-WAY of the highways that are part of the ROAD SYSTEM, the CONCESSIONAIRE must also supply the SISPROJ in a digital copy.

4. INTEGRAL DIGITAL SYSTEM FOR DRILLING AND TESTS - SISSOND

- 4.1. In the first year of the CONCESSION, the CONCESSIONAIRE must implement the SISSOND with access via web and / or mobile app at the discretion of ARTESP. The drilling must be updated at SISSOND for each drilling carried out and validated within the RIGHT-OF-WAY of the highway by the CONCESSIONAIRE or third parties. They should contain location information (georeferenced), description of the layers' horizons and their respective thickness and *Nspt* index, as well as water level, rock occurrence and other relevant information. It should also contain a module for recording the results of laboratory tests of the collected samples. It will allow greater control, management and reliability of the drilling information used either for the purpose of geological mapping for the purposes of project and / or determination of any geological / geotechnical irregularities.

5. INTEGRATED DIGITAL SYSTEM FOR MANAGING TECHNOLOGICAL CONTROL AND WORKS QUALITY - SISQUALI

- 5.1. In the first year of the CONCESSION, the CONCESSIONAIRE must implement SISQUALI, in order to maintain an updated register of the results of the tests foreseen in the applicable norms in force (ARTESP, ABNT and DER / SP), as well as the processing of these data through calculations by statistical procedures data in order to demonstrate full compliance with the normative provisions and applicable technical specifications in force. The monitoring data of the works must be updated in SISQUALI *online* and in real time by the technical team responsible for quality control. It should be noted that the risks associated with the Quality Control of the works are the full responsibility of the CONCESSIONAIRE. Provision should be made for data integration between SISPROJ and the Integrated BIM model for Construction Monitoring / *As Built* (MBIM-AB), as well as with SISGIS.
- 5.2. Without prejudice to the data and documents that will be available for digital access through SISQUALI, the CONCESSIONAIRE shall comply with the maintenance obligations of the physical path signed by the enterprise responsible for the field control together with the work's documentation and, when applicable, of delivery and protocol of physical copies of documents, including for statement of service and calculation of the relevant procedural deadlines.
- 5.3. ARTESP reserves the right, at any time, to express recommendations and guidelines, including for the purpose of drawing the attention of the CONCESSIONAIRE to comply with a certain norm, which may also be done based on the information to which it has access through SISQUALI.

6. GIS INTEGRATED DIGITAL SYSTEM OF CONCESSION - SISGIS

- 6.1. In the first year of the CONCESSION, the CONCESSIONAIRE must implement the SISGIS, which should allow the receipt of automatic communications, *download* of files and information, as well as registration of information, data and documents by the technical areas of ARTESP. SISGIS should have a robust interface capable of incorporating, integrating and managing, in the form of *layers* of georeferenced maps, all the information contained in the databases of the various digital systems provided for in the Concession, as well as relevant information contained in the BIM models generated over the course of the CONCESSION and the MDSR. Minimum characteristics of SISGIS:
- (i) to be compatible with the SIRGAS2000 coordinate system or any other that ARTESP may eventually adopt;
 - (ii) to provide historical aerial images (satellite photo) with a minimum resolution of 10m on a weekly basis; and aerial images with a minimum resolution of 0.50 m with bimonthly frequency, as well as maintaining and managing such records (they must be available for consultation and research by ARTESP);
 - (iii) to provide, by *default* and from official or reliable sources, a digital road map of all roads in the ROAD SYSTEM, as well as the roads granted or not around the CONCESSION;
 - (iv) to be able to plot information from different databases on a road map, based on geolocation or approximate location information, based on a physical reference of the milepost of highways of the ROAD SYSTEM;
 - (v) to provide, from official or reliable sources, mapping (updated *layers*) of data and socioeconomic indicators: population density; population growth, vehicle volumes; GDP, among others considered relevant for the analysis of claims / demands of society, as well as analysis of the viability of undertakings;
 - (vi) to provide, from official or reliable sources, mapping (updated *layers*) of data and indicators of land use and occupation;
 - (vii) to provide, from official or reliable sources, mapping (updated *layers*) of data and historical records of climatic indicators, such as: rainfall density (hourly, daily, weekly, monthly and annual); temperature (hourly, daily, weekly, monthly and annual).
 - (viii) to provide, from official or reliable sources, mapping (updated *layers*) of data and indicators of land use and occupation;
 - (ix) to provide, from official or reliable sources, updated *layers* of geological maps and pedological maps;
 - (x) to provide, from official or reliable sources, updated *layers* of topographic maps (relief), with an accuracy of 10 meters or higher;
 - (xi) to provide, from official or reliable sources, updated *layers* of hydrographic basin maps;
 - (xii) to enable real-time integration (automatic update) with databases of the other CONCESSION digital systems, for example, with the databases of the SIR and SISATIVOS systems;
 - (xiii) to enable navigation on an aerial map, aerial image and / or 'street view' (the latter through the integration of data from the survey of the video-record carried out by the Concessionaire and stored in the SIR database);

