




**Development of a Decision Support System for increasing the Resilience of Road Infrastructure based on combined use of terrestrial and airborne sensors and advanced modelling tools- Grant Agreement Number: 769129**

**D1.12: Initial Data Management Plan**

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## **Executive Summary**

The PANOPTIS Data Management Plan is a living document that will be updated where necessary. It describes the way the data of the project are managed during the project duration and beyond. The objective of the data management plans is that all types of data useful to the project (and other projects as well) are clearly identified, FAIR (easily Findable, openly Accessible, Interoperable and Re-usable), that they don't raise any ethical or security concern.

This initial version identifies the topics that need to be addressed in the data management plan and that will be detailed when the architecture and the specifications of the system are elaborated (from Month 12).

## 1 Data Summary

The project is built on three main pillars, namely:

- Elaboration of precise forecasts (weather essentially but also other hazards when predictable),
- Elaboration of the vulnerabilities for the Road Infrastructure (RI) components,
- Monitoring of the RI status.

The data that will be collected and generated after processing fall in these domains. An important aspect of PANOPTIS is the monitoring over the time of the events and their effects on the Road Infrastructure (RI). So, both for deep learning method and for statistics, the data have to be kept for several years. Typically, we need data from the last ten years and data over the whole duration of the project (4 years).

The origin of the data is the sensors and processing systems that can provide a description of the environment and detect events that can threaten the RI. Among these sensors and processing systems, there are:

- Satellites: EO/IR images for macroscopic events (flood, landslides, etc.) and SAR for smaller events (regular ground move).
- UAVs: In PANOPTIS, the UAVs are equipped with various types of cameras depending on the defects that need to be detected (EO/IR, multi-spectral, hyperspectral) and LIDARs to elaborate 3D maps. The size of the data base collected for the project will be quite huge because it will be thousands of high resolution pictures taken from the project and additionally pictures from external data bases to train the detection algorithms.
- Weather data: again a huge volume of data as the size of the base area to compute the forecast will be small.
- Hazard data: content and size depends on the hazards. In general they are under the form of hazard maps with different colours depending on the probability of occurrence and the resulting severity.
- Vulnerability data: these data will combine the descriptive data for the road and supporting infrastructure (bridges, tunnel, etc.). On the 3D map, the defects will be super-imposed (results of inspections and status assessment). The volume of data is once again dependent on the type of infrastructure (from the most simple which is the road directly built on the terrain to the more complex bridges).

The project will create data:

- WP3 will compute weather forecast/hazard forecast which will be stored as maps with additional free text comments.
- WP4 will elaborate the vulnerability of the roads and their supports.
- WP5 will collect the sensors of the data and pre-process them.
- WP6 will fuse the data to produce a Common Operational Picture (maps with risk, events, objects) completed by HRAP for decision support.

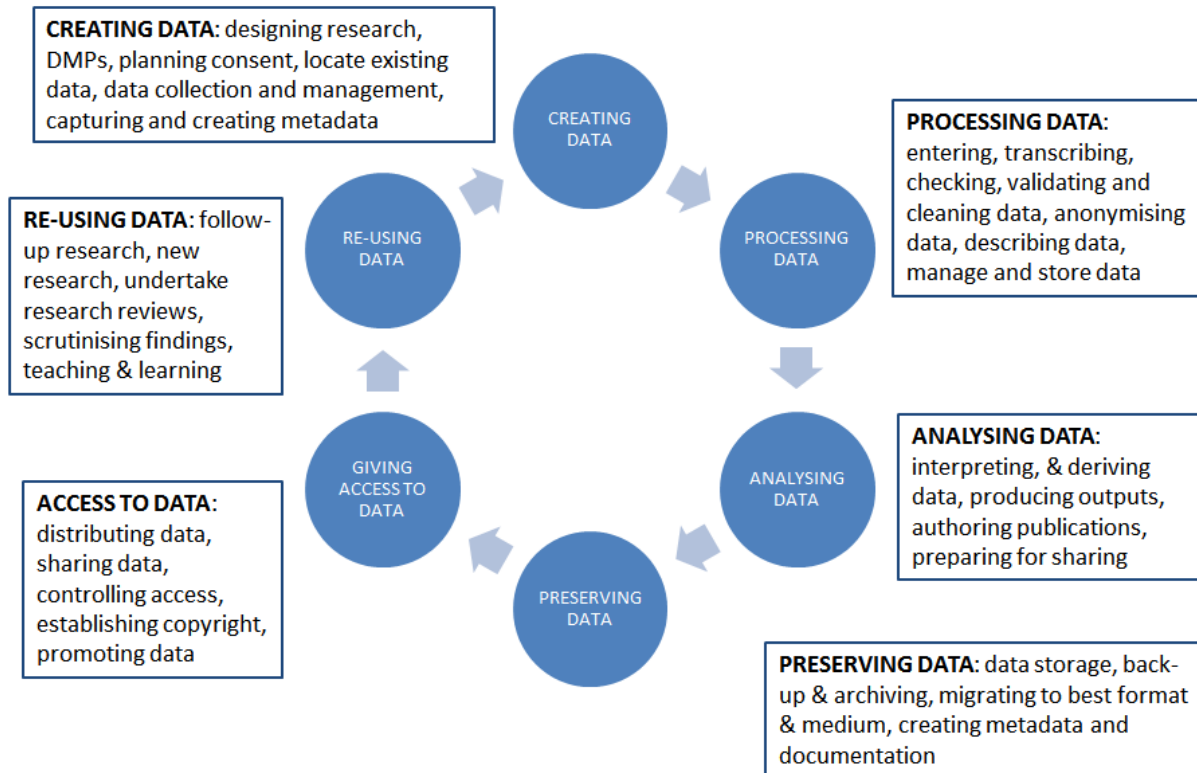
As the system capabilities are optimized with the data and statistics from previous events, the data have to stay in the archives for a very long period of time (at least during the whole life of the components).

