




Improved Robotic Platform to perform Maintenance and Upgrading Roadworks: The HERON Approach

Grant Agreement Number: 955356

D7.2: Report on the system configurations for the field trials and deployment at the demonstration sites

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Abbreviation List

Abbreviation	Definition
AI	Artificial Intelligence
AR	Augmented Reality
BB	Bounding Box
DoA	Description of the Action
EC	European Commission
EDGEVIS	Computer Vision system deployed on site
GA	Grant Agreement
GPS	Global Positioning System
HLP	High Level Planner
IMS	HERON Frontend interface
KPI	Key Performance Indicator
MIDDF	HERON middleware and data fusion layer
OS	Operating System
PATVEC	Patrol vehicle
PILOTGUI	UGV's web service interface
PoI	Point of Interest
REMVIS	Computer Vision system
RUP	Removable Urban Pavement
UAV	Unmanned aerial vehicle
UGV	Unmanned Ground Vehicle
WP	Work Package

Executive Summary

This report is written in the framework of WP7 - Field integration, demonstration and validation activities of HERON project under Grant Agreement No. 955356.

The deliverable presents the system configuration for the field trials and the deployment specifics for each of the HERON demonstration sites, where pilot activities will take place. This work is the outcome of Task 7.2, “Preparation of system configurations for the field trials and deployment”. A timeplan for the pilot deployment along with logistics and other issues to be considered are also included in the document.

The document is a continuation of the work performed in WP2, especially D2.1, End-user needs and KPIs report, where the pilot sites and the respective use cases were analysed in detail. The document also feeds into all WP7 deliverables, especially the ones reporting on the validation and evaluation outcomes of pilot activities.

1 Introduction

1.1 Purpose of the Document

The purpose of this document is to present the system configurations for the field trials and deployment at the HERON demonstration sites, where pilot activities will take place. This work is the outcome of Task 7.2, “Preparation of system configurations for the field trials and deployment”, led by partner INAC.

The document presents an overview of the HERON pilot sites, the various actions that comprise the HERON “minimum viable demo” and a plan for the deployment and pilot use of the use case scenarios in each site, along with logistics and other issues to be considered.

1.2 Intended Audience

The document’s main audience is the HERON consortium partners. The document is public, hence anyone interested in the planning of the HERON pilot deployment activities may refer to it for relevant information.

1.3 Interrelations

This deliverable interacts with all other project activities and deliverables. It is strongly connected to the outcomes of WP2, especially D2.1, End-user needs and KPIs report, where the pilot sites and the respective use cases were analysed in detail. The document also feeds into all WP7 deliverables, especially the ones reporting on the validation and evaluation outcomes of pilot activities.

2 Overview of demonstration sites

HERON will perform extensive platform testing, validation and evaluation activities in four demonstration sites in Spain, France and Greece. The pilot sites were described in detail in D2.1: End-user needs and KPIs report. An overview of the pilot sites follows.

2.1 ACCIONA Constuction – Spain

Pilot A2 – Guadalajara (Spain) – ACCIONA

A-2 is part of the Trans-European Transport Network and is the Connecting Europe Facility (CEF corridor) between Madrid and Barcelona. The motorway is owned by the Spanish National Road Authority and the section selected has a length of 77.5 km.

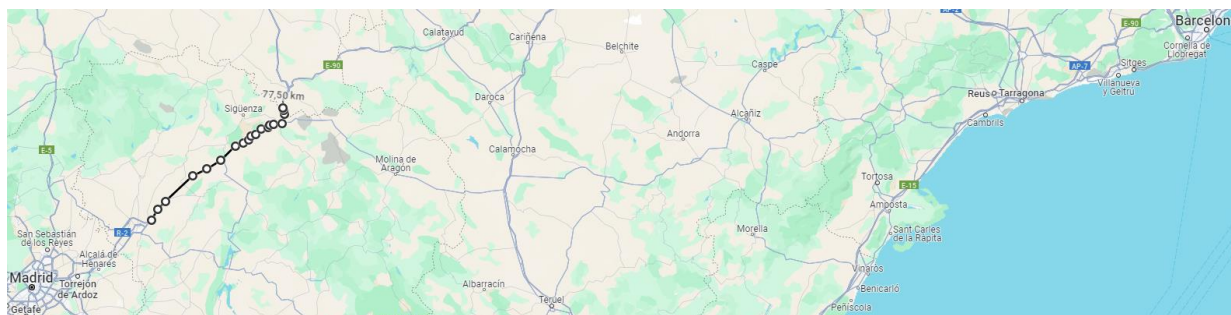


Figure 1: Section of A2 operated and maintained by ACCIONA

The section has four lanes (two per traffic direction) and crosses a region with Continental-Mediterranean climate, with long and severe winters, long, dry and hot summers and high heavy traffic levels, so pavement maintenance is crucial to preserve the optimum pavement conditions required.

The formal name of the contract is: “Awarding of public works contract for the maintenance and exploitation of the A-2 dual motorway. Section: R2 - L.P. Soria/ Guadalajara”. The contract is managed by ACCIONA, that oversees the operation and maintenance of the asset from the traffic control centre located in Torija (Guadalajara), which is the base for machinery, maintenance, and patrol vehicles. Monitoring the motorway status, visualising and assessing the data provided by CCTV, inductive loops, GPS-based fleets, weather stations, weigh in motion systems etc. are other key activities included in the contract.



Figure 2: Traffic control centre in Torija

2.2 Universite Gustave Eiffel – France

2.2.1 Transpolis

Transpolis is a proving ground which has been created by 5 entities among which Univ. Eiffel and has been opened officially in 2019. It is typically used to test autonomous vehicles in a secure and controlled environment thanks to several kilometers of road (notably 12 km in the “city area”) and all reinforced concrete buildings. Many types of Vehicle to Everthing (V2X) and Vehicle to Infrastructure (V2I) communication means are also available, as well as camera monitoring.

2.2.2 LaVallee

UGE is involved in several implementations of the concept of smart city. Some of them are quite small implementing one given functionality, while others implement and test several functionalities of the road of the future, resilient, adaptable and automated. Among those, the site LaVallée, also called E3S, is an urban development project at the former place of Ecole Centrale de Paris where several new mobility infrastructures and services will be implemented to create an evolutive, energy-neutral and cooperative road.

In particular, in the frame of this pilot of the city of the future, the concept of urban removable pavement will be studied, using hexagonal concrete slabs prefabricated. These removable tiles allow quick access to networks, improve durability of surface properties roadways and can be recycled. Their prefabrication should make it possible to offer other integrated functions (various textures, porous, silent or depolluting surfaces, insertion of sensors, etc.). Currently, this CUD concept is not fit for TEN-T traffic, so inspecting these tiles regularly for cracks and repairing them is crucial.

