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Executive Summary

The YADES project is focused on enhancing the resilience of cultural heritage (CH) sites located in areas vulnerable to multiple hazards. This deliverable documents the data collection phase, which employed advanced technologies such as drones with RGB cameras and mobile cameras to gather detailed visual data from historic sites, including Corfu Castle, Aitoliko and Mytilene. The aim was to capture a comprehensive set of imagery that would support the assessment of structural integrity and environmental interactions at these sites.

Aerial data collection via drones allowed for the extensive coverage of hard-to-reach areas, while mobile cameras provided detailed ground-level perspectives. This combination ensured that both macro and micro vulnerabilities could be documented, including structural wear and the surrounding environmental conditions. The integration of these datasets into a unified platform will enable detailed risk assessments, facilitating better preparedness, quicker response strategies, and sustainable reconstruction efforts for CH sites in the face of natural disasters.

1 Introduction

Cultural heritage sites, particularly those located in regions prone to natural hazards, face a growing threat from both environmental and human-induced factors. The YADES project aims to address these vulnerabilities by developing an integrated platform that leverages modern technologies and methodologies to assess, manage, and improve the resilience of historic areas. By incorporating advanced data collection methods, such as terrestrial and satellite imaging, and employing cutting-edge machine learning techniques, YADES is designed to provide a comprehensive understanding of multi-hazard risks, improve preparedness, and support faster, more efficient responses to disasters.

A key focus of the project is to ensure that the preservation and reconstruction of cultural heritage sites are sustainable on technical, social, environmental, and economic levels. The active participation of local communities and the implementation of innovative business models—such as a "load-balancing" economy that distributes resources across various sectors—are central to this approach. Financial risk-transfer tools, including parametric insurance and catastrophe bonds, also play a critical role in securing timely and effective responses to disasters, ensuring that reconstruction efforts are well-funded and properly executed.

This deliverable outlines the data collection phase of the YADES project, highlighting the methods used to gather data from key cultural heritage sites across Greece, including Corfu Castle, Aitoliko and Mytilene. The collected data will serve as the foundation for building resilience strategies that address the unique challenges faced by each of these sites.

2 Data Collection Methodology

The data collection methodology for the YADES project was designed to ensure comprehensive and high-quality data that supports the integrated platform for resilience assessment of cultural heritage (CH) areas. The process involved gathering diverse datasets from multiple sources, with a focus on terrestrial and satellite imaging to document historical sites of interest. Advanced tools and technologies, including drones equipped with RGB cameras and mobile cameras, were employed to capture accurate and detailed visual data for analysis. This section outlines the methodology used to collect data, providing an understanding of how these tools were deployed in the selected locations.

2.1 Overview of the Methodology

The objective of the data collection process was to provide a robust and accurate dataset that could be used to support multi-hazard risk understanding, improved preparedness, efficient response, and sustainable reconstruction of historic areas. To achieve this, a combination of aerial and ground-level imagery was collected using advanced imaging tools. The following steps were undertaken during the data collection process:

- **Site Selection**: Five areas of interest were identified for data collection based on their historical significance and vulnerability to natural hazards. These areas included Corfu, Aitoliko and Mytilene. These sites are representative of the diverse ecosystems and cultural heritage locations that the YADES project seeks to protect and preserve.
- **Aerial Data Collection**: Drones equipped with RGB cameras were utilized to capture high-resolution aerial imagery of the selected sites. The use of drones allowed for extensive coverage of large and complex areas, ensuring that all relevant features were documented. This method was particularly effective in capturing areas that are difficult to access by traditional means, such as rugged terrain or restricted zones in the historical sites.
- **Ground-Level Data Collection**: In addition to aerial data, mobile cameras were used to collect ground-level imagery. These cameras captured detailed photos and videos of the cultural heritage structures, architectural features, and surrounding environments. Ground-level data provided a closer view of the intricate details and conditions of the structures, complementing the aerial imagery by offering a more complete understanding of the physical state of the sites.

2.2 Use of Drones for Aerial Data Collection

The drones utilized for aerial data collection were equipped with high-resolution RGB (red, green, blue) cameras, which provided accurate color representation and fine detail. This was essential for mapping the historical areas, identifying structural features, and assessing the condition of the built environment. The drones operated at various altitudes to capture both wide-area images and close-up details of specific structures.