The data related to the Road Infrastructure belong to the management agencies, namely ACCIONA and Egnatia Odos. Any additional use that could be done of these data has to be approved by them.

The data collected and processed from external services (weather, environment) will be protected as per the respective contracts clauses with this external services.

The data cycle is the following one (EUDAT – OpenAIRE):

# Research data lifecycle



At each step of the cycle, the IPRs and contractual clauses need to be respected. In particular: who owns these data, is the process applied to these data allowed, where will the data be stored and during how much time, who can have access to these data, to do what?

## 2 FAIR data

### 2.1 Making data findable, including provisions for metadata

The data produced in the project will be discoverable with metadata. The majority of the data used and produced by the project will be time-stamped, geo-referenced and classified (generally type of defects). The following scheme shows the types of data that will be collected by the system with the in situ sensors. The rest of the collected data will be provided by the UAVs and the satellites.



The UAV are equipped with cameras (EO/IR) so the data are images with their respective metadata. To create accurate 3D maps, the UAVs can also be equipped with Lidars and in this case, the data will be a cloud of points.

In Panoptis, two types of satellites instruments will be used:

- Cameras (visible images) which will be processed like UAV images but to detect more macroscopic events (floods, landslides, collapses of bridges, mountains rubbles, etc.). The images will be provided by SENTINEL 2 or SPOT 6/7.
- SAR (Synthetic Aperture Radar): radar images to detect small movements. The radar images will be provided by SENTINEL 3 (SENTINEL 1 has not enough precision to identify the changes that are interesting for PANOPTIS).

The detailed list of the data used and processed in PANOPTIS is provided here-below.

<b>DATASET NAME</b>	<b>Data from SHM sensors</b>
<b>Data Identification</b>	
Dataset description	Referring to data from sensors installed in the demo sites for monitoring structural health of the different Road Infrastructures (RI). Can be of geotechnical focus in the Greek site (inclinometers, accelerometers, seismographs, etc.), and corrosion sensors in Reinforced Concrete (RC) in the Spanish site.
Source	Direct insitu measurements (Spanish and Greek demosite). Accessible from local legacy data acquisition systems
<b>Partners activities and responsibilities</b>	
Partner owner of the data; copyright holder (if applicable)	ACCIONA (Spanish demosite), EOAE (Greek demosite)
Partner in charge of data collection	ACCIONA (Spanish demosite), EOAE (Greek demosite)
Partner in charge of data analysis	WP4 partners (IFS, NTUA, SOF, C4controls, AUTH, ITC)
Partner in charge of data storage	ACCIONA and EOAE
Related WP(s) and task(s)	WP4, (all tasks), WP7 (Task 7.5)
<b>Standards</b>	
Info about metadata (production and storage dates, places) and documentation?	<ul style="list-style-type: none"> <li>• Geotechnical data: Angle of friction, Cohesion, Dry unit weight, Young's modulus, Void ratio, Soil Permeability coefficient, Soil porosity, Soil bearing capacity.</li> <li>• Corrosion data. The wireless sensors located on multiple monitoring points provide electrical parameters such as corrosion current density (iCORR), electrical resistance of concrete (RS) of the system, and the double layer capacity (CDL) to a unique electronic system. The information directly stored by the</li> </ul>

	<p>electronic system consists of raw data of sensors (electrical response). In order to transform these primary data into profitable monitoring information a specific computer tool based the R software belonging to the R Development Core Team is used. This application allows to execute the data analysis process in a fast and automated way. As a result, a series of easily interpretable graphs are obtained. All the monitoring graphics are updated daily in an automated way and are available from any of the computers linked to the system.</p>
Standards, format, estimated volume of data	<ul style="list-style-type: none"> <li>• <b>Geotechnical sensors:</b> Settlement cells, Vertical Inclinometers, Horizontal Inclinomometer, Rod extensometer, Standpipe Piezometer, Pneumatic Piezometer</li> <li>• <b>Corrosion sensors:</b> extension R, .rda, .Rdata. Graphs updated every day during the demo period (foreseen period of 2 years)</li> </ul>
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	<ul style="list-style-type: none"> <li>• Feed geotechnical model of cut-slope located at active landslide region (Greek site)</li> <li>• Feed structural models of bridges (Greek site)</li> <li>• Feed corrosion model of reinforced concrete underpass (Spanish site)</li> </ul>
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	<ul style="list-style-type: none"> <li>• <b>Geotechnical sensors:</b> Settlement cells, Vertical Inclinometers, Horizontal Inclinomometer, Rod extensometer, Standpipe Piezometer, Pneumatic Piezometer</li> <li>• <b>Corrosion sensors:</b> During the project any computer from PANOPTIS partners involved can be linked to the local measurement system. PANOPTIS system will be as well connected to the local monitoring system. These data shall not be disclosed, by any means whatsoever, in whole or in part. However, publication and dissemination of these data is possible after previous approval by ACCIONA/EOAE. Prior notice of any planned publication shall be given to ACCIONA/EOAE</li> </ul>



	at least 45 calendar days before the publication
Embargo periods (if any)	no
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	No
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	ACCIONA, EOAE control centres. PANOPTIS backup system. Information generated during the project for at least 4 years after the project in the project repository.