2.3 Olympia Odos Motorway – Greece

Olympia Odos is the motorway connecting Athens (the Capital of Greece) with the main gate to the west (the Port of Patras) running at the north side of Peloponnese. It is 202 km in length and comprises of two existing motorway sections, i.e. Elefsina - Korinthos (ELKO) 64 km long and Patra by Pass (PbP) 18 km long, along with 120km of the new Korinthos-Patra (KOPA) motorway, whose construction was completed in 2017. Another part from Patra to Pyrgos (approx. 75 kms length) is under construction and expected to be completed in 2025.

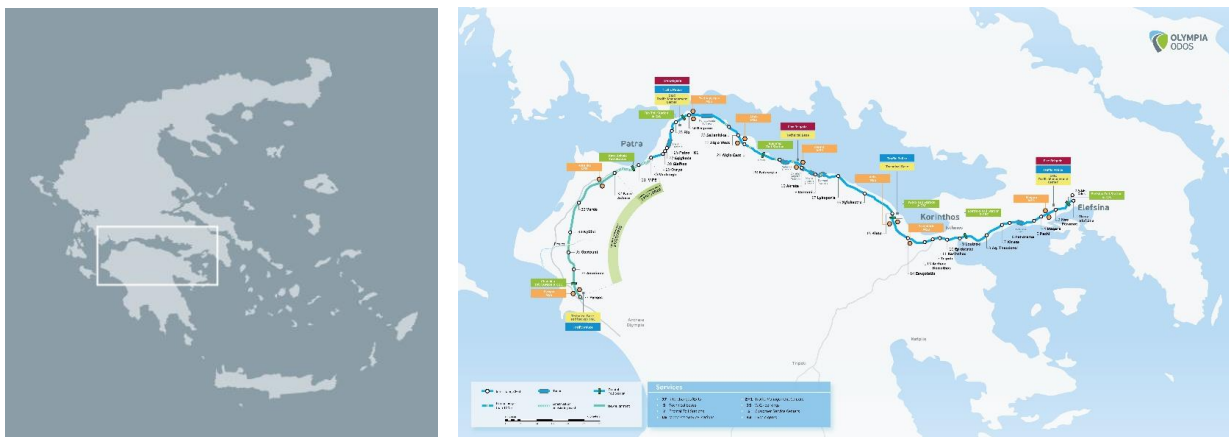


Figure 3: Map of Olympia Odos Motorway

In the framework of the Concession Agreement for the Project of the Motorway “Elefsina-Korinthos-Patra- Pyrgos-Tsakona”, the company “Olympia Odos Operation S.A.” has undertaken since 6 August 2008 on behalf of the Concessionaire (Olympia Odos S.A.), the operation of the road section from Elefsina (Thiva I/C) until the end of Patras Bypass.

3 System configuration for the field trials

This section presents the system configuration for the field tests. The initial perception was that the HERON platform would be configured at each pilot site based on the scenarios to be executed in each field location. However, in the course of the project it was decided that all scenarios will be deployed and pilot tested across all locations. As a result, the “minimum viable demo” to be deployed in all pilot locations is presented.

3.1 Minimum viable demo

The HERON minimum viable demo includes all actions provided by HERON. When combined, these actions create a mission (i.e. a more complex set of actions) that will be pilot tested across the demonstration sites as pilot use case scenarios.

3.1.1 Main Actors

The main actors in HERON are:

- **Operator** (via GUI, off-site)
- **Safety Pilot** (on-site with robot, mainly for safety purposes)
- **UAV** (if available)
- **UGV Robot** with components (internally communicating via ROS, externally to CLOUD)
 - HLP: High level planner
 - NAV: Robot navigation (base motion planning, obstacle avoidance)
 - ARM-X Functionalities for each manipulation skill X.
 - SEG / OBJDET: Semantic segmentation / object detector vision module
- **CLOUD** (includes GIS road data)
 - Transfers data between Robot and GUI
 - Transfers data between UAV and GUI and Robot, if UAV available

3.1.2 High-Level Repair and Robot Actions

The following high-level repair and robot actions should be commanded from the high-level operator GUI. A combination of actions creates a HERON mission.

- Start mission
- Place cones
- Pick up cones
- Spray road markings
- Repair crack
- Fill pothole

- Place RUPs
- Return home
- Stop mission

3.1.3 HERON Action Walk-Throughs

Pre-Requisites

All activities performed during a pilot use case, have as prerequisite that:

- An up-to-date **overhead image** from CLOUD is available through UAV or GIS high-resolution image
- The UGV Robot is transported physically near the **mission area**.

Start Mission

1. GUI operator selects “Start Mission”.
2. GUI operator draws mission bounding box on overhead image.
3. GUI operator selects “home” position on overhead image.
4. Mission OBB (Oriented Bounding Box) and home position sent to CLOUD and transferred to Robot.

Place Cones

1. Operator presses “Place Cones” in GUI.
2. GUI operator draws connected line segments on overhead image along which cones should be placed.
3. Segment positions sent to CLOUD and transferred to Robot.
4. High-level planner (HLP) computes cone positions along segments, sends to CLOUD.
5. HLP commands robot to move next to first cone position via NAV.
6. HLP commands ARM-PLACE-CONE to place it at the target location.
7. Repeat from 5 until all cones are placed.

Pick Up Cones

1. Operator presses “Pick Up Cones” in GUI
2. Robot queries cone positions from CLOUD, sends to HLP
3. HLP commands robot to move next to first cone position via NAV
4. HLP commands arm camera to move to top-down view of cone position
5. Refinement of cone pose through OBJDET (which view?)
6. HLP commands ARM-PICK-CONE on refined cone position to pick up cone
7. Repeat from 3 until all cones are removed

Repair Crack

1. Operator presses “Repair Crack” in GUI
2. Operator selects reliable OBB for crack in overhead image in GUI (this can be based on OBJDET detections from UAV, Robot, or CLOUD GIS but may need human refinement)
3. OBB is sent to CLOUD and transferred to Robot

4. High-level planner (HLP) segments the OBB into workspace-sized partitions
5. HLP commands robot to move to the next partition via NAV
6. HLP commands the robot to blow the crack clean of debris
7. HLP commands robot to move next to the next partition via NAV
8. HLP moves the arm camera to top-down view of the partition and runs SEG to get a segmentation mask of the crack
9. HLP commands ARM-REPAIR-CRACK to fill the crack in the partition using the segmentation
10. Repeat from 5 until the crack is entirely sealed.

Paint Road Markings

1. Operator presses “Paint Road Markings” in GUI
2. Operator selects reliable OBB for road markings to refresh in GUI (this can be based on OBJDET detections from UAV, Robot, or CLOUD GIS but may need human refinement)
3. OBB is sent to CLOUD and transferred to Robot
4. High-level planner (HLP) segments the OBB into workspace-sized partitions
5. HLP commands robot to move next to the next partition via NAV
6. HLP moves the arm camera to top-down view of the partition
7. SEG produces a segmentation mask of the road markings (assumption: extents of marking visible)
8. HLP commands ARM-PAINT-ROAD-MARKING to refresh the road markings using segmentation.
9. Repeat from 5 until all road markings are painted/refreshed.