Key advantages of using drones with RGB cameras included:

- **Efficient Coverage of Large Areas**: The drones enabled rapid and efficient surveying of large areas, reducing the time and resources required for traditional ground-based surveying techniques. This was particularly beneficial in sites like Corfu, where the expansive layout could be documented in a shorter time frame.
- **Access to Hard-to-Reach Areas**: Drones provided access to areas that would otherwise be difficult or dangerous to reach, such as the upper sections of historical buildings, rooftops, and cliffs. For example, the use of drones in Mytilene allowed

for the capture of images from elevated vantage points that would have been challenging with ground-based tools.

- **High-Resolution Imaging**: The high-resolution capabilities of the RGB cameras enabled the capture of detailed images, which are critical for identifying small-scale features such as cracks, material degradation, and weathering. This level of detail is essential for assessing the condition of historical structures and planning for sustainable reconstruction efforts.

The data collected through drones was georeferenced, meaning that each image was tagged with precise geographic coordinates. This facilitated the creation of accurate maps and models of the sites, which could be integrated into the YADES platform for further analysis and risk assessment.

2.3 Ground-Level Data Collection Using Mobile Cameras

Ground-level data collection was conducted using mobile cameras to capture a more detailed view of specific features of the historical sites. Mobile cameras provided a close-up perspective of the structures and allowed for the documentation of elements that might not be visible from aerial imagery. This method was particularly useful for capturing the following:

- **Architectural Features**: Ground-level cameras captured intricate architectural details such as carvings, columns, doorways, and masonry. This level of detail is important for cultural heritage documentation and for assessing the condition of the structures.
- **Material Conditions**: By photographing the materials up close, the team was able to identify signs of aging, damage, and weathering on the surfaces of the buildings. This is crucial information for understanding the current state of preservation and for planning future restoration efforts.
- **Environmental Context**: The ground-level data also captured the immediate surroundings of the historical sites, including vegetation, water bodies, and neighboring buildings. This data helped to assess the environmental factors that might influence the resilience of the sites to natural hazards such as floods or landslides.

2.4 Integration of Aerial and Ground-Level Data

Once collected, the aerial and ground-level data were integrated into a unified dataset. This involved processing the imagery to create 3D models, orthophotos, and maps that could be used for detailed analysis. The integration of aerial and ground-level data provided a comprehensive view of the sites, enabling the identification of vulnerabilities at both the macro and micro levels.

- **3D Modelling**: The data from the drones was used to create detailed 3D models of the historical areas, providing a virtual reconstruction that can be analyzed for structural integrity and potential risk factors.
- **Orthophotos**: High-resolution orthophotos were generated by stitching together multiple drone images. These orthophotos provide a bird's-eye view of the sites and are useful for large-scale mapping and spatial analysis.
- **Site-Specific Analysis**: The integration of both aerial and ground-level data allowed for a site-specific analysis of each location, providing insights into both the broad environmental factors affecting the areas and the specific conditions of individual structures.

2.5 Data Validation and Quality Assurance

To ensure the accuracy and reliability of the data collected, several quality assurance measures were implemented:

- **Cross-Referencing with Existing Data**: The newly collected data was cross-referenced with existing maps, historical records, and satellite imagery to verify its accuracy and consistency.
- **On-Site Ground Control Points (GCPs)**: Ground control points were used to improve the accuracy of the drone imagery. These points were surveyed using GPS, and the coordinates were used to calibrate the aerial images, ensuring precise alignment with real-world locations.
- **Data Processing and Cleaning**: The raw data collected from the drones and mobile cameras underwent processing to remove any distortions or errors. This included correcting for lens distortion, lighting variations, and other factors that could affect the quality of the images.

By employing these advanced data collection techniques and methodologies, a comprehensive and high-quality dataset was gathered for each of the selected sites. This data will be used to support the broader objectives of the YADES project, contributing to multi-hazard risk assessment, resilience planning, and the sustainable reconstruction of historic areas.

3 Overview of the Drone Implementation

This section provides a detailed account of the drones deployed and planned for future use within the YADES project. The project's data capture relies heavily on high-performance drones to gather comprehensive visual data of cultural heritage sites, enabling robust analysis through computer vision models. This section covers the equipment specifications and unique advantages of each drone model used, emphasizing how they meet project requirements for imaging, localization, and resilience assessment.

3.1 Deployed Equipment

For the YADES project's data-capturing sessions, two DJI drones—the **DJI Air 2S** and **DJI Mavic 2 Pro**—were selected due to their exceptional imaging capabilities, reliability, and compatibility with diverse environmental conditions. These drones were employed to (i) evaluate the computer vision models' performance with UAV imaging data, (ii) collect training data to enhance model robustness, and (iii) test the localization framework integral to resilience assessment and 3D modeling of heritage sites.