DATASET NAME	Data from weather stations and pavement sensors
Data Identification	
Dataset description	Local weather data coming from legacy weather stations (belonging to end-users) and new PANOPTIS micro weather stations. Main parameters: Temperature, relative humidity, pavement temperature, pavement humidity, wind speed, wind direction, rain precipitations, presence of ice, chemical concentration, freeze point of solution on the surface.
Source	In situ measurements of weather stations. Accessible from local legacy data acquisition
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA and EOAE
Partner in charge of data collection	ACCIONA and EOAE
Partner in charge of data analysis	FINT, AUTH, HYDS, FMI, IFS
Partner in charge of data storage	ACCIONA, EOAE
Related WP(s) and task(s)	WP3 (Tasks 3.5, 3.6, 3.7), WP4 (Tasks 4.1, 4.2, 4.3, 4.4), WP7 (Task 7.5), WP2 (Task 2.4 and Task 2.5)
Standards	
Info about metadata (production and storage dates, places) and documentation?	Data is produced online, in real time, every 3 hours (although the frequency can be adapted), and stored at ACCIONA/EOAE legacy data acquisition system.
Standards, format, estimated volume of data	Data can be downloaded from the end-users legacy data management tool in form of pdf., xlsx., doc. The selection of specific date ranges and parameters is possible. Size of data depends on the date range and number of parameters selected (various kB-MB per file).
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	<ul style="list-style-type: none"> <li>• Providing real-time information of the weather conditions and forecasts for the DSS.</li> </ul>

	<ul style="list-style-type: none"> <li>• Update climatic models</li> <li>• Update risk models</li> <li>• Update ice prone areas on the road surface for winter operations management</li> <li>• Rain precipitations data is fed to geotechnical and erosion models of slopes</li> </ul>
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	<p>PANOPTIS partners can access to the data via ACCIONA and EAOE legacy data acquisition during the project. At some point of the project, weather stations will transfer data online to PANOPTIS system.</p> <p>ACCIONA/EAOE must always authorise dissemination and publication of data generated with legacy systems (existing weather stations). It is historic data, it is not generated for the project. Publication and dissemination of data from PANOPTIS micro weather stations must be approved by ACCIONA/EAOE Prior notice of any planned publication shall be given to ACCIONA/EAOE at least 45 calendar days before the publication. The use of data from PANOPTIS microweather stations for any other purposes shall be considered a breach of this Agreement.</p>
Embargo periods (if any)	no
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	No
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	ACCIONA and EAOE control centres. Data generated during the project, must be stored at least for 4 years

DATASET NAME	Thermal map of Spanish A2 Highway (pk 62-pk 139.5)
Data Identification	
Dataset description	Thermal profile of the road surface; thermal characteristics per georeferenced zone along the road corridor
Source	ACCIONA data base
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA

Partner in charge of data collection	ACCIONA
Partner in charge of data analysis	IFS, FMI, HYDS, AUTH, ITC
Partner in charge of data storage	ACCIONA
Related WP(s) and task(s)	WP3 (Tasks 3.5, 3.6, 3.7), WP2 (task 2.5), WP4 (Tasks 4.1, 4.3)
<b>Standards</b>	
Info about metadata (production and storage dates, places) and documentation?	Test performed under request
Standards, format, estimated volume of data	Kmz. 138 kB
<b>Data exploitation and sharing</b>	
Data exploitation (purpose/use of the data analysis)	Identify ice-prone areas on the road corridor (vulnerable RI). This areas should be equipped with sensors to control ice formation
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	These data shall not be disclosed, by any means whatsoever, in whole or in part. However publication and dissemination of these data is possible after previous approval by ACCIONA. Prior notice of any planned publication shall be given to ACCIONA at least 45 calendar days before the publication
Embargo periods (if any)	no
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	No
<b>Archiving and preservation (including storage and backup)</b>	
Data storage (including backup): Where? For how long?	ACCIONA, control centre, for the duration of the concession contract

DATASET NAME	UAV data
<b>Data Identification</b>	
Dataset description	Data taken in UAV missions, comprising all the datasets obtained with the different kind of sensors (RGB, LiDAR, IR, etc.) used in the project
Source	ACCIONA acquisitions, ITC acquisitions
<b>Partners activities and responsibilities</b>	
Partner owner of the data; copyright holder (if applicable)	ACCIONA, EOAE
Partner in charge of data collection	ITC, ACCIONA, EOAE
Partner in charge of data analysis	ITC, NTUA
Partner in charge of data storage	ACCIONA, EOAE