Repair Potholes

1. Operator presses “Repair Pothole” in GUI
2. Operator selects reliable OBB for pothole from overhead imagery (this can be based on OBJDET detections from UAV, Robot, or CLOUD GIS but may need human refinement)
3. OBB sent to CLOUD and forward to robot
4. HLP commands robot to move next to the pothole OBB via NAV
5. HLP moves the arm camera to top-down view of the pothole and runs SEG to get a segmentation mask of the pothole. Optionally uses the depth image to estimate volume.
6. HLP commands robot via NAV to move so robot pothole sealant nozzle is over pothole
7. HLP commands ROB-REPAIR-POTHOLE to fill the pothole (material storage opens, dumping filler into pothole)
8. HLP commands ROB-SMOOTH-POTHOLE to compress and smooth material (using components mounted on body of robot)

Replaceable Urban Pavements (“CUD” elements)

Due to the weight and complexity of the RUPs, the pilot activities will only perform experiments with downscaled RUPs and an ETHZ arm. At the pilot location it will also be demonstrated that the UGV can approach te area of interest of RUPs.

1. Detect RUP area of interest
2. Position robot correctly in front of RUP area of interest
3. Show video of robot doing replacement operation in scaled-down lab scenario
4. Show that CV component can detect damage in the RUP

3.2 Overview of actions deployed in each pilot site

The following table presents an overview of the HERON actions to be deployed at each pilot site

HERON Action	ACCIONA	Transpolis	Olympia Odos	LaVallee
Start/Stop mission	X	X	X	
Place cones	X	X	X	
Pick up cones	X	X	X	
Spray road markings	X	X	X	
Repair crack	X	X	X	
Fill pothole	X	X	X	
Place RUPs				X

4 Deployment plan per pilot site

4.1 ACCIONA Constuction

4.1.1 Pilot Objectives

The objective of the ACCIONA pilot is to implement in a real environment the services and technological components developed in HERON. It is also intended to facilitate the integration of the HERON platform with the existing legacy systems of ACCIONA, to support and enhance actual planning of maintenance, inspection, and inventorying operations.

The cost, features, benefits, and technical feasibility of the proposed solutions will be compared to conventional procedures in the operation and maintenance of transport infrastructures, including:

- Inspection and patrolling activities: identification of obstacles (stopped vehicles, tires, rubbish or debris), detection of surface defects, damaged or absent safety elements as well as blurred road markings.
- Maintenance operations to repair cracks, potholes, road markings (painting).
- Inventorying of safety elements (bollards, vertical signs, New Jersey barriers, studs, and guardrails)

4.1.2 Scope and Scale / System Configuration

The pilot includes the validation of the different HERON functionalities at two scales:

- 1) In a controlled environment in the old N-2;
- 2) In three active roads: 1) A2 motorway (both in the main section and in an access road) and the secondary roads CM-1008 and CM-2000.

The integrated HERON platform and all the functionalities developed for both the unmanned ground and aerial vehicles (UGV and UAV respectively) will be validated in a controlled environment in the old N-2. For this purpose, the staff from AMISA, the company of the ACCIONA group in charge of the maintenance in A-2 will create different scenarios to cover the functionalities that are not feasible to validate in the selected section (e.g. potholes repair, presence of obstacles, debris, incidents with safety elements like traffic signs, guardrails, bollards, concrete barriers, etc.).

The inspection and inventorying functionalities will be validated in A-2 motorway to check the performance of the systems covering long distances using both the UAV and the visual systems mounted on regular patrol vehicles.

Due to the status of the pavement surface in A-2 (well maintained and with few relevant surface defects), it is also planned to validate the Inspection functionality to detect surface defects (crack, potholes and blurred road markings) in two secondary roads CM-1000 and CM-2008 with much more surface defects (different types of cracking: longitudinal, oblique, alligator cracks etc.).

Locations and coordinates:

The KML Google Earth files including the precise coordinates of the all the pilot locations and areas for the trials have been uploaded in the HERON shared folder. The following is a brief summary of the information included.

As shown in the screenshot, the areas selected are all accessible in minutes and are close to the Torija Traffic Control Center (8km ahead).

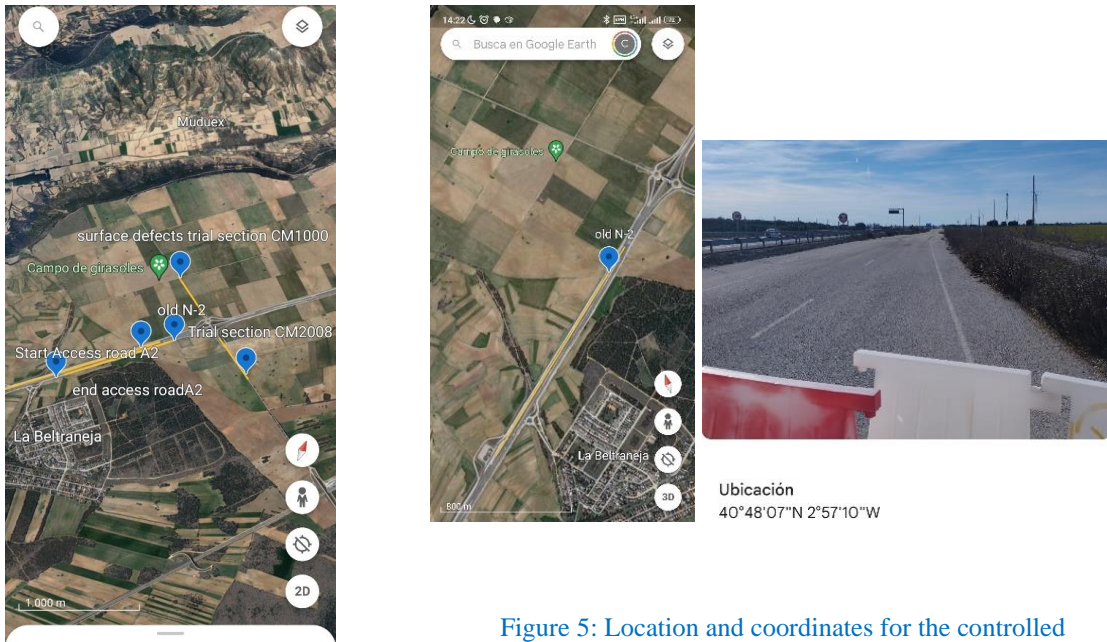


Figure 5: Location and coordinates for the controlled environment trials in the old N-2

Figure 4: Google Earth locating for the different trials areas



Figure 6: Location and coordinates for the evaluation of the surface defects in CM-2008 and CM-1000

4.1.3 Stakeholders involved in the pilot

The following stakeholders are involved in the pilot.

- ACCIONA Construction Technology Centre. Partner in HERON and leader of the Spanish pilot.

