

## **APPENDIX H**

### **ANNEX 5**

#### **DIGITAL SYSTEMS**

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INTERNATIONAL TENDER No 01/2019

**CONCESSION TO PROVIDE PUBLIC SERVICES FOR OPERATION, MAINTENANCE AND MAKING OF INVESTMENTS REQUIRED FOR EXPLOITATION OF THE HIGHWAY SYSTEM CALLED THE PIRACICABA-PANORAMA LOT**

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## 1. INTRODUCTION

1.1. This APPENDIX provides the digital systems and the respective details for their implementation and operation by the CONCESSIONAIRE, without prejudice to the provisions of the CONTRACT and ANNEXES.

1.2. For all deployed systems, future integration with ARTESP information systems must be provided for, observing the speed, confidentiality, guarantee, integrity, reliability of information security, in terms aligned with and up-to-date with best market practices, and ARTESP approval is required. in all respects in the text noted here.

1.2.1. Annually, the CONCESSIONAIRE shall perform an independent audit, with the delivery of the respective report to ARTESP, in digital systems that involve the calculation of IQD or that are a source of information for ARTESP's supervision. The audit must be performed by a specialized company previously approved by ARTESP.

1.1. Digital systems must meet the following mandatory conditions:

(i) portal with web access and / or mobile app at ARTESP's discretion, providing ARTESP user / password pairs for consultation and eventual download of files and information, validation of information, registration of comments and upload of documents in formats defined by ARTESP;

(ii) export of 100% of the registered information to editable and standard documents 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 electronic document 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 support all existing and future demands, if they occur;

(v) delivery and return, at the end of the CONCESSION AGREEMENT, of all digital content on high capacity electronic media, as well as backup of all stored contractual data, including database in current and performative formats, images, digital collections, historical collections, along with all technology transfer to developed software;

(vi) approval of ARTESP's technical area (s) for each module developed;

(vii) in the case of system development, the following shall be provided: source code, requirements documentation, as well as functional and procedural workflow of all computerized systems implemented by the CONCESSIONAIRE or third parties contracted by the CONCESSIONAIRE, provided that the licenses applicable to the systems allow;

(viii) for systems that depend on valid licenses, the CONCESSIONAIRE shall secure at least two (2) years of licenses after termination of the CONCESSION CONTRACT;

(ix) issuance of management reports in spreadsheet or other format defined by ARTESP;

(x) initial implementation by the end of the first year of CONCESSION with expansion forecast and improvements for the remaining years;

(xi) exchange of information between the various systems, when applicable;

(xii) integration of information with BIM CONCESSION model databases, generated from the EXECUTIVE PROJECTS referring to expansion works, prepared by the CONCESSIONAIRE during the CONTRACT, as well as the models generated from the road restitution work in BIM modeling, as provided in the APPENDIX to ANNEX 5, 6 and 7;

(xiii) integration and synchronization of information, whenever possible in real time, with SISGIS - which shall act as the main information management system for CONCESSION;

(xiv) possibility of automatic determination of the IQD of the Concession, in accordance with the rules established by ARTESP in the PUBLIC NOTICE, in the CONTRACT and other rules on the subject;

(xv) linked basic register of location information (highway, type of road, direction of the track, bearing lane, coordinates of the elements, etc.), including for purposes of registration of elements, as well as research and consultation;

(xvi) full compatibility with the SIRGAS2000 or other coordinate system that ARTESP may eventually adopt.

1.1.1. The CONCESSIONAIRE may propose, at its discretion, the development of a single platform to meet the requirements set out in the PUBLIC NOTICE, provided that a modular development architecture (modules essentially independent of each other for implementation and operationalization purposes) is maintained.

1.2. The stages of development, testing, implementation and effective operation of SISPROJ, SISQUALI, SISSOND and SISDEMANDA shall be described by the CONCESSIONAIRE in its registration.

1.3. Notwithstanding the virtual sharing of data and documents through SISPROJ, SISQUALI and SISSOND, the CONCESSIONAIRE shall comply with the deadlines and, upon request by ARTESP, deliver deliveries on physical routes to ARTESP for the purpose of instructing physical administrative processes. corresponding.