Related WP(s) and task(s)	WP5, WP4(4.5), WP7 (Task 7.5)
Standards	
Info about metadata (production and storage dates, places) and documentation?	Data is produced under scheduled mission and shared with end users and WP5 partners for processing. Metadata should include: <ul style="list-style-type: none"> <li>- Date/time of data acquisition</li> <li>- Coordinate system information</li> <li>- Information of UAV system (camera info, flight height, titl/angle of camera)</li> </ul>
Standards, format, estimated volume of data	Depending on the sensor used: <ul style="list-style-type: none"> <li>- Optical: Images/video.JPEG, MP4,</li> <li>- Multispectral; Images</li> <li>- Thermal infrared : Images/ video JPEG, .TIFF, .MJPEG</li> <li>- Point cloud: ASCII</li> </ul> <p>Estimated volume of images and videos depend on number and size of inspected road corridor elements. Could range from one to couple of hundreds of GB.</p>
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	<ul style="list-style-type: none"> <li>- Inspection and degradation assessment of road infrastructure: including slopes erosion; road pavement degradation; cracks in concrete bridges/underpasses, overpasses; degradation of road furniture; vegetation encroaching; corrosion of steel elements</li> <li>- 3D modelling of road infrastructure</li> </ul>
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	These data shall not be disclosed, by any means whatsoever, in whole or in part. However publication and dissemination of these data is possible after previous approval by ACCIONA/EOAE. Prior notice of any planned publication shall be given to ACCIONA/EOAE at least 45 calendar days before the publication
Embargo periods (if any)	No
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	No
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where?	PANOPTIS backup system, during 4 years following

For how long?	the end of the project
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DATASET NAME	RGB camera data
Data Identification	
Dataset description	Imagery from fix camera monitoring the soil erosion on slope pk 64 of A2 Highway (Spanish demo)
Source	ACCIONA fix camera (to be installed within the project). Accessible from local legacy data acquisition and to be accessible from PANOPTIS systems (online).
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA
Partner in charge of data collection	ACCIONA
Partner in charge of data analysis	NTUA
Partner in charge of data storage	NTUA
Related WP(s) and task(s)	WP4
Standards	
Info about metadata (production and storage dates, places) and documentation?	Production of data in continuous data stream, data is sent online and stored in PANOPTIS system and ACCIONA legacy data management system.
Standards, format, estimated volume of data	High quality images JPEG Continuous data stream
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	An empirical approach can be applied for erosion of slopes, comparing data on local water precipitation (from micro weather stations) with volume of soil erosion (from RGB camera).
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	These data shall not be disclosed, by any means whatsoever, in whole or in part. However publication and dissemination of these data is possible after previous approval by ACCIONA. Prior notice of any planned publication shall be given to ACCIONA at least 45 calendar days before the publication
Embargo periods (if any)	No
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	Yes, occasionally, when any operation is carried out by the concessionary staff. The consent will be managed when necessary.

Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	Data storage in PANOPTIS system for at least 4 years after the end of the project

DATASET NAME	Videos of road surface and road assets
Data Identification	
Dataset description	Videos of road surface and road assets taken with 360-degree camera (Garmin VIRB <sup>1</sup> ) by ACCIONA
Source	ACCIONA database
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA
Partner in charge of data collection	ACCIONA
Partner in charge of data analysis	ITC
Partner in charge of data storage	ITC
Related WP(s) and task(s)	WP5
Standards	
Info about metadata (production and storage dates, places) and documentation?	Videos are acquired by ACCIONA every 1 month and shared with involved partners (ITC) via file sharing service for processing. Software for editing videos VIRB 360: <a href="https://www.youtube.com/watch?v=COItl8HDEko">https://www.youtube.com/watch?v=COItl8HDEko</a>
Standards, format, estimated volume of data	Mp4 Video raw mode 5K (2 files at 2496 × 2496 px) 5.7K (2 files at 2880 x 2880)
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	Road surface image analysis for deterioration assessment
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	Dissemination of this data must be always authorised by ACCIONA, (it is historic data, it is not produced for the project). Prior notice of any planned publication shall be given to ACCIONA at least 45 calendar days before the publication. The use of Confidential Information for any other purposes shall be considered a breach of this Agreement.
Embargo periods (if any)	No
Personal data protection: are they personal data? If so, have you gained	Yes, occasionally, when any operation is carried out by the concessionary staff.