- AMISA. ACCIONA Mantenimiento de Infraestructuras. Company responsible for the maintenance of A-2. In the pilot will create the simulated scenarios to facilitate the demonstration of the HERON platform and all the system functionalities.
- ACCIONA Concesiones. Company responsible for the operation of A-2. In the pilot will support the integration of HERON in ACCIONA legacy systems. Will support the team in all the required communication systems and IT needs. Final responsible of the trials as is the main client of the asset owner (Spanish Ministry of Transport).
- Spanish Ministry of Transport, Mobility and Urban Agenda. Asset owner. The Ministry Inspector will issue the final permission to facilitate all the trials in the active motorway.
- Guardia Civil de Trafico. Traffic authority. Responsible of the traffic in A-2. Will be informed of the operations and will supervise if any additional safety measures are necessary to grant A-2 users safety.
- ENAIRE. Spanish public company to grant permissions for flights of UAVs.
- HERON partners: Partners involved in WP7 and main roles: ICCS: Artificial Visual systems; Flights of drones. ETHZ and ROB: Responsible for the UGV and all the modules developed for cracks a potholes repair, cones placement and removal and road marking painting. STWS and RISA: HERON platform and integration with ACCIONA legacy system; IKH: Visual system. ENAC: overall coordination of the pilot and verification of the accomplishment of the deployment plan.

4.1.4 Available resources and legacy systems

HW availability / Devices used

The A-2 server will be accessible for HERON.

Three cameras will be bought by the ACCIONA team to install one in the ACCIONA UAV (to be used after the pilot activities) and other two cameras for regular patrol vans.

If necessary, CCTV cameras installed in A2 as well as the weather information stations will be available for the HERON team.

SW / Legacy / Integrations. Communications required

Integration 1. Plug and play of the HERON platform and Satways IMS in the ACCIONA system.

Integration 2. Integration within the actual ACCIONA legacy system: “ACCIONA Smart roads”.

There will be coordination between the HERON team and the software developer: ITERNOVA

All the information linked to the inspection and inventorying functionalities should be exported to the ACCIONA server in .csv format, to facilitate the creation of warns/alerts and to support the maintenance activities planning.

An API should be created by the HERON team, from the middleware to the ACCIONA server. ACCIONA and ITERNOVA will integrate these data in the Smart Roads legacy system.

A Raspberry is available to facilitate these communications, but other systems might be required.

5G available in all the areas planned for the pilot. A 4G router and fiber are also available in the Torija traffic control centre.

4.1.5 Deployment environment

Activities and locations for the demonstration activities in a controlled environment

For this part of the pilot, it has been selected a section of the old N-2 section (now closed to live traffic) that runs in parallel to A2. The section is close to the small residential area of La Beltraneja in Trijueque only eight kilometres ahead of the Traffic Control Centre in Torija (Guadalajara).

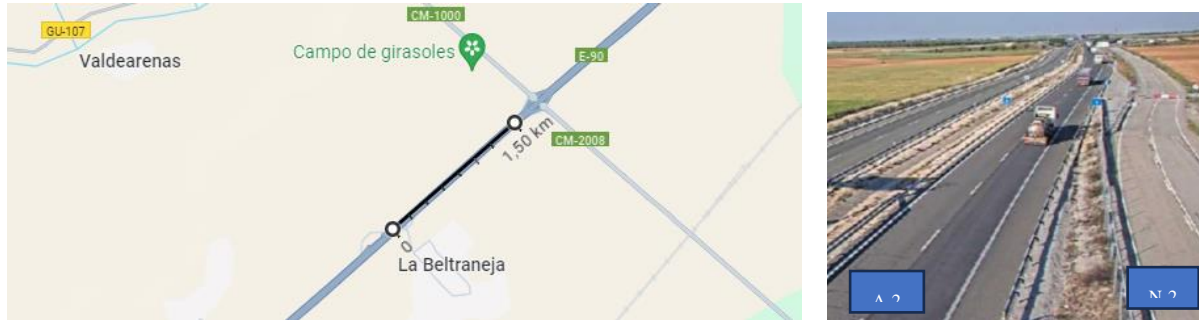


Figure 7: Location and picture of the old N-2

The length of the selected section of the old N-2 is 1,5km and the geometry is almost equal to actual heavy traffic motorways (2 lines, width shoulders or sides of the road, safety elements, etc.).

There is room to validate the cones placing and removal functionality. Different scenarios can be simulated to validate small areas of intervention (few cones required) and big areas of intervention (many cones required). It was agreed that the Spanish Ministry of Transport will participate in the pilot activities and will verify the stop and safety measures to stop the operation in case of failure or errors with the navigation system and the UGV.

As it is not well maintained, there are surface defects, road markings blurred and small potholes, so it is ideal to test the surface defects inspection functionality for short-mid distances (0-3km?) with both patrol vans and Unmanned Aerial Vehicle (UAV) and the modules of the Unmanned Ground Vehicle (UGV) for painting road markings and repairing cracks and small potholes.



Figure 8: Cracks and road markings blurred in the section selected in the old N-2

If necessary, it is feasible to simulate in this section, different types of potholes to fully validate the potholes repair functionality. For this purpose a pneumatic hammer can be used to create different sizes, geometries etc.

On the other hand, to validate the **incidents management functionality**, obstacles can be placed in the pavement to test the detection of stopped vehicles, tires, rubbish, or debris.

To support **the validation of the incident management system, and of the inspection and inventorying functionalities**, it is intended to simulate different scenarios:

- Guardrails damaged by an accident can be installed to check if the artificial visual system detects it.
- Guardrails fixings can be disassembled to simulate a problem due to a small crush.
- Concrete barriers can be placed in the required position to simulate an accident and barriers moved.
- Damaged concrete barriers could be installed to check if the artificial visual system detects it.
- Vertical traffic signs can be removed to simulate their absence. Damaged traffic signs can be installed to check if the artificial visual system detects it. The same can be done for bollards.
- Vegetation can be placed on the road edges and partially covering traffic signs to check if the artificial visual system detects it.
- Debris, tires, rubbish, etc. can be placed in the middle of the pavement to check if the artificial visual system detects it.

Activities and locations for the demonstration activities in active roads

1) A-2 motorway (both main section and access roads)

For A-2 motorway, it is planned to validate the inspection and inventorying functionalities for long distances (3-15km?) with both patrol vans and Unmanned Aerial Vehicle (UAV).



Figure 9: The A-2 motorway

For the validation of the cones placing and removal functionality, after discussions with the traffic authority (police) and the owner of the asset (Spanish Ministry of Transport), it was agreed to arrange a double safety measure organizing a regular line signaling (following traditional procedures) and display the UGV in the road edge to simulate the cones placing and removal with very low interaction with live traffic.

This scenario is also planned to prevent potential errors and to count on a buffer zone or safety area in case there is any issue with the navigation system and the UGV.