1.4. Failure to comply with the requirements set forth in this APPENDIX subject to CONCESSIONAIRE the penalties provided for in APPENDIX 11 to the CONTRACT.

1.5. The CONCESSIONAIRE shall present, within 120 (one hundred and twenty) days from the signing of the CONTRACT, detailed schedule for the implementation and operation of the systems, for ARTESP approval.

## **2. INTEGRATED DIGITAL MANAGEMENT SYSTEM OF COMPANY DEMANDS - SISDEMANDA**

2.1. In the first year of the CONCESSION, the CONCESSIONAIRE shall implement SISDEMANDA, which shall allow the receipt of automatic communications, consultation, download of files and information, as well as registration of information, data and documents by ARTESP's technical areas. The system must be able to store and manage the various claims and demands received from society and the various public participation bodies (Public Administration, City Halls, Chambers, Associations, etc.).

2.2. It must have a portal via web and / or mobile app at the discretion of ARTESP, where the various sectors of society can register their users and subsequently register their respective demands, by filling out the form, with fields predefined by the CONCESSIONAIRE together

with ARTESP - minimum information required for technical analysis of claims and socioeconomic justifications, including submission of preliminary draft of the requested investment and any proof of payment of analysis fees, when ARTESP defines this.

2.3. In this portal, other USERS may also consult claims previously registered by other USERS on the portal by consulting the location (highway, kilometer, type of investment required, etc.) and, eventually, also contribute to the same pre-existing demand / claim with the possibility of attaching documents and justifications that corroborate the need for prioritization of the investments demanded on site.

2.4. SISDEMANDA must be able to synchronize basic information contained in the CONCESSIONAIRE's database about the locations under study, such as current road geometry, safety elements (barriers, walkways, etc.), average daily volumes, hourly volumes, accidents, regional indices of socioeconomic growth (GDP, per capita income, population, etc.), as well as assigning weights to these elements, in accordance with pre-established rules by ARTESP, in order to define technical priorities for investments required. In this system there must be an option to correlate investment sites with georeferencing for applications in GEO latitude and longitude maps and SIGGIS. ARTESP will define which information will be visible to the general public and which information will be visible only to ARTESP and CONCESSIONAIRE.

2.5. SISDEMANDA shall also inform the user, at the time of registration, when the place of investment requested is located outside the CONCESSIONAIRE 's area / administration. All management must be done by the CONCESSIONAIRE and the process steps may be followed by all USERS. Integration with ARTESP digital systems must be provided for the same purposes.

2.6. All third party claims, as well as the inclusion of new investments not foreseen in the POI and the details of the relevant activities, related to the functions specified in ANNEX 5, shall be registered and made available in SISDEMANDA, according to the rules established in the CONTRACT according to the procedures described in ANNEX 7 of the CONTRACT, observing the rules applicable to the ORDINARY REVISIONS.

2.7. SISDEMANDA shall facilitate and instrumentalize the processing of ORDINARY REVIEWS and have an exclusive service channel for local authorities. The Digital Platform, which is not to be confused with the ombudsman and citizen service channels, must serve as the appropriate channel for the authorities, users and other interested parties to submit suggestions for improvements and new investments, the execution of which, if appropriate, must included as obligation of the CONCESSIONAIRE for the next years of the CONTRACT. The CONCESSIONAIRE will ensure ARTESP's access to all information necessary for the proper knowledge of each suggestion submitted through the Digital Platform.

2.8. The CONCESSIONAIRE shall comply with the specifications presented in this APPENDIX for the implementation of the SISDEMANDA Platform, through which it shall manage the demands and, within one year before the ORDINARY REVIEW, submit to ARTESP a document containing the compilation of the investments, expansions and improvements, staggered justifiably in order of priority, for the improvement of the ROAD SYSTEM (Consolidation of Demands for Ordinary Review), together with the preliminary and / or related FUNCTIONAL PROJECTS that have been submitted and received by the CONCESSIONAIRE via SISDEMANDA and / or already were prepared by the CONCESSIONAIRE itself.