<sup>1</sup> [http://static.garmin.com/pumac/VIRB\\_360\\_OM\\_EN.pdf](http://static.garmin.com/pumac/VIRB_360_OM_EN.pdf)

(written) consent from data subjects to collect this information?	The consent will be managed when necessary.
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	Data storage in PANOPTIS system for at least 4 years after the end of the project

DATASET NAME	Data Laser Crack Measurement System (LCMS)
Data Identification	
Dataset description	3D (point cloud) data of the road which is labelled by LCMS system. Cracking tests results
Source	ACCIONA data base (inspection test separate of the project)
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA
Partner in charge of data collection	ACCIONA
Partner in charge of data analysis	ITC
Partner in charge of data storage	ACCIONA
Related WP(s) and task(s)	WP5
Standards	
Info about metadata (production and storage dates, places) and documentation?	Data is obtained under scheduled inspection mission, and stored at ACCIONA control centre. ACCIONA shares results with image analysis experts of the project via file sharing service
Standards, format, estimated volume of data	Point cloud ASCII, .ply, .las, .pts x, y, z information (coordinates) Excel file summarising cracking results on the corridor.
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	3D information of road surface distresses for deterioration assessment (quantification of damage).
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	Dissemination of this data must be always authorised by ACCIONA, (it is historic data, it is not produced for the project). Prior notice of any planned publication shall be given to ACCIONA at least 45 calendar days before the publication. The use of Confidential Information for any other purposes shall be considered a breach of this Agreement
Embargo periods (if any)	No
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to	No

collect this information?	
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	ACCIONA data base during the duration of the highway concession contract
DATASET NAME	
	3D scan data using Terrestrial Laser Scanner system.
Data Identification	
Dataset description	3D scan data (point cloud) of slopes in Spanish A2 highway using Trimble sx10 scanning total station
Source	ACCIONA database
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA
Partner in charge of data collection	ACCIONA
Partner in charge of data analysis	ITC
Partner in charge of data storage	ACCIONA
Related WP(s) and task(s)	WP5
Standards	
Info about metadata (production and storage dates, places) and documentation?	Data acquired under scheduled mission by ACCIONA, stored in ACCIONA database and shared with PANOPTIS image analysis experts via file sharing service
Standards, format, estimated volume of data	Point cloud ASCII 1 to 5 GB/scan.
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	3D model of slopes for high precision monitoring of soil erosion and landslides with time (evolution of 3D models with time)
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	These data shall not be disclosed, by any means whatsoever, in whole or in part. However publication and dissemination of these data is possible after previous approval by ACCIONA. Prior notice of any planned publication shall be given to ACCIONA/EOAE at least 45 calendar days before the publication
Embargo periods (if any)	No
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	no
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where?	ACCIONA Control centre, until the end of the



For how long?	concession contract.
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DATASET NAME	Results of inspection tests on RI
Data Identification	
Dataset description	Results of inspection tests performed out of the scope of the project, but used in the project. For instance for road surface: IRI results, slip resistance, transverse evenness, strength properties, macrotexture; results of bridges inspections, results of slopes inspections
Source	ACCIONA/EOAE data base
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA/EOAE
Partner in charge of data collection	ACCIONA/EOAE
Partner in charge of data analysis	ITC, IFS
Partner in charge of data storage	ACCIONA/EOAE
Related WP(s) and task(s)	WP5, WP4
Standards	
Info about metadata (production and storage dates, places) and documentation?	Inspection tests are performed according to a year planning. For instance IRI tests, 2 times per year, slip resistance of the road service is tested 3 times per year + additional time every 2 years. The data produced is stored at ACCIONA/EOAE legacy data management system and shared with PANOPTIS partners involved under request.
Standards, format, estimated volume of data	Format and size is specific for each test. Results can be presented in form of report (xlsx., pdf.)
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	Vulnerability analysis Input for deterioration analysis via image analysis
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	Dissemination of this data must be always authorised by ACCIONA/EOAE, (it is historic data, it is not produced for the project). Prior notice of any planned publication shall be given to ACCIONA/EOAE at least 45 calendar days before the publication. The use of Confidential Information for any other purposes shall be considered a breach of this Agreement.
Embargo periods (if any)	No
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	No

Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	ACCIONA/EOAE legacy data management system, until at least the end of the concession contract

DATASET NAME	Historic inventories of events in the demosites
Data Identification	
Dataset description	Incidences, accidents, procedures applied, lessons learnt
Source	ACCIONA and EOAE database
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA, EOAE
Partner in charge of data collection	ACCIONA, EOAE
Partner in charge of data analysis	IFS
Partner in charge of data storage	ACCIONA, EOAE
Related WP(s) and task(s)	WP4
Standards	
Info about metadata (production and storage dates, places) and documentation?	Inventory of historical data (actuations, accidents, incidences, etc.)
Standards, format, estimated volume of data	Report in xlsx. or pdf. format
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	Vulnerability analysis
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Dissemination level: confidential (only for members of the Consortium and the Commission Services).
Data sharing, re-use, distribution, publication (How?)	Dissemination of this data must be always authorised by ACCIONA/EOAE, (it is historic data, it is not produced for the project). Prior notice of any planned publication shall be given to ACCIONA/EOAE at least 45 calendar days before the publication. The use of Confidential Information for any other purposes shall be considered a breach of this Agreement.
Embargo periods (if any)	No
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	no
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	ACCIONA/EOAE database, at least until the end of the concession project