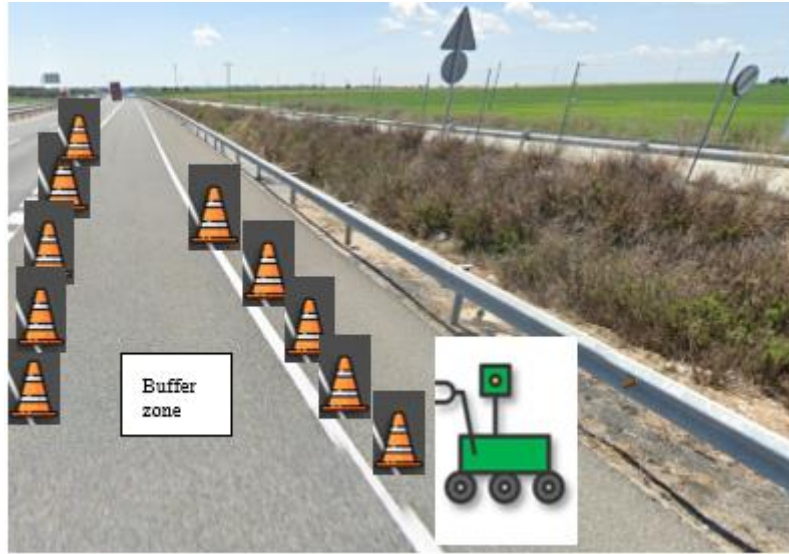


Figure 10: Simulation of the cones placing and removal functionality in A-2 as agreed with the relevant authorities.

An area with small cracks and blurred road markings will be selected (if available at the time of the pilot, because regular maintenance is mandatory and maybe there are no major cracks or road markings blurred in that particular moment). As contingency plan: an access road of A-2 near the old N-2 (where it is more probable to find these failures) has been selected.



Figure 11: Access Road of La Beltraneja in A-2

2) *CM-1008 and CM-2000 secondary roads*

To fully validate the **surface defects inspection functionality**, two secondary roads have been selected to make feasible the detection of all kind of cracking (longitudinal, oblique, alligator cracks etc.), any other wear, such as potholes, asphalt bleeding, detachment/separation of particles etc. and loss of operational characteristics (texture depth, lateral skidding, surface regularity), road markings blurred etc.

These roads are not well maintained and it is also a good area to validate the visual systems in shadow areas. The following figures are good examples of the surface defects in CM-1008 and CM-2000.



Figure 12: Surface defects in CM-2008



Figure 13: Surface defects in CM-1000

4.2 Universite Gustave Eiffel

4.2.1 Transpolis

Transpolis is a test site, which makes it possible to test in (semi-) controlled conditions the following use cases linked to HERON:

- Connectivity (with server, system, RSUs): stability, volume/speed of exchanged data,
- Inspection and repair of road markings (older ones, and new ones adapted to autonomous driving),
- Inspection of (bituminous) road surface, detection of defaults, repair of potholes (or cracks)

The Transpolis location is in the countryside near Lyon (<https://maps.app.goo.gl/MKD7WeuhibiPch3J8>). The site will be available to the HERON consortium for a total of 10 days.

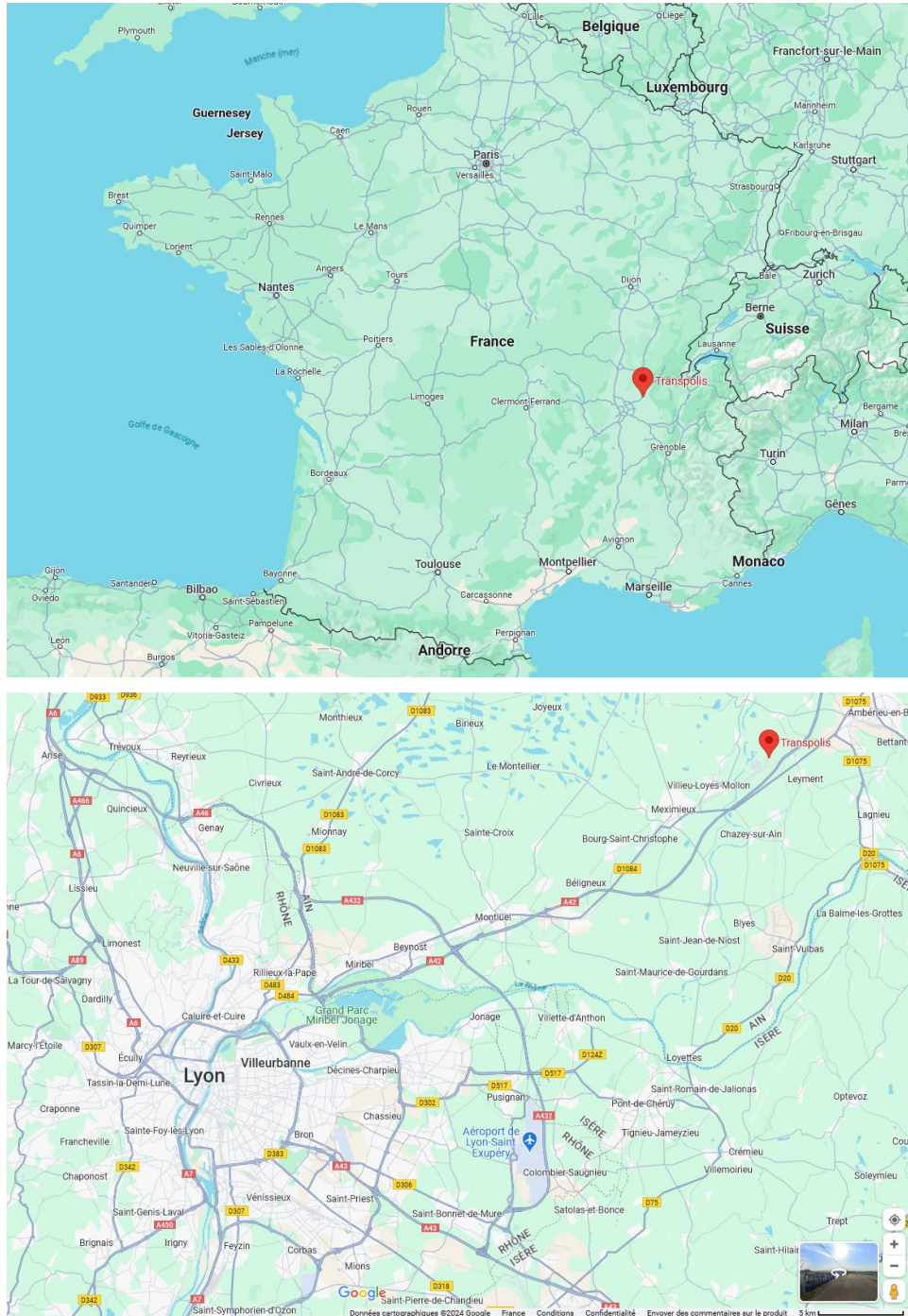


Figure 14: Transpolis location

4.2.2 LaVallee

The objectives of the LaVallee pilot site are to inspect the RUP slabs, detect different kind of surface anomalies, make a management decision and replace (if needed) some slabs. There are two available locations, one on the premises of UGE, and one in the city of Nantes.

For this pilot case, due to the size and weight of the RUPs, only the inspection part of the system will be implemented and tested on the pilot onsite. The replacement will be tested in ETH premises, using small scale slabs.