2.8.1. The scheduling presented in the Consolidation of Demands shall present the justifications of the need for the contractual modification eventually arising from the demand received, as well as elements that demonstrate the advantage to the Administration and interest of the USERS.

### **3. INTEGRATED DIGITAL SYSTEM OF DIGITAL PROJECT MANAGEMENT – SISPROJ**

3.1. In the first year of the CONCESSION, the CONCESSIONAIRE shall deploy SISPROJ with web access and / or mobile app at ARTESP's discretion. BIM designs and models must be made available in the system with each delivery. Once made available, there will be no possibility of change of versions in the system by the CONCESSIONAIRE without proper registration and versioning control activated through alert work, warning, communication and / or science to users registered by ARTESP. The coding standards (Work Id) of work item / service and project document coding in force and defined by ARTESP shall be maintained.

3.2. For the execution of any services specified in ANNEX 5, 6 and 7, where the submission of engineering projects is required, they shall be fed into SISPROJ.

3.2.1. The CONCESSIONAIRE shall insert, within 12 (twelve) months after the implementation of SISPROJ, all engineering projects previously submitted to ARTESP.

3.3. If it is necessary to submit projects related to obtaining authorization to access the lane for the DOMAIN RANGE of the highways of the ROAD SYSTEM, the CONCESSIONAIRE shall also feed the SISPROJ in digital version.

### **4. INTEGRAL DIGITAL SYSTEM OF PROBES AND TESTS**

4.1. In the first year of the CONCESSION, the CONCESSIONAIRE shall deploy SISSOND with web access and / or mobile app at ARTESP's discretion. Surveys shall be updated in SISSOND at each survey conducted and validated within the DOMAIN RANGE of the highway by the CONCESSIONAIRE third parties. They must contain location (georeferenced) information, description of the layer horizons and their respective thickness and Nspt index, as well as water level, rock occurrence and other relevant information. It must also contain a module for registering laboratory test results of the collected samples. It will allow greater control, management and reliability of the drilling information used for geological mapping purposes, design purposes and / or investigation of possible geological / geotechnical irregularities.

### **5. INTEGRATED DIGITAL MANAGEMENT SYSTEM OF THE TECHNOLOGICAL CONTROL AND QUALITY OF WORKS– SISQUALI**

5.1. In the first year of the CONCESSION, the CONCESSIONAIRE shall implement SISQUALI, in order to maintain an updated register of the results of the tests provided for in the applicable regulations (ARTESP, ABNT and DER / SP), as well as the processing of these data through procedures calculations. in order to demonstrate full compliance with applicable regulatory provisions and applicable technical specifications. 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 is noteworthy that the risks associated with the Quality Control of the works are the sole responsibility of the CONCESSIONAIRE. Data integration must be foreseen between SISPROJ and the BIM Integrated Works Monitoring (MBIM-AB) model 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 physical road maintenance obligations signed by the company responsible for field control along with the work documentation and, where applicable, delivery and protocol of physical copies of documents, including for purposes of demonstration of compliance and calculation of the relevant procedural deadlines.



5.3. ARTESP reserves the right to make recommendations and guidelines at any time, including with the purpose of drawing the CONCESSIONAIRE's attention to compliance with a certain standard, which may also be based on the information to which it has access through SISQUALI.

## **6. INTEGRATED DIGITAL SYSTEM OF THE GRANT – SISGIS**

6.1. In the first year of the Concession, the CONCESSIONAIRE shall implement SISGIS, which shall allow the receipt of automatic announcements, download of files and information, as well as registration of information, data and documents by ARTESP's technical areas. SISGIS shall have a robust interface capable of incorporating, integrating and managing, in georeferenced map layer format, 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 throughout. CONCESSION and the MDSR. SISGIS Minimum Features:

(i) to be compatible with the SIRGAS2000 or other coordinate system that ARTESP may eventually adopt;

(ii) to provide weekly high-resolution historical aerial (satellite photo) images, as well as maintain and manage such records (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 of the ROAD SYSTEM, as well as of roads granted or not in the vicinity of the CONCESSION;

(iv) to be able to plot information from various databases on a road map, based on geolocation or approximate location information, based on the physical reference of the road mileage 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 the feasibility analysis of enterprises;

(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 climate indicators, such as: rainfall density (hourly, daily, weekly, monthly and annual); temperature (hourly, daily, weekly, monthly and yearly).