DATASET NAME	Data winter operations
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Data Identification	
Dataset description	Preventive and curative protocols applied on the road surface (salt/brine use per GPS location) for the last winter seasons
Source	ACCIONA/ EOAE database
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA/ EOAE
Partner in charge of data collection	ACCIONA/ EOAE
Partner in charge of data analysis	IFS
Partner in charge of data storage	ACCIONA/ EOAE
Related WP(s) and task(s)	WP4, WP7 (Task 7.5)
Standards	
Info about metadata (production and storage dates, places) and documentation?	An inventory of the winter operations carried out, including salt/brine spreading and removal of snow from the road surface is produced every day in which any action is performed (the anti-icing protocol is activated). The inventory reports the area affected (km range) and the exact time/date. All the information is stored in the data management tool of the end-users. The information is shared under request with the PANOPTIS partners involved.
Standards, format, estimated volume of data	Daily or Yearly reports detailing daily actions are emitted in form of pdf. or xlsx. (hundred of kB).
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	<ul style="list-style-type: none"> <li>• Relate the use of salt/brine for deicing operations with pavement deterioration, reinforcement of reinforced concrete corrosion</li> <li>• Create models to optimise the use of deicing agents in winter operations</li> </ul>
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Dissemination level: confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	Dissemination of this data must be always authorised by ACCIONA/EOAE, (it is historic data, it is not produced for the project). Prior notice of any planned publication shall be given to ACCIONA/EOAE at least 45 calendar days before the publication. The use of Confidential Information for any other purposes shall be considered a breach of this Agreement.
Embargo periods (if any)	No
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	No

Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	ACCIONA/EOAE database, at least until the end of the concession project
DATASET NAME	Design details of the road corridor of Spanish A2 Highway and Greek Egnatia Odos Highway
Data Identification	
Dataset description	Inventory, location and design of road infrastructure, slopes, ditches, transverse drainage works, road sections, road signs. Drawings, geometry, topography, DTM, DSM, geotechnical surveys of the RI.
Source	Project as built, Rehabilitation projects, data base of the Conservation Agency
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA/EOAE
Partner in charge of data collection	ACCIONA/EOAE
Partner in charge of data analysis	IFS, AUTH, NTUA
Partner in charge of data storage	ACCIONA/EOAE
Related WP(s) and task(s)	WP3, WP4
Standards	
Info about metadata (production and storage dates, places) and documentation?	Historic data of the end-users, stored in the control centres. It is shared with PANOPTIS partners under request.
Standards, format, estimated volume of data	Format and weight depends of the file. Some indicative information below: <ul style="list-style-type: none"> <li>- Designs in dwg. various Mb</li> <li>- Topography in dwg. various Mb</li> <li>- Geotechnical surveys (report pdf.) various Mb.</li> </ul>
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	Models of the RI under study Information for vulnerability and risk analysis
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Dissemination level: confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	Dissemination of this data must be always authorised by ACCIONA/EOAE, (it is historic data, it is not produced for the project). Prior notice of any planned publication shall be given to ACCIONA/EOAE at least 45 calendar days before the publication. The use of Confidential Information for any other purposes shall be considered a breach of this Agreement.
Embargo periods (if any)	No

Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	No
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	ACCIONA/EOAE

DATASET NAME	CCTV
Data Identification	
Dataset description	Imagery of CCTV installed on the road corridor
Source	ACCIONA/EOAE legacy data acquisition systems
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA/EOAE
Partner in charge of data collection	ACCIONA/EOAE
Partner in charge of data analysis	NTUA, C4C
Partner in charge of data storage	ACCIONA/EOAE
Related WP(s) and task(s)	WP4, WP5, WP7 (Task 7.5)
Standards	
Info about metadata (production and storage dates, places) and documentation?	Spanish A2T2, images are currently taken online every 5 minutes. Data is accessible online in the legacy data management tool. Egnatia Odos motorway images.
Standards, format, estimated volume of data	Accessible online via legacy data management tool of the end-users.
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	Model the road corridor Vehicle information in real time (risk, and impact analysis) Feed for the DSS module
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Dissemination level: confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	Dissemination of this data must be always authorised by ACCIONA/EOAE, (it is historic data, it is not produced for the project). Prior notice of any planned publication shall be given to ACCIONA/EOAE at least 45 calendar days before the publication. The use of Confidential Information for any other purposes shall be considered a breach of this Agreement.
Embargo periods (if any)	No
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to	

collect this information?	
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	ACCIONA/EOAE database, at least until the end of the concession project
DATASET NAME	
Traffic information	
Data Identification	
Dataset description	Traffic intensity per hour, per vehicle class (light or heavy), per direction
Source	ACCIONA/EOAE control centres (legacy data management tool)
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA/EOAE
Partner in charge of data collection	ACCIONA/EOAE
Partner in charge of data analysis	NTUA, IFS, C4C
Partner in charge of data storage	ACCIONA/EOAE
Related WP(s) and task(s)	WP2 (Task 2.5), WP4 ,WP7 (Task 7.5)
Standards	
Info about metadata (production and storage dates, places) and documentation?	Information is produced in real time on line. PANOPTIS partners can access via legacy data management tool.
Standards, format, estimated volume of data	Accessible online via legacy data management tool of the end-users.
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	Data used for vulnerability, risk and impact analysis
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Dissemination level: confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	Dissemination of this data must be always authorised by ACCIONA/EOAE, (it is historic data, it is not produced for the project). Prior notice of any planned publication shall be given to ACCIONA/EOAE at least 45 calendar days before the publication. The use of Confidential Information for any other purposes shall be considered a breach of this Agreement.
Embargo periods (if any)	No
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	Yes, occasionally, when any operation is carried out by the concessionary staff. The consent will be managed when necessary.
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	ACCIONA/EOAE database, at least until the end of the concession project