- (xiv) to enable integration of information with the BIM models generated by CONCESSION;
 - (xv) to enable integration of information with the MDSR;
 - (xvi) visualization of the various information and maps mentioned above in format of layers or filterable *layers* ;
 - (xvii) to enable integration of information with the BIM models generated by CONCESSION;
 - (xviii) to enable integration with the MDSR;
 - (xix) visualization of the various information and maps mentioned above in format of layers or filterable *layers* ;
 - (xx) search by topographic coordinates or by address (highway code, lane, track, mileage);
 - (xxi) possibility of tracking images for overlay on an aerial map;
 - (xxii) possibility of importing and exporting vectorized lines to drawings *software* files;
 - (xxiii) possibility of developing a management interface for all elements and digital systems of the CONCESSION for the purposes of asset management and integrated operation, as well as visualization of various information in an aerial map format;
 - (xxiv) to allow the sharing of information with other public service providers, such as Highway Police, Firefighters, DER / SP, etc.
 - (xxv) to establish a procedure to indicate / map, register in SISGIS and maintain an updated record, areas along the highway to be used as support for water supply (potential water reservoirs, with availability for use), as described in the Fire Fighting Service item contained in ANNEX 5;
 - (xxvi) To establish a communication plan, via SISGIS, including possible availability of user / password pairs, or another alternative way (to be evaluated by ARTESP) for automatic communication of fire events and monitoring of the areas surrounding the CONCESSION via aerial photo or images from cameras to the competent authorities (firefighters, CETESB, etc.); and
 - (xxvii) To establish a procedure for registering fire occurrences in SISGIS, in order to generate a database of critical events.
- 6.2. The SISGIS will consist of a web interface (open GIS platform service or equivalent) that allows navigation on an aerial map and visualization / overlay and quick access to the historical images collected and properly stored in databases. This platform should also enable navigation and access to the historical images of the video-record surveys carried out by the CONCESSIONAIRE, as required by ANNEX 6.
- 6.2.1. The data will be incorporated into the system used by ARTESP through digital restitution. In this way, the primary database of the ROAD SYSTEM will be obtained, including, but not limited to, graphic files (containing the registered spatial information) and tabular files (containing the attributes of each registered element).
- 6.2.2. The data from the monitoring of the physical structures must be cataloged by means of records, which must already have the geographic address of the observed spot, so that its introduction in the database will already presuppose its connection with the georeferenced graphic data. In case of unregistered elements, equipment of the global positioning system (GPS - *Global Position System*) must be used, in order to provide the location data with sufficient approximation for its perfect definition.

- 6.2.3. The information corresponding to the georeferenced attributes, as well as the data from the monitoring, will compose tables in the system database. Only, these tables will have an index to link with the data stored in the graphical base, allowing double access to that data (accesses of the attributes by query to the graphical base and access to the graphic elements by querying the database).
- 6.3. In the first year of CONCESSION, the CONCESSIONAIRE must submit to ARTESP's approval a publication schedule of the various layers of information related to the CONCESSION prepared by the CONCESSIONAIRE, resulting from each of its contractual obligations. For each new information included, the schedule must be revised and sent to ARTESP's knowledge and approval. In this document, the CONCESSIONAIRE must also foresee what information will be visible to the various interested sectors: information for the general public, information for USERS of the ROAD SYSTEM, information for public service providers, information for ARTESP, etc. ARTESP reserves the right to agree or request changes.
- 6.4. ARTESP reserves the right, at any time, to request the registration and publication of new information on SIGGIS, provided that it is within the scope of CONCESSIONAIRE's contractual obligations. In this case, an appropriate deadline must be provided, appropriate to the level of detail of the requested information. Once agreed by the CONCESSIONAIRE, the agreed deadlines must be met under the penalty of applying the sanctions provided for in the AGREEMENT.