(viii) to provide, from official or reliable sources, mapping (updated layers) of data and indica

(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 (relief) maps, accurate to 10 meters or greater;

(xi) to provide, from official or reliable sources, updated layers of watershed maps;

(xii) to enable real-time integration (automatic updating) with databases of other CONCESSION digital systems, for example, with databases of SIR and SISATIVOS systems;



(xiii) to enable navigation in aerial map, aerial image and / or 'street view' (the latter through the integration of the video record survey data 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 information integration with MDSR;

(xvi) visualization of the various information and maps mentioned above in the form of filterable layers;

(xvii) to enable integration with the BIM models generated by the Concession;

(xviii) to enable integration with MDSR;

(xix) visualization of the various information and maps mentioned above in the form of filterable layers;

(xx) to search by topographic coordinates or by address (highway code, lane, lane, mileage);

(xxi) possibility of tracking images for overlay on an aerial map;

(xxii) possibility of importing and exporting vectorized lines to drawing software files;

(xxiii) possibility of developing management interface of all digital elements and systems of CONCESSION for asset management and integrated operation purposes, as well as visualization of various information in aerial map format;

(xxiv) to allow the sharing of information with other public service providers such as Road Police, Fire, DER / SP etc.

(xxv) to establish procedure to indicate / map, register in SISGIS and keep updated record, areas along the highway to be used as support for water supply (potential water reservoirs, with availability of use), as described in item Fire Fighting listed in ANNEX 5;

(xxvi) to establish a communication plan via SISGIS, including possible provision of user / password pairs, or other alternative (to be evaluated by ARTESP) for automatic communication of fire events and monitoring of areas surrounding CONCESSION via photo. aerial or camera images to the competent authorities (fire brigade, 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. SISGIS will consist of a web interface (open GIS platform service or equivalent) that allows aerial map navigation and viewing / overlay and quick access to historical images collected and properly stored in databases. This platform shall also enable navigation and access to historical images of the video registration surveys carried out by the CONCESSIONAIRE, pursuant to the obligation set forth in ANNEX 6 of the CONTRACT.

6.2.1. The data will be incorporated into the system used by ARTESP by digital refund. 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. Data from the monitoring of physical structures must be cataloged by means of records, which must already have the geographic address of the observed point, so that its introduction in the database

will already assume its connection with the georeferenced graphical data. In the case of unregistered elements, Global Position System (GPS) equipment must be used to provide location data with sufficient approximation for its perfect definition.

6.2.3. Information corresponding to georeferenced attributes, as well as data from monitoring, will compose tables from the system database. These tables will only have index to link to the data stored in the database, allowing double access to this data (accesses of attributes by query to the database and access to graphics by query to the database).

6.3. And also in the first year of CONCESSION, CONCESSIONAIRE shall submit for ARTESP's approval a publication schedule for the various layers of information relating to the CONCESSION prepared by CONCESSIONAIRE, resulting from each of its contractual obligations. With each new information included, the schedule shall be reviewed and forwarded to ARTESP's knowledge and approval. In this document, the CONCESSIONAIRE shall also foresee which information will be visible to the various sectors concerned: information for the general public, information for ROAD SYSTEM USERS, information for public service providers, information for ARTESP etc. ARTESP reserves the right to approve or request changes.

6.4 ARTESP reserves the right, at any time, to request the registration and publication of new information in SIGGIS, provided that under the CONCESSIONAIRE's contractual obligations. In this case, a timely period appropriate to the level of detail of the requested information shall be provided. Once agreed by the CONCESSIONAIRE, the agreed deadlines must be met under penalty of applying the sanctions provided for in the CONTRACT.