Additionally, NTUA is in the process of procuring a more advanced drone, the **DJI Matrice 350 RTK**. This future addition promises significant enhancements in data collection due to its sophisticated depth perception and LiDAR capabilities, making it a powerful tool for comprehensive site analysis.

3.2 DJI Air 2S

The DJI Air 2S combines ease of use with advanced imaging technology, making it suitable for both amateur and professional data capture. This lightweight and highly maneuverable drone is optimized for detailed image acquisition and features a range of capabilities suited to the YADES project's requirements:

- **Aircraft Specifications**: The Air 2S has a takeoff weight of 595 grams and compact dimensions (folded: 180×97×77 mm, unfolded: 183×253×77 mm). This allows it to reach hard-to-access areas in heritage sites while maintaining portability. It can ascend at 6 m/s and reach altitudes up to 5000 meters, providing a maximum flight time of 31 minutes per charge. These features enable extensive coverage in a single flight session, ideal for capturing large sites like the Corfu Castle.
- **Imaging Capabilities**: Equipped with a 1" CMOS sensor capable of capturing 20 MP images, the Air 2S produces high-resolution photos essential for detecting fine structural details. It also records video at up to 5.4K at 30 fps, ensuring that even small-scale damage or environmental wear on historical structures is visible. The range of photography modes, including burst shooting and auto exposure bracketing, adds flexibility for capturing various lighting and atmospheric conditions.
- **Battery and Power Management**: The intelligent battery provides 40.42 to 41.4 Wh of energy, supporting extensive flight time and quick charging at up to 38 W. This efficiency allows prolonged data capture with minimal downtime between sessions, which is crucial for capturing large datasets in limited timeframes.
- **Flight and Stability**: The Air 2S achieves speeds of up to 19 m/s and has wind resistance up to 10.7 m/s, ensuring stable operation even in moderate winds common in coastal regions like Aitoliko. Its 3-axis gimbal provides excellent stability, essential for clear and consistent data capture. The drone's GPS, GLONASS, and GALILEO systems enhance its positioning accuracy, ensuring that all images and data points are precisely georeferenced.

- **Obstacle Avoidance and Transmission**: With sensors on all sides, the Air 2S avoids obstacles effectively, protecting both the drone and heritage sites from accidental damage. The O3 transmission system provides high-definition video feeds up to 12 km, allowing operators to maintain oversight even when the drone is beyond visual range.

3.3 DJI Mavic 2 Pro

The DJI Mavic 2 Pro, part of the Mavic 2 series, offers versatility and superior imaging quality, making it ideal for detailed structural assessment in heritage documentation. Its combination of a powerful camera and reliable flight performance ensures comprehensive data collection across diverse conditions.

- **Imaging Capabilities**: The Mavic 2 Pro's standout feature is its 1" CMOS sensor with 20 MP resolution and adjustable aperture (f/2.8 to f/11). This configuration enables precision in capturing images under varying light, which is beneficial for evaluating structural features that might be obscured by shadows or low light. The video quality reaches 4K resolution, with advanced color profiles like Dlog-M and D-Cinelike, which retain color detail in post-processing, providing more accurate representations of the sites' conditions.
- **Physical Specifications**: With a takeoff weight of approximately 907 grams and compact design, the Mavic 2 Pro combines stability and ease of transport. It reaches a maximum speed of 5 m/s, and its battery supports flight times up to 31 minutes, maximizing operational efficiency across extended data capture missions.
- **Sensing and Obstacle Avoidance**: The Mavic 2 Pro includes omnidirectional obstacle sensing, which is essential when navigating complex heritage sites where structures and vegetation may present hazards. OcuSync 2.0 ensures a reliable video feed up to 10 km, facilitating effective monitoring from a distance.
- **Battery and Environment Suitability**: The intelligent flight battery (3850 mAh) extends flight duration, supporting uninterrupted capture, while the operational temperature range (-10°C to 40°C) enhances adaptability for various seasonal and geographic conditions.