DATASET NAME	Data on ACCIONA Smart Roads Management Tool (legacy data management system)
Data Identification	
Dataset description	Any information shared through the legacy ACCIONA Smart Road Tool
Source	ACCIONA control centres (legacy data management tool)
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ACCIONA
Partner in charge of data collection	ACCIONA
Partner in charge of data analysis	NTUA, IFS, C4C, FINT, AUTH, ADS, ITC
Partner in charge of data storage	ACCIONA
Related WP(s) and task(s)	WP2 (Task 2.5), WP3, WP4, WP5, WP6, WP7 (Task 7.5)
Standards	
Info about metadata (production and storage dates, places) and documentation?	PANOPTIS partners can access to all the data about the RI in the data management system of ACCIONA (previously authorised by ACCIONA).
Standards, format, estimated volume of data	Accessible online
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	Data used for vulnerability, risk and impact analysis, feeding all the models (weather, corrosion), image analysis of cameras
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Dissemination level: confidential (only for members of the Consortium and the Commission Services)
Data sharing, re-use, distribution, publication (How?)	Dissemination of this data must be always authorised by ACCIONA/EOAE, (it is historic data, it is not produced for the project). Prior notice of any planned publication shall be given to ACCIONA/EOAE at least 45 calendar days before the publication. The use of Confidential Information for any other purposes shall be considered a breach of this Agreement.
Embargo periods (if any)	No
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	No
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	ACCIONA/database, at least until the end of the concession project

DATASET NAME	Land use and cover
Data Identification	
Dataset description	Land use and land cover maps
Source	Open Access inventories of the Spanish Administration: Ministry of Finance for land use <a href="https://www.sedecatastro.gob.es/Accesos/SECACC/DescargaDatos.aspx">https://www.sedecatastro.gob.es/Accesos/SECACC/DescargaDatos.aspx</a> SIOSE geoportal (Ministry of Public Works) and CORINE Land Cover, for land cover data
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	Open source data
Partner in charge of data collection	ACCIONA
Partner in charge of data analysis	AUTH, FMI
Partner in charge of data storage	AUTH, FMI
Related WP(s) and task(s)	WP2 (Task 2.4), WP3
Standards	
Info about metadata (production and storage dates, places) and documentation?	Data can be downloaded from download services of all the public agencies in the three levels of Spanish administration, national, regional and local
Standards, format, estimated volume of data	“.shp” or raster format like “.geotiff” Various Mb
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	Feed for climatic and geo-hazards models
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Public
Data sharing, re-use, distribution, publication (How?)	Open source inventory Can be published
Embargo periods (if any)	no
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	no
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	Data storage in PANOPTIS Open source repository for 4 years after the end of the project.

DATASET NAME	Vegetation maps
Data Identification	
Dataset description	Vegetation maps of the areas surrounding the demosites
Source	Open Access inventories of the Spanish Ministry of Environment



Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	Open source
Partner in charge of data collection	AUTH, FMI
Partner in charge of data analysis	AUTH, FMI
Partner in charge of data storage	AUTH, FMI
Related WP(s) and task(s)	WP3
Standards	
Info about metadata (production and storage dates, places) and documentation?	Data can be downloaded from download services of all the public agencies in the three levels of Spanish administration, national, regional and local
Standards, format, estimated volume of data	Vegetation maps in shape format LiDAR x,y,z data (laz files ASCII files, ESRI matrix (.asc), (various Mb)
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	Improve simulations of the climate related hazards on the road
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Public
Data sharing, re-use, distribution, publication (How?)	Open source inventory Can be published
Embargo periods (if any)	no
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	no
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	Data storage in PANOPTIS Open source repository for 4 years after the end of the project. Also in National and Regional Open Source inventories.

DATASET NAME	Hydrological data
Data Identification	
Dataset description	Hydrological maps, rain precipitation historic, flood prone areas
Source	Open Access inventories of the Spanish Ministry of Environment
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	Open source data
Partner in charge of data collection	ACCIONA
Partner in charge of data analysis	AUTH, FMI
Partner in charge of data storage	AUTH, FMI

Related WP(s) and task(s)	WP2 (Task 2.4), WP3
Standards	
Info about metadata (production and storage dates, places) and documentation?	Data can be downloaded from download services of all the public agencies in the three levels of Spanish administration, national, regional and local.
Standards, format, estimated volume of data	".shp", arpsis Various Mb
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	Feed for climatic and geo-hazards models
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Public
Data sharing, re-use, distribution, publication (How?)	Open source inventory Can be published
Embargo periods (if any)	no
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	no
Archiving and preservation (including storage and backup)	
Data storage (including backup): Where? For how long?	Data storage in PANOPTIS Open source repository for 4 years after the end of the project. Also in National and Regional Open Source inventories.