## **7. INTEGRATED DIGITAL SYSTEM OF WORK MONITORING – SISOBAS**

7.1. In the first year of the CONCESSION, the CONCESSIONAIRE shall implement SISOBAS, in which it shall record through photographic records, the progress of each of the fronts of works in the ROAD SYSTEM with real time online update and with at least one photo per type of service / intervention. Photos must contain time, date, location information (georeferenced with latitude and longitude coordinate) and basic comments on the type of service performed. The system must have a reporting tool. You must have filters to select the work item, type of intervention, date, location, etc.

## **8. INTEGRATED DIGITAL MANAGEMENT SYSTEM OF CONSERVATION FUNCTIONS – SIGECON**

8.1. In the first year of CONCESSION, the CONCESSIONAIRE shall deploy SIGECON with access to ARTESP via the web. ARTESP user / password pairs must be made available to receive automatic announcements, consultation and information downloads by ARTESP technical areas.

8.2. SIGECON shall be capable of storing and managing routine conservation nonconformities verified in the ROAD SYSTEM in accordance with the standards defined in this ANNEX. The system shall allow the registration and updating of photos, and other pertinent information (description, classification, date, location, etc.), of the nonconformities verified in the ROAD SYSTEM according to its assumption, regarding the compliance with the standards indicated in the program. conservation routine. The update of the register of “nonconformities” may be performed by either the CONCESSIONAIRE or by the GRANTING AUTHORITY.

8.3. The system shall also allow the registration of the counterproofing of the services performed by the CONCESSIONAIRE (upload of photos and other pertinent information). Photos must contain time, date, location information (georeferenced with latitude and longitude coordinate) and basic comments on the type of service performed. The system must have a reporting tool. You must have filters to select type, class, date, time, location, etc. Integration with ARTESP digital systems must be provided for the same purposes.

8.4. SIGECON shall be able to record and account for quantities of materials and services performed in a given period, in accordance with the coding standard described in this APPENDIX, DER / SP unit price table (TPU) configuration 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 CRS with web access to register and update the images and information collected in both conventional field surveys and video registration surveys. The system shall contain two modules being (1) image display module and (2) road inventory management module.

9.2. In the image display module, the system must be able to synchronize the information recorded by the attributes (location by km, GPS etc.) when reproducing the images, as well as enabling the search of images by mileage reference.

9.3. In the road inventory management module, the system shall be able to maintain an up-to-date register of the inventoried road elements. Based on the data entered, the system must also be able to produce management reports by consolidating and summarizing information according to user needs (for example: total length of rolling lanes year to year, total length of rigid barriers, number of plates). by type, number of accesses to the domain range and their status regarding regularity, etc.).

9.4. The system must also be able to generate specific files for visualization of the elements registered in specific map software (kmz, kml or equivalent files), as well as generate rectigraphic diagrams representing registered elements along the road. It must be foreseen the exportation of the information registered in electronic spreadsheets, as well as the supply, at the end of the CONTRACT, of high capacity digital media, with copy of all the files registered in standard electronic spreadsheet files. It must also be foreseen to integrate this system with systems used by ARTESP for the same purposes, as well as integration with ARTESP CCI.

## **10. ELECTRONIC MANAGEMENT SYSTEM OF GRANT ASSETS – SISATIVOS**

10.1. The CONCESSIONAIRE shall implement SISATIVOS, whose data shall be managed within SIGIS.

10.2. Such system will have the function of keeping an updated database record of all assets (linear and nonlinear) of the CONCESSION, as well as maintaining the history of maintenance, additions, deletions and modification of these.

10.3. Full integration between SISATIVOS and MDSR databases must be provided as it is deployed so that data can be loaded or queried across both platforms or interfaces, ie certain information must be passable from both the MDSR and the SISATIVOS system interface itself.

10.4. The data update in the system must be at least six (6) months, except in the case of specific elements in which ARTESP will determine different periodicity.

10.5. The CONCESSIONAIRE shall provide for the initial implementation of SISATIVOS within two (2) years after the signing of the INITIAL TRANSFER CONTRACT. Any improvements may be implemented during the remaining years of the CONCESSION.