7. INTEGRATED DIGITAL SYSTEM FOR MONITORING WORKS - SISOBAS

- 7.1. In the first year of the CONCESSION, the CONCESSIONAIRE must implement SISOBAS, in which it must register through photographic registration, the progress of each of the work front in the ROAD SYSTEM with *online* and real time update and with at least one photo per type of service / intervention. The photos must contain information on time, date, location (georeferenced with latitude and longitude coordinates) and basic comments on the type of service performed. The system should have a tool for issuing reports. You must have filters to select the work item, type of intervention, date, location, etc.

8. INTEGRATED SYSTEM OF DIGITAL MANAGEMENT OF CONSERVATION FUNCTIONS - SIGECON

- 8.1. In the first year of CONCESSION, the CONCESSIONAIRE must implement SIGECON with access, to ARTESP, via the *web*. User/password pairs must be made available to ARTESP in order to receive automatic communications, consult and *download* information by ARTESP's technical areas.
- 8.2. SIGECON must be able to store and manage the routine conservation non-conformities verified in the ROAD SYSTEM, according to the standards defined in this APPENDIX. The system should allow recording and updating of photos, and other pertinent information (description, classification, date, location, etc.), of the non-conformities verified in the ROAD SYSTEM according to their assumption, with regard to meeting the standards indicated in the routine conservation program. The updating of the "non-conformities" register may be carried out either by the CONCESSIONAIRE or by the GRANTING AUTHORITY.
- 8.3. The system should also allow the registration of the counterproof of the services performed by the CONCESSIONAIRE (photos *upload* and other pertinent information). The photos must contain information on time, date, location (georeferenced with latitude and longitude coordinates) and basic comments on the type of service performed. The system should have a tool for issuing reports. You must have filters for selecting type, class, date, time, location, etc. Integration with ARTESP digital systems should be provided for the same purposes.
- 8.4. SIGECON must be able to record and account the quantities of materials and services performed in a given period, according to the coding standard described in this APPENDIX,

configuration of items contained in the TPU (DER / SP unit price table) or other standard that ARTESP will define.

9. INTEGRATED DIGITAL SYSTEM OF ROAD INVENTORY REGISTRATION - SIR

- 9.1. The CONCESSIONAIRE shall implement, in the first year of the Concession, the SIR with access via *web* to register and update the images and information collected both in the conventional field surveys and in the video-record surveys. The system should contain two modules, being (1) the image display module and (2) the road inventory management module.
- 9.2. In the image display module, the system should be able to synchronize the information recorded by the attributes (location by km, by GPS, etc.) when reproducing the images, as well as making it possible to search for images by kilometer reference.
- 9.3. In the road inventory management module, the system must be able to maintain an updated record of the inventoried road elements. Based on the registered data, the system should also be able to produce management reports consolidating and summarizing information according to the user's needs (for example: total extension of roadways year by year, total extension of rigid barriers, number of signs by type, number of accesses to the right-of-way and its status as to regularity, etc.).
- 9.4. The system should also be able to generate specific files for viewing the elements registered in specific map *software* (kmz, kml or equivalent files), as well as generating straight-line diagrams that represent elements registered along the road. Provision should be made for the export of the information registered in electronic spreadsheets, as well as the supply, at the end of the AGREEMENT, of high-capacity digital media, with a copy of all files registered in standard electronic spreadsheet files. The integration of this system with systems used by ARTESP for the same purposes should also be provided for, as well as integration with ARTESP's CCI.