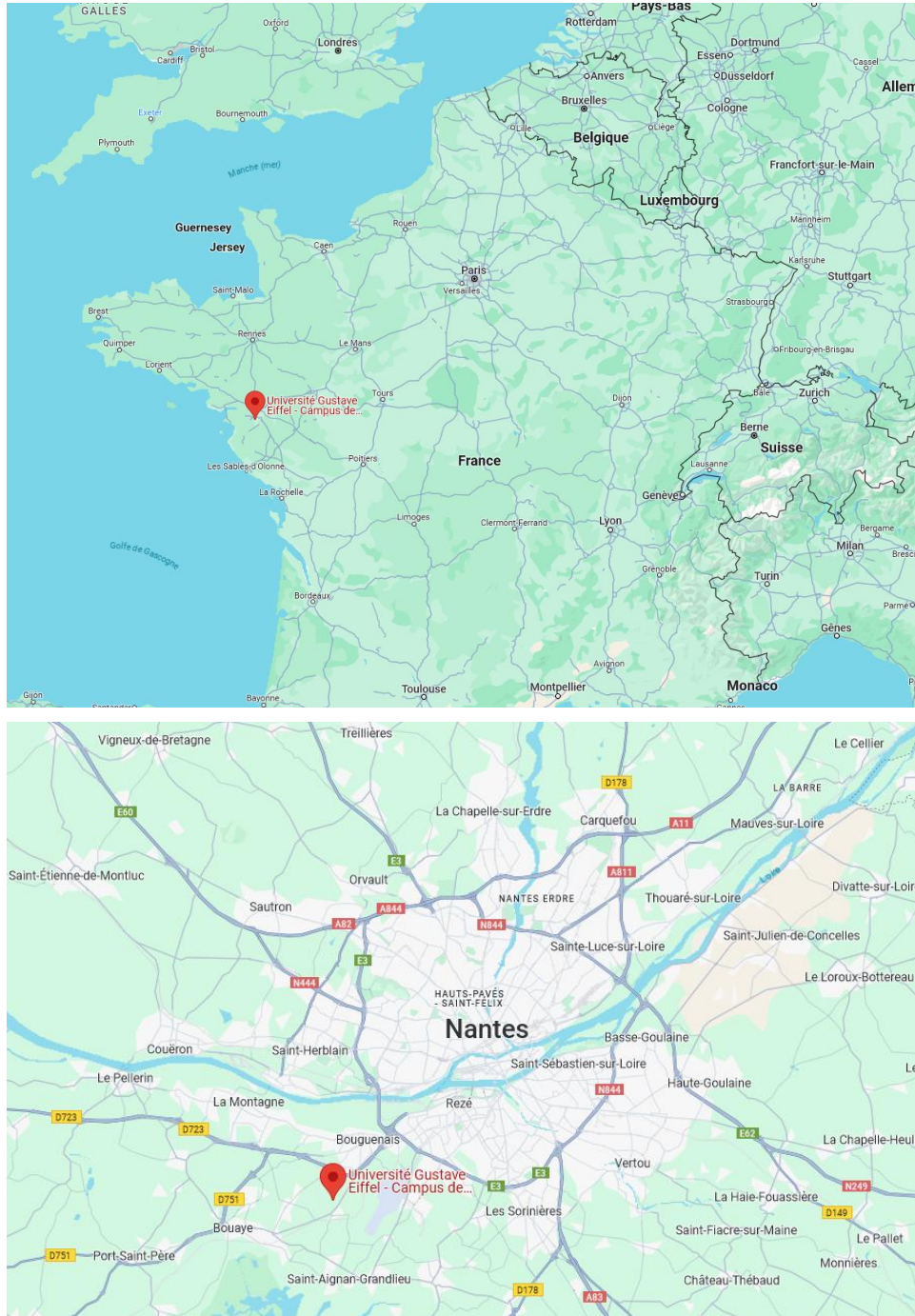


Figure 15: RUPs pilot location

4.3 Olympia Odos

4.3.1 Pilot overview and objectives

The Olympia Odos motorway is divided in two operational Districts:



Figure 16: Olympia Odos districts and main installations

The main installations of the Operation and Maintenance Centre (OMC) are located in the area of Ano Vlychada, Megara Municipality, on the 32nd km of the Athens- Korinthos NNR at the north service road.



Figure 17: The Olympia Odos Operation and Maintenance Centre (OMC) at Megara

Apart from the central administrative services (headquarters) of the Operation company, the OMC houses:

- one of four technical bases, competent for patrolling, inspection and maintenance works in the section from Elefsina to Epidavros,
- fleet service area,
- parking area for project machinery and other company fleet vehicles,
- central warehouse and salt-shed for the winter maintenance needs.

The OMC also houses the new modern Traffic Management Centre (TMC) of District 1, which operates 24/7 all year through.



Figure 18: The Olympia Odos Traffic Management Centre (TMC) of District 1

In the TMC, the traffic management cameras project to a modern video wall comprising of 12 screens of 60". It has 4 workstations, one of which is exclusively a snow ploughing and winter maintenance centre. It has an updated automatic incident detection system and a new system of equipment control and management, which allows the remote operation of fire-fighting, irrigation, road lighting, tunnel safety and dynamic signage systems. The TMC is connected to the meteorological stations along the Project, which render possible the direct provision of information, aiming at the timely diagnosis and dealing with dangerous weather conditions. The TMC specialized personnel replies to the emergency 1025 calls, as well as to the new Emergency Roadside Telephones calls. The TMC personnel cares for the smooth operation of the motorway by collecting, analyzing and transmitting information in order to coordinate incident dealing actions by using the company measures, as well as the emergency services when required.

Another two Technical Bases are located at Kiato and Akrata, while in Rio the second OMC is located, as well as the Technical base and the TMC of District 2.

The objective of this Pilot is to implement on-site integration and scale – demonstration of the services and the technological components and to validate the HERON platform.

The cost, features, benefits and reaction time of the proposed system and incurred procedures will be compared to conventional procedure of the motorway operation.

4.3.2 Scope and Scale / System Configuration

The pilot is concentrated in two different areas:

- The area of inspections in order for defects to be identified.
- The area of maintenance activities and more specifically: painting of road markings, potholes patching and crack sealing, including the traffic cones disposal and removal before and after these maintenance activities.

4.3.3 Stakeholders involved in the pilot

The following stakeholders from Olympia Odos are involved in the pilot:

- Quality and Administrative Manager
- Systems Engineer
- IT Manager
- Head of Road Operations
- Maintenance Manager
- TMC Coordinator
- TMC Supervisor / Operator on duty
- Foreman / Patroller on duty

4.3.4 Available resources and legacy systems

HW availability / Devices used

A CCTV camera is installed at the Thisseas tunnel diversion to oversee the test area.

The HERON platform will be fed with traffic related information from two (2) Road Weather Information Stations (Elefsina & Kakia Skala), Traffic counting stations and Variable Message Signs (VMS).