## 11. DIGITAL MANAGEMENT SYSTEM OF PAVEMENTS – SGP

11.1. The CONCESSIONAIRE shall provide for the implementation, after 1 (one) year of the DATE OF THE EXISTING SYSTEM CONTROL TRANSFER, the GSP with web access. This system must include at least the following modules / functions:

(i) geometrical registration module of the Batch: Piracicaba road network - Panorama and Concession - this module shall be able to maintain the updated basic geometric register of the lot ROAD SYSTEM in terms of nomenclatures, mileage, homogeneous segment extensions, number of lanes, number of lanes, presence of shoulders for all roads and other road system devices such as handles of clovers and marginal roads;

(ii) Traffic data entry module - the GSP shall include a basic data entry module for road system traffic data in terms of VDMs and vehicle weighing data for the calculation of segment vehicle factors. batches for the purpose of design and / or characterization of the current fleet;

(iii) floor structure registration module - this module shall be able to maintain an up-to-date register concerning existing and new pavement structures in terms of material characterization and thickness; as well as registration of survey data and tests performed with the respective materials;

\* (iv) works monitoring module and basic record of road system interventions - this module must be able to maintain an up-to-date register of the various pavement interventions in road segments along the CONCESSION such as surface and deep repairs, partial reconstructions and totals, deployments, etc. You must be able to illustrate, by means of a diagram, the solutions applied to each section and bearing range. It must also be able to record and account for the quantities of materials and services performed in a given period, according to the standard coding and item configuration contained in the TPU (DER / SP unit price table). Interventions must be updated at the end of the day;

(v) quality index surveys registration module - this module must be able to keep up to date the pavement quality index surveys carried out during the Concession (periodic, extraordinary and project monitoring). The database must be compatible with the one currently used by DER / SP, so that it is possible to check the general state of the road network under any of the control parameter criteria. The system must be able to identify eventual and summarize eventual gaps (places of the registered mesh where the surveys were not performed or were performed outside the standard provided for in the notice and / or rules in force) so that the CONCESSIONAIRE can maintain a register and inform / report to ARTESP the problems that made it impossible to obtain the data from the survey of that segment during the calculation period (Concession year);

(vi) individualized graphic control module of surface parameters, deflection, comfort and safety;

(vii) module "single-line monitoring summary report (online)" - this module shall be developed to process the annual pavement monitoring summary document electronically and online, in accordance with the standards established by ARTESP. The monitoring summary document consists of a diagram of the rectigraphic type, which represents, in terms of homogeneous segments (segment usually defined between milestones), the traffic lanes (including shoulders) of the constituent roads of the lot ROAD, according to the pre-defined standard. -established by ARTESP. After updating the data on the annual pavement monitoring surveys, the system shall be able to determine the average values for each homogeneous segment and traffic range of the road network of the lot and to classify, by means of color legend, where The indices have the following ratings: good (green), fair (yellow) or bad (red), according to the criteria established by ARTESP. Thereafter, the CONCESSIONAIRE will inform in 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 CONTRACT (repair period not exceeding 90 (ninety) days). After completing this process, the CONCESSIONAIRE will

submit this saved scenario, via web system, to ARTESP analysis and validation that will validate and / or request changes according to the needs detected also via the system. A field must also be provided for the CONCESSIONAIRE to report the progress of the services in each critical section. Once ARTESP's repair deadlines have been approved and validated, ARTESP will be able to monitor the execution of the proposed repair schedule in the system, and further changes to the surveys and / or the deadlines provided for in the repair schedule must be submitted to a new one validation by ARTESP;

(viii) pavement performance models module - this module shall be able to estimate, based on mathematical models established in the literature (HDM, MEPDG, etc.), the annual evolution of pavement quality indices over the remaining CONCESSION term, from data updated annually in the SGP, and for predefined homogeneous segments (normally considered equal to the homogeneous segments defined in the project). It must provide for the elaboration of graphs and calculation of the remaining life of the segments, based on the limits established in CONTRACT for quality indexes;

(ix) Design verification module of new pavement structures (reconstructions and extensions) - this module shall be able to perform the calculation of verification of the minimum thicknesses of the proposed layers for new pavement structures in design, in accordance with current regulations. applicable, based on projected traffic data, up-to-date test data as well as other design-relevant information provided by the USER (material specifications, finite element program outputs, etc.);