10. ELECTRONIC SYSTEM FOR CONCESSION'S ASSETS MANAGEMENT - SISATIVOS

- 10.1. The CONCESSIONAIRE must implement SISATIVOS, whose data must be managed within SIGIS.
- 10.2. Such system will have the function of keeping a record in an updated database, of all assets (linear and non-linear) of the CONCESSION, as well as maintaining the history of maintenance, inclusions, exclusions and modification of these.
- 10.3. Full integration between SISATIVOS and MDSR databases should be provided for, as it is implemented, so that data can be loaded or consulted on both platforms or interfaces, that is, certain information must be passable of consultation both from the MDSR and from the SISATIVOS system interface itself.
- 10.4. The update of the data in the system must have a minimum periodicity of 6 (six) months, except in the case of specific elements in which ARTESP determines a different periodicity.
- 10.5. The CONCESSIONAIRE shall provide for the initial implementation of SISATIVOS within a maximum period of 2 (two) years after the signature of the INITIAL TRANSFER TERM. Eventual improvements may be implemented during the remaining years of the CONCESSION.

11. PAVEMENT MANAGEMENT DIGITAL SYSTEM- SGP

- 11.1. The CONCESSIONAIRE shall provide for the implementation of the SGP with access via *web*, after 1 (one) year of the TRANSFER DATE OF THE ROAD SYSTEM CONTROL. This system should include, at least, the following modules / functions:
 - (i) geometric registration module of the Rodoanel Norte Lot road network - this module should be able to maintain the basic geometric registration updated of the lot ROAD SYSTEM in terms of nomenclatures, mileage, extensions of homogeneous segments,

number of lanes, number of roadways, presence of shoulders for all highways and other devices of the road system such as grade-separated interchange and frontage roads;

- (ii) traffic data registration module - the SGP shall include a basic registration module of information related to the traffic data of the road system in terms of VDMs and data relating to the weighing of vehicles to subsidize the calculation of the vehicle factors of homogeneous segments of the lot for purposes of project and / or characterization of the current fleet;
- (iii) pavement structure registration module - this module should be able to maintain an updated register regarding existing and new pavement structures in terms of characterization of materials and thicknesses; as well as registration of data from drillings and tests carried out with the respective materials;
- (iv) works monitoring and basic record of interventions carried out on the road system module - this module should be able to maintain an updated register of the various interventions carried out on the pavement in the road segments during the CONCESSION such as superficial and deep repairs, partial and total reconstructions, implantations etc. You should be able to illustrate the solutions applied to each stretch and roadway using a straight-line diagram. You should also be able to record and account for the quantities of materials and services performed in a given period, according to the coding and configuration standard of items in the TPU (DER / SP unit price table). Interventions should be updated at the end of the day;
- (v) surveys related to quality indexes registration module - this module should be able to maintain an updated register of surveys related to pavement quality indexes carried out throughout the Concession (periodic, extraordinary and project monitoring). The database must be compatible with the one currently used by DER / SP, so that it is allowed to check the general state of the road network under any of the criteria of the control parameters. The system should be able to identify and summarize any “gaps” (places in the registered network where the surveys were not carried out or were carried out outside the norm provided for in the request for bids and / or in current norms) so that the CONCESSIONAIRE can maintain a registration and inform / report to ARTESP the problems that occurred that made it impossible to obtain the survey data for that segment in the determination period (year of Concession);
- (vi) individualized graphic control module for surface, deflection, comfort and safety parameters;
- (vii) “single-line monitoring synthesis report (*online*)” module - this module should be developed in order to process the synthesis document of the annual monitoring of the pavement electronically and *online*, according to the standards established by ARTESP. The synthesis document of the monitoring consists of a diagram of the straight-line type, which represents, in terms of homogeneous segments (section normally defined between mileposts), the traffic tracks (including shoulders) of the roads constituting the ROAD SYSTEM of the lot, according to the pre-established standard by ARTESP. After updating the data related to the annual monitoring surveys of the pavement, the system should be able to determine the average values for each homogeneous segment and traffic tracks of the lot's road network and classify, by means of a color legend, the places where the indexes are classified as follows: good (green), regular (yellow) or bad (red), according to criteria established by ARTESP. Thereafter, the CONCESSIONAIRE will inform in an appropriate field, the solution to be applied and its respective date of completion for each homogeneous segment that presents its indexes outside the limits established in the AGREEMENT (repair deadline never exceeding 90 (ninety) days). After completing this process, the CONCESSIONAIRE will submit this saved scenario, via *web* system, to the analysis and validation of ARTESP, which will validate and / or request changes according to the needs detected also via the system. A field should also be provided for the CONCESSIONAIRE to inform the progress of the services in each critical stretch.