DATASET NAME	Satellite data
Data Identification	
Dataset description	Imagery (several processing levels available) JPEG 2000, GEOTIFF (Spot 6/7); Images, metadata, quality indicators, auxiliary data SENTINEL-SAFE (JPEG 2000, .XML, .XML/GML) (Sentinel-2); Images, metadata, quality indicators, ground control pointsb.GEOTIFF, .ODL, .QB, .GCP (Landsat 7 ETM +)
Source	Spot 6/7, Sentinel-2, Landsat 7 ETM+
Partners activities and responsibilities	
Partner owner of the data; copyright holder (if applicable)	ADS
Partner in charge of data collection	ADS
Partner in charge of data analysis	ADS, ITC
Partner in charge of data storage	
Related WP(s) and task(s)	WP5
Standards	
Info about metadata (production and	In ADS data bases

storage dates, places) and documentation?	
Standards, format, estimated volume of data	The satellite images are constituted with pixels. The size of the pixels depends on the instruments. The images can be taken with various wavelengths (multi-spectral, hyperspectral). For PANOPTIS, the number of satellite images will be limited (due to the slow variation of the landscape and the cost of images). Expected volume around 20 images.
<b>Data exploitation and sharing</b>	
Data exploitation (purpose/use of the data analysis)	Identify the changes in the landscape and in the RI to detect possible problems (landslides, rockslides, flows, etc.)
Data access policy / Dissemination level: confidential (only for members of the Consortium and the Commission Services) or Public	Public
Data sharing, re-use, distribution, publication (How?)	The images are exploited and only the results of exploitation will be distributed.
Embargo periods (if any)	N/A
Personal data protection: are they personal data? If so, have you gained (written) consent from data subjects to collect this information?	N/A
<b>Archiving and preservation (including storage and backup)</b>	
Data storage (including backup): Where? For how long?	ADS data bases for 10 years.

## 2.2 Making data openly accessible

At this time of the project, we can make the hypotheses that the data will be stored:

- In the project web site repository.
- At the end-user premises/maintenance systems,
- In the integration platform (system repository),
- At the partners premises.

Some of the data will be collected from external data bases (open) so as to develop system capabilities. It is especially true for images of defects on RI or images of weather/disasters effects on RI. These images will be used to calibrate the detection/analysis algorithms as several modules will use deep-learning techniques. So, the more images will be available, the more accurate the results should be.

In the other way round, some data collected and processed in the project should be made accessible to researchers outside the consortium so they can use them for similar purposes. The WP leaders will therefore decide after the trials which data should be made accessible from outside the consortium in respect of the IPRs and of the data owners decisions.

The repository that will be used for the open data will be accessible through the project website hosted by NTUA.

## 2.3 Making data interoperable

PANOPTIS is dealing with data that describe an environment which is the same all over Europe (and over the world). The Meteorological data are in general standardised (WMO) but the interpretation that is done from them to produce alerts can vary. The approach in PANOPTIS is to use as much as possible existing standards and propose standardization efforts in the domain where the standards are not widely used or not yet existing.

For the vulnerability of infrastructures, although not completely standardized, there are very similar approaches in Europe to define an ID card of infrastructure hot spots (bridges, tunnels). In AEROBI project, a bridge taxonomy has been proposed as well as a bridge ontology that enables a standardization of names and attributes. The taxonomy and the ontology of bridges from AEROBI will be re-used in PANOPTIS.

For the Command and Control system/COP, the objects displayed in the situation will be exchanged using pre-standardised or widely spread formats: XML documents collection (NVG or TSO objects). Using these formats, the situation elaborated in PANOPTIS can easily be exchanged with other parties having a modern information system/control room/call centre (e.g. Civil Protection, 112, road police,etc.).

## **2.4 Increase data re-use (through clarifying licences)**

The data will start to be available when the first version of the system is integrated and validated (From month 24).

From all the data collected and processed by the system, the data related to the Road Infrastructure can be confidential. They belong to the road operators (respectively ACCIONA and Egnatia Odos), so if any third party outside the consortium wants to use them, a case by case authorization is needed from the operators.

The data should be accessible after the end of the project;

The web site of the project will be maintained one year after the project, Academic and Research partners of the project will continue to use it after the project.

## **3 Allocation of resources**

The costs for making data fair in PANOPTIS are related to Task 2.4, managed by AUTH, with the support of FMI and the end-users (ACCIONA and Egnatia Odos). The maintenance of these data after the project life-time will be decided within this task after the system architecture (especially data models) completion.

## **4 Data security**

The data security will be assured by:

- The project data repository (controlled access);
- The partners secured accesses to their data bases.

PANOPTIS data are not sensitive. The infrastructure data owners (ACCIONA and Egnatia Odos) essentially want to control the use of their data and be sure that they are not used in improper ways.

HRAP module will handle a big set of rules and procedures that will also be used for operational decision support

## **5 Ethical aspects**

PANOPTIS data concern natural phenomena and road infrastructure. No part of PANOPTIS system manipulates personal data.

However, during the tests, trials or dissemination events, pictures of persons can be taken, either by the system sensors (fixed cameras, UAV cameras) or by individual cameras to illustrate reports or to put in the project galleries. In addition, persons from or outside the consortium can be interviewed.

Any time there will be a collection of personal data (images, CVs, etc.), the persons will sign a consent form under which they accept the use of these data in the context of the project and provided that the use cannot go beyond what is specified in the consent form.