(x) special conservation design parameter verification and registration module - this module shall be capable of performing the minimum reinforcement thickness verification calculation to be applied to the homogeneous segments of special pavement conservation projects in accordance with the standards applicable and based on the most up-to-date deflectometric survey of the system and projected traffic data, as well as other project-relevant information provided by the USER (homogeneous design segments, in-depth repairs and planned reconstructions etc.); paving services execution quality control module - this module shall maintain an up-to-date register of the results of the tests carried out on the site, in accordance with the applicable standard (ABNT, DER / SP and ARTESP), as well as as the processing of these data through calculations by statistical procedures in order to verify the full compliance with the applicable normative provisions and applicable technical specifications. The data must be updated in the SGP at the end of the day; and

(xi) Module for determining CONCESSION performance indicators related to pavement indexes.

11.2 These various modules must gather information from each other for processing.

11.3 The system shall include the future possibility of integrating the SGP with the ARTESP project management system, so that SGP's registered and validated information regarding periodic surveys can automatically update the project documentation control system (monitoring reports). of the floor).

11.4 The CONCESSIONAIRE shall maintain an up-to-date record of the pavement and traffic structure data in the input format for the HDM-4 software and make it available annually to ARTESP.

## **12. ELECTRONIC MANAGEMENT SYSTEM OF OAE (SPECIAL ART WORK) AND CATWALKS**

12.1 The CONCESSIONAIRE shall implement SISOAES. The system must provide web access. The CONCESSIONAIRE shall provide username / password pairs for use by ARTESP.

12.2 Implementation shall be in the first year of CONCESSION and shall follow the rules set forth for the other electronic management systems provided for in this APPENDIX.



12.3 The monitoring and management program shall be available and up to date. Your database must contain, soon after performing the recovery of OAE and catwalk, photos of recognition of the pathologies and their therapies executed and dated with methodology and materials employed.

12.4 In the monitoring and management program, the updated conditions shall be presented, with classification of the structural, functional and durability aspects of the EEOs and walkways, with electronic files containing the reports of the special inspections and projects that were used, including the projects that may alter original geometric records such as extensions, extensions, rigid fender deployments or OAE replacements and walkways.

12.5 The database shall be updated with additional information on implantation and enlargement works, geotechnical data and mechanical properties of the building materials, accidents and information on the passage of special loads.

12.6 The CONCESSIONAIRE shall always present complete electronic files of inspections of all OAE with photos, including recoveries, identifying the services and dates.

### **13. ELECTRONIC MANAGEMENT SYSTEM OF RADAR DATA – 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 radar (SIS-RAD).

13.2. User / password pairs must be provided to query, search and audit information directly in the system - access to raw and consolidated vehicle speed and count / volume information.

### **14. ELECTRONIC MANAGEMENT SYSTEM OF ACCIDENT DATA – SIS-ACIDENTES**

14.1. The CONCESSIONAIRE shall make available, in the first year of CONCESSION, the SIS-ACCIDENTS, according to the rules stipulated in ANNEX 5.

14.2. User / password pairs must be provided to query, search and audit information directly in the system - access to raw and consolidated accident information.

### **15. WEIGHING DATA MANAGEMENT MODULE OF THE ELECTRONIC WEIGHING SYSTEM IN MOTION - SISPEMOV**

15.1 The SISPEMOV electronic data acquisition system shall have a real-time web access module / platform for all data collected in the field.

15. 2. User / password pairs must be provided for ARTESP use and consultation.

### **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 field traffic sensors, and have all the necessary resources to monitor the operation, with real-time consultation of the data collected by the equipment.

Appendix H – Piracicaba – Panorama lot

16.1.1 The SIS-SAT shall allow the identification of traffic sensor failures and the issuing of alarms to operators.

16.2. The SIS-SAT must make available integrated digital system, via web, for consultation of the data collected by the SATs (SIS-SAT).

16.2.1 User / password pairs must be provided to query, search, and audit information directly in the system - access to raw and consolidated vehicle count / volume information.