SW / Legacy / Integrations. Communications required

In order to feed data into the HERON platform, the following data from the Motorway Management System DB will be transmitted to HERON:

- Traffic Counts.
- METEO measurements.
- VMS status.

All of the above data will be transmitted via FTP infrastructure for further processing by HERON.

On the location the following communications infrastructure is available:

- At the Thisseas Tunnel Bypass: 4G, 5G & fiber
- At the N. Peramos Head Offices: 4G, 5G.

4.3.5 Deployment environment

All equipment will be secured at the headquarters described above, also shown at the following google map: <https://maps.app.goo.gl/ufyCFX64TUWaVyxcA>

At the headquarters there is also availability for a meeting room and all other necessary facilities.

The proposed pilot execution point is located approximately 15 kilometres from the headquarters and can be found at the following google map: <https://maps.app.goo.gl/etRQ3SUVbUEGKiBP8>

It is a secure area, as it is the by-pass of the small tunnel “Thisseas”, on direction to Athens (see aerial photos below) and used only in emergency cases, when the tunnel is closed either for maintenance activities or due to an incident.

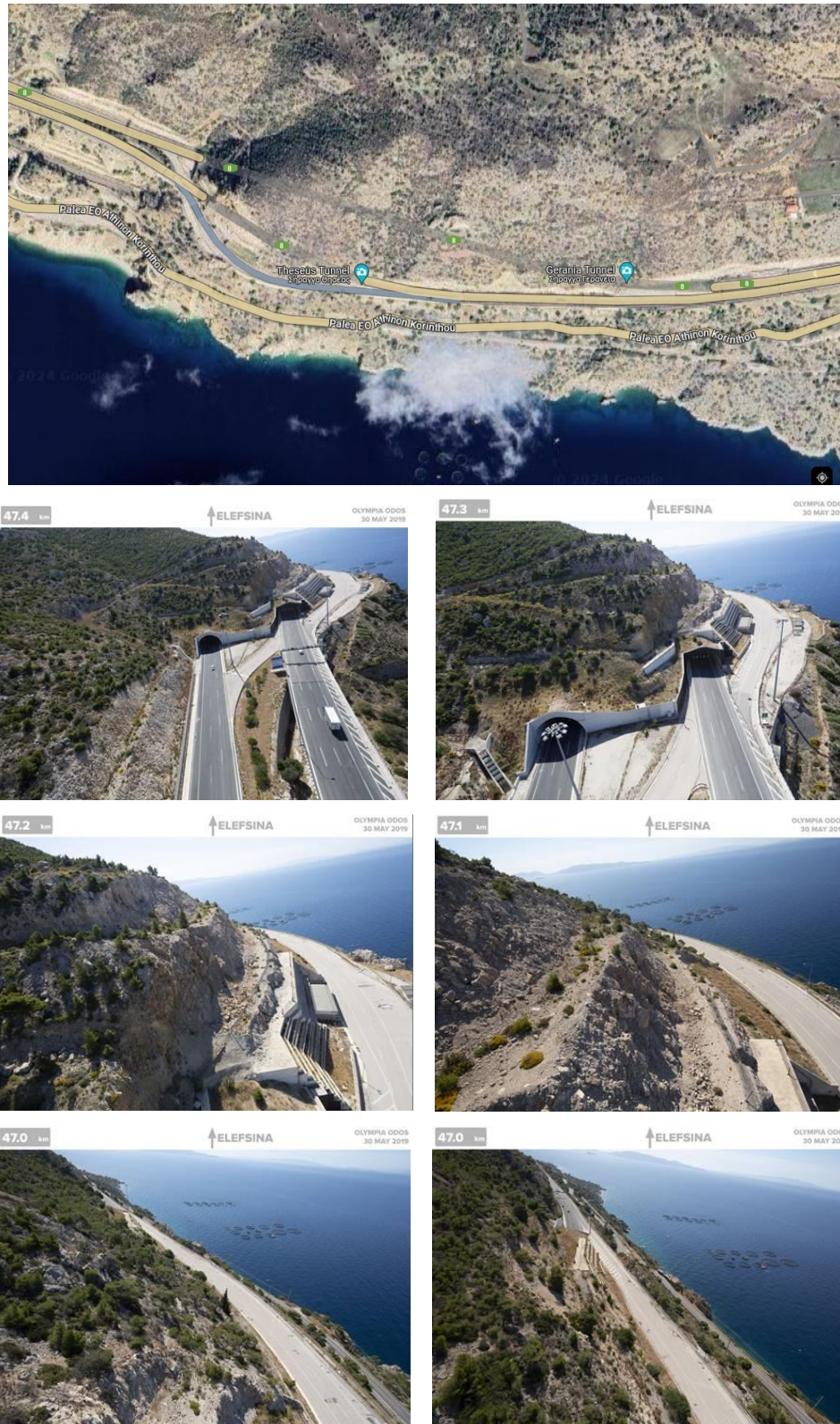


Figure 19: Aerial photos of the Olympia Odos pilot deployment location

As seen in the next photos, dated 31.01.2024, the area has plenty of space, it is isolated from the rest of the traffic and potholes, cracks and road markings with defects may be found. A Mid Voltage Substation also exists there, which can provide electricity, access to the fiber optic and

a camera may also be installed. Transfer for the headquarters to the pilot execution point, can only be done by car.

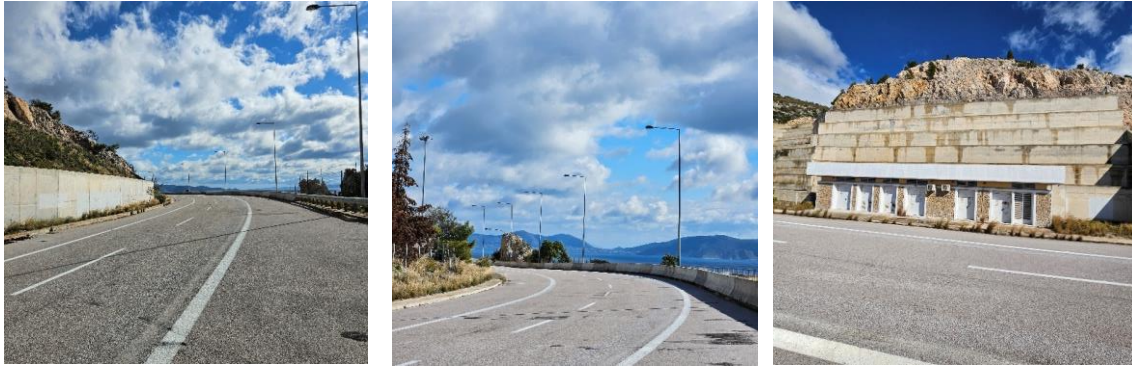


Figure 20: The Olympia Odos pilot deployment location

5 Pilot deployment timeplan

For the deployment of the HERON platform at the field sites and the actual implementation of pilot activities, a timeplan has been developed, taking into consideration the following factors:

- The availability of the pilot site,
- The logistics (time, cost) for transporting the UGV to each location,
- The delivery of V1 and V2 of the HERON platform,
- The purpose of each pilot implementation.