Once ARTESP's repair deadlines have been approved and validated, it will be able to monitor the implementation of the proposed repair schedule in the system, and new changes to the surveys and / or the deadlines set out in the repair schedule should be submitted to a new validation by ARTESP;

- (viii) pavement performance models module - this module should be able to estimate, based on mathematical models established in the literature (HDM, MEPDG etc.), the annual evolution of the pavement quality indexes in the remaining deadline of the CONCESSION, from the data updated annually in the SGP, and for predefined homogeneous segments (normally considered equal to the homogeneous segments defined in the project). It should provide for the drawing up of graphs and calculation of the remaining life of the segments, based on the limits established in the AGREEMENT for quality indexes;
 - (ix) module for checking the project of new pavement structures (reconstructions and extensions) - this module should be able to perform the verification calculation of the minimum thicknesses of the proposed layers for new pavement structures under design, in accordance with the applicable norms in force, with based on projected traffic data, updated test data, as well as other information relevant to the project informed by the USER (material specifications, outputs of finite element programs, etc.);
 - (x) verification and registration of parameters for special conservation projects module - this module should be able to perform the verification calculation of minimum reinforcement thickness to be applied in homogeneous segments of special pavement conservation projects in accordance with the applicable regulations in force and based on the most updated deflectometric survey of the system and projected traffic data, as well as other information relevant to the project informed by the USER (homogeneous project segments, deep repairs and planned reconstructions, etc.);
 - (xi) quality control module for the performance of paving services - this module must maintain an updated registration of the results of the tests carried out on the work, in accordance with the norm contained in the applicable regulations in force (ABNT, DER / SP and ARTESP), as well as the processing of these data through calculations by statistical procedures in order to verify the full compliance with the normative provisions and the applicable technical specifications in force. The data must be updated in the SGP at the end of the day; and
 - (xii) Module for determining CONCESSION performance indicators related to pavement indexes.
- 11.2. These various modules must collect information from each other for processing.
- 11.3. The system should contemplate the future possibility of integrating the SGP with the ARTESP project management system, so that the registered and validated information of the SGP referring to periodic surveys can automatically update the project documentation control system (pavement monitoring reports).
- 11.4. The CONCESSIONAIRE must maintain an updated registration of the data referring to the pavement and traffic structure in the input format for the HDM-4 software and make it available annually to ARTESP.

12. ELECTRONIC SYSTEM FOR OAE AND PEDESTRIAN FLYOVERS MANAGEMENT - SISOAES

- 12.1. The CONCESSIONAIRE shall implement SISOAES. The system should provide access via web. The CONCESSIONAIRE shall make available user/password pairs for use by ARTESP.

- 12.2. The implementation must be carried out in the first year of CONCESSION and must follow the rules foreseen for the other electronic management systems provided for in this APPENDIX.
- 12.3. The monitoring and management program must be available and updated. Your database should contain, right after performing the recovery of OAEs and/or pedestrian flyover, photos of recognition of the pathologies and the respective therapies performed, dated and with the specification of the methodology and materials used.
- 12.4. The updated conditions of the OAEs and pedestrian flyover should also be presented in the monitoring and management program, with the classifications of their structural, functional and durability aspects, with electronic files containing the reports of the special inspections and projects that were used, including the projects that come to alter original geometric registrations such as enlargements, extensions, rigid barriers deployments or replacements of OAEs and pedestrian flyovers.
- 12.5. The database should be updated with additional information on enlargements and extensions works, with data on geotechnics and mechanical properties of the materials that make up the structures of these works, accidents and information on the passage of special loads.
- 12.6. The CONCESSIONAIRE must always present complete electronic files of the inspections of all OAEs with the photos, including the recoveries, identifying the services and dates.