3.4 DJI Matrice 350 RTK (Future Acquisition)

The DJI Matrice 350 RTK represents a major upgrade in NTUA's drone fleet, expected to provide substantial capabilities for the YADES project. This drone's LiDAR and advanced sensor technology bring several unique advantages:

- **Advanced Depth Perception**: The Matrice 350 RTK is equipped with a LiDAR sensor, allowing it to create highly accurate 3D models of complex structures, such as intricate carvings or deteriorating surfaces. LiDAR's precision makes it possible to capture fine details that are challenging to detect through traditional RGB imaging, improving the assessment of structural vulnerabilities.
- **Enhanced Localization and Imaging**: Besides LiDAR, the Matrice 350 RTK is equipped with high-resolution cameras and RTK (Real-Time Kinematic) technology. RTK significantly improves geolocation accuracy, essential for mapping heritage sites in detail and supporting integration with Geographic Information Systems (GIS).
- **Operational Capacity**: This UAV has extended flight endurance and robust weatherproofing, which allow it to operate in harsh conditions, making it suitable for remote and exposed sites. Its depth perception and obstacle avoidance systems

are advanced, ensuring minimal risk of collision or damage during operation around heritage structures.

3.5 Future Data Capture and Model Integration

With the DJI Matrice 350 RTK's addition, YADES will be able to expand its dataset, using high-fidelity 3D models and georeferenced images to enhance the computer vision and machine learning models. These datasets will not only improve the accuracy of structural assessments but also provide an expanded training set, helping the models recognize a broader array of environmental and structural factors that influence site resilience.

The use of the three UAVs together—DJI Air 2S, Mavic 2 Pro, and Matrice 350 RTK—creates a scalable framework for imaging that balances detail, coverage, and advanced depth sensing. This approach ensures that each drone's unique capabilities can be optimized based on site requirements, with the DJI Air 2S and Mavic 2 Pro covering standard imaging needs and the Matrice 350 RTK offering specialized capabilities for high-precision modeling.

The implementation of these UAVs strengthens YADES's data-capturing capabilities, providing comprehensive documentation essential for risk assessment and resilience planning. By integrating aerial imagery, ground-level data, and depth sensing, YADES ensures that its resilience strategies are built on precise, high-quality data, positioning the project at the forefront of heritage site preservation through innovative technology.

4 Corfu Castle

The Old Fortress of Corfu, known in Greek as Παλαιό Φρούριο and in Venetian as Fortezza Vecchia, is a significant historical site located in the city of Corfu. Originally built during Byzantine times and later extensively fortified by the Venetians, this imposing structure sits on a promontory between the Gulf of Kerkyra to the north and Garitsa Bay to the south. It was a key defensive stronghold, successfully repelling three major Ottoman sieges over the centuries, making it a critical part of the cultural heritage of Corfu.

For the YADES project, which focuses on resilience assessment and multi-hazard risk management of historic areas, the Old Fortress of Corfu is a prime example of the type of cultural heritage site that requires careful analysis and preservation. The combination of its rich historical significance, complex architecture, and strategic location makes it highly susceptible to multiple natural hazards, including coastal erosion, earthquakes, and extreme weather events. Understanding and documenting the current state of this fortress is crucial for future protection efforts, making it an important subject for the YADES initiative.

Figure 1 depicts photos from Corfu castle area, in the images that focusing on the walls of the fortress, we observe visible signs of deterioration. This includes cracks in the masonry, missing stones, and surface degradation, which are likely caused by a combination of natural aging, weathering, and exposure to environmental hazards such as humidity, salt from the nearby sea, and temperature fluctuations. The visible decay highlights the importance of immediate assessment and intervention, which aligns with YADES' goal of improving resilience to natural hazards in cultural heritage sites.

Figure 1: Photos collected from Corfu

The photos also reveal sections where modern repairs or reinforcements, such as the use of red bricks, have been implemented. However, these recent additions appear juxtaposed against the original Venetian-era construction, raising concerns about the integration of newer materials with the older structures. Such interventions must be carefully analyzed for their impact on the historical integrity and long-term sustainability of the site.

The photos provide both ground-level and aerial views, offering a clear understanding of the architectural layout and its relationship with the surrounding environment. The aerial shots, in particular, show how closely the historical structures are intertwined with modern-day Corfu's urban fabric. This proximity highlights potential risks from urban encroachment and pollution, as well as the need for a comprehensive, ecosystem-based approach to preservation, as envisioned by the YADES project.

Additionally, the ground-level images of the fortress's pathways, surrounding vegetation, and neighboring buildings reflect the interplay between natural and built environments. These interactions are crucial for understanding how environmental factors might exacerbate structural weaknesses or, conversely, support resilience efforts by controlling runoff or stabilizing soil around the fortress.

The detailed documentation of structural conditions through these images is vital for the YADES project's multi-hazard risk assessment and resilience strategy. The visible deterioration highlights the need for advanced imaging and machine learning analysis to assess vulnerabilities accurately and prioritize areas for intervention. Additionally, the data from these images can inform the sustainable reconstruction approaches and risk-transfer tools being developed within the project