The implementation of pilot activities will take place in two cycles, each one following the delivery of v1 and v2 of the HERON platform respectively.

In the first cycle, HERON v1 (loosely integrated components) will be tested in controlled environments in Torija and Transpolis. The selection of the two locations has been made based on the availability of a controlled environment and their proximity to the UGV initial location (Valencia, Spain) to facilitate the UGV transportation.

In the second cycle, HERON v2 (fully integrated and improved version of components) will be tested in Megara and Torija.

The following table presents the pilot implementation timeplan. The exact dates for each pilot are to be confirmed.

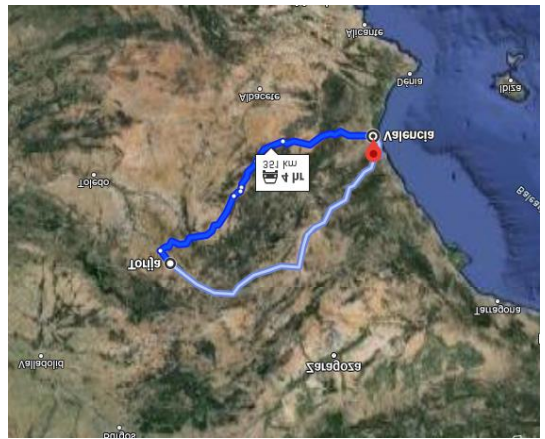
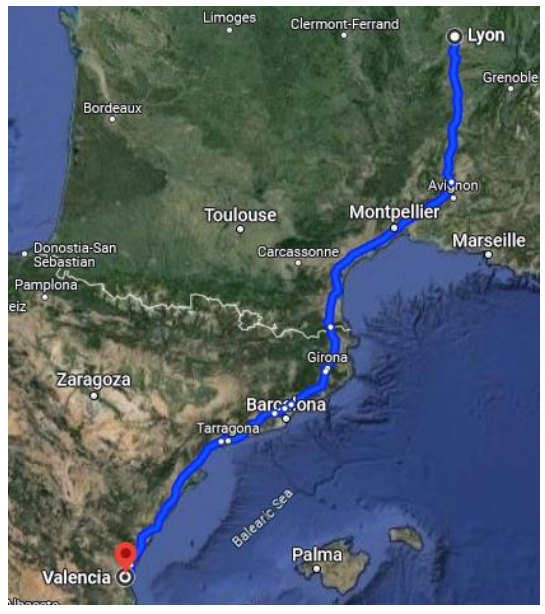

Project Month	M40	M41	M42	M43	M44	M45	M46	M47	M48
Actual Month	2024				2025				
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
HERON platform V1	X								
Pilot test of HERON v1 in Torija , Spain (ACC) in a controlled environment in the old N-2. Loosely integrated tests of all components, performing all actions		X							
Pilot test of HERON v1 in Transpolis , France (UGE) in a controlled environment Loosely integrated tests of all components, performing all actions			X						
HERON platform V2, incl. improvements suggested in pilot activities						X			

Pilot test of HERON v2 in Megara , Greece (OLO) Fully integrated platform.							X		
Pilot test of HERON v2 in Toriya , Spain (ACC) Fully integrated platform.								X	
Final reporting – Project end									X

6 Logistics and other issues

6.1 Estimation of UGV transportation duration

The following transportation durations are non-stop travelling times by car. The actual transportation duration will be longer, due to the required break times.

UGV initial location	UGV destination	Distance	Non-stop driving time (based on google maps)	
Valencia, Spain	Torija, Spain (Acciona)	350 Km	4 hours	
Valencia, Spain	Lyon, France (Transpolis)	980 Km	11 hours	
Valencia, Spain	Megara, Greece (Olympia Odos)	3500 Km	36 hours	

6.2 Permissions / Approvals required

6.2.1 ACCIONA

UAV Flight permissions.

If the pilot of the UAV is not Spanish (as it will be the case considering that the responsible of drone activities is ICCS), a special permission needs to be granted. It is recommended to compile all the required documentation at least two months in advance prior to the pilot activities. Thus, the Partner(s) responsible for the drones flight should investigate the whole procedure and make the necessary written correspondence at least 3 months before the start of the Pilot. As contingency, there are pilots in ACCIONA that can take the lead of this task if necessary.

Activities in A-2.

There is always risk of accidents/incidents in active roads, so safety first. In case of accident/incident, the police and incidents responsible in ACCIONA will take the lead and HERON activities will be secondary. Recovery time is short in A-2, so the impact will be reduced.

Depending on the date of the pilot, the presence of snow is feasible in A-2. If that is the case, winter maintenance activities might be required and might affect HERON and the activities planned. As contingency plan, the HERON activities have been planned in October and April, thus avoiding the winter months.

Permissions

The police and asset owner (Spanish Ministry of Transport) require a formal report with all the activities and precise dates for the HERON pilot to issue the required permission. Two-three weeks should be enough to get the required signature as both authorities were informed in advance and are aware of the activities planned.

6.2.2 TRANSPOLIS

Approvals

If UAVs are used, an authorization will have to be asked for: it will be approved (except if confidential testing on the other tracks). Estimated time to obtain the authorization is one week.

If cracks or potholes need to be created, an authorization will have to be asked.

6.2.3 OLYMPIA

Flight permissions

There is procedure which has to be followed for the issuance of permissions for the flight of the drone(s). In general, if the flight is not over 50m above the ground a permission is not required. Else a special procedure has to be following with the Aviation Authority. Thus, the Partner(s) responsible for the drones flight should investigate the whole procedure and make the necessary written correspondence at least 3 months before the start of the Pilot.

Furthermore, as a military area also exist very close to the site of the pilot, the whole procedure may be either more time consuming or even impossible to get a permission. Thus, the whole procedure has to be initiated as soon as possible in order to have the time to look for alternative solutions if needed.

Other permissions

A Police Decision will be issued, which will allow us to use the site for the pilot. The exact time period, the geographic area and the means of safety have to be described. The whole procedure will be undertaken by OOO. Due to the extensive experience on this subject, no risks and/or delays are expected. The whole procedure has to begin not more than 15 days before the pilot starts.

7 Conclusions

This deliverable report, developed under the framework of WP7 - Field integration, demonstration, and validation activities of the HERON project, presents a comprehensive overview of the system configuration for field trials and the deployment specifics for each HERON demonstration site. These sites are crucial for pilot activities, which form the core of the project's practical applications. The deliverable is the result of Task 7.2, "Preparation of system configurations for the field trials and deployment," and outlines a detailed timeplan for pilot deployment, addressing logistics and other pertinent considerations.

Building on the foundational work of WP2, particularly D2.1, "End-user needs and KPIs report," this document extends the analysis of pilot sites and respective use cases. By doing so, it ensures a seamless transition from theoretical frameworks to practical implementation. The insights and configurations detailed in this report are integral to all WP7 deliverables, especially those focused on validating and evaluating the outcomes of pilot activities.