13. ELECTRONIC SYSTEM FOR RADAR DATA MANAGEMENT - SIS-RAD

- 13.1. The CONCESSIONAIRE shall make available, in the first year of CONCESSION, an integrated digital system, via web, for consultation of the data collected by the radars (SIS-RAD).
- 13.2. User / password pairs should be provided to consult, search and audit information directly in the system - access to raw and consolidated speed and vehicle counts / volumes information.

14. ELECTRONIC SYSTEM FOR ACCIDENT DATA MANAGEMENT - SIS-ACIDENTES

- 14.1. The CONCESSIONAIRE shall make available to ARTESP an accident database containing all accidents occurring in the ROAD SYSTEM, with indications about their nature, type of vehicle involved, schedule, consequences generated, georeferencing and other information, according to the model indicated by ARTESP. In order to assemble the Database, the CONCESSIONAIRE must collect, from the DER, the information from the last 05 (five) years prior to the beginning of the concession.
- 14.2. The accident database must be made available by digitally sending data from the date of signature of the INITIAL TRANSFER TERM, as well as sent online to the ARTESP ICC, in accordance with the provisions of APPENDIX G.
- 14.3. For this obligation, the CONCESSIONAIRE shall make available, in the first year of the Concession, an integrated digital system, via web, to consult the accident data (SIS-ACIDENTES). User / password pairs should be provided to consult, search and audit information directly in the system - access to raw and consolidated accidents information.
- 14.4. User / password pairs should be provided to consult, search and audit information directly in the system - access to raw and consolidated accidents information.

15. WEIGHING DATA MANAGEMENT MODULE FOR THE ELECTRONIC WEIGHING SYSTEM IN MOTION - SISPEMOV

- 15.1. The electronic data acquisition system of SISPEMOV must have a web access module / platform, in real time, of all data collected in the field. The information to be made available must be available via real-time telemetry, a control panel with statistical analysis of passages, weight per axle, PBT, verification certificates, operating time (inspection agent login) and other monitoring data established in the ARTESP Technical Specifications.

15.2. Monitoring must be carried out for the weighing-in-motion system (selective scale), precision scale and all monitoring systems established in Ordinance SUP/DER 087/2021.

15.3. User / password pairs must be provided for use and consultation by ARTESP.

16. TRAFFIC ANALYSIS SYSTEM - SIS-SAT

16.1. The CONCESSIONAIRE shall, in the first year of CONCESSION, have SIS-SAT, a central control system, to be installed at the CCO, which will be responsible for the management of the traffic sensors in the field, and have all the necessary resources to monitor the operation, with real-time consultation of the data collected by the equipment.

16.1.1. The SIS-SAT should allow the identification of faults in the traffic sensors and the emission of alarms to the operators.

16.2. The SIS-SAT shall provide an integrated digital system, via web, for consultation of the data collected by the SATs (SIS-SAT).

16.2.1. User / password pairs should be provided to consult, search and audit information directly in the system - access to raw and consolidated vehicle counts / volumes information.

17. SYSTEM FOR ENVIRONMENTAL AND SOCIAL MANAGEMENT - SGAS

17.1. The Concessionaire shall, as a condition for completion of the PRE-CONSTRUCTION PERIOD, prepare and implement an Environmental and Social Management System in line with the PERFORMANCE STANDARDS and ISO standards 14001, 14004 and 45001. Within this period, the Environmental and Social Management System must be 100% (one hundred percent) operational and able to be certified, and the certifying company has been hired.

17.2. The SGAS developed by the CONCESSIONAIRE shall be evaluated by the independent external environmental audit provided in ANNEX 06 for certification purposes as to the alignment with the PERFORMANCE STANDARDS.

18. INTEGRATED DIGITAL NOTIFICATION SYSTEM - SISNOT

18.1. The Concessionaire shall, within 12 (twelve) months from the signature of the INITIAL TRANSFER TERM, implement a digital system via web to manage the information, data and documents related to the penalties applied by ARTESP and the respective administrative procedures or processes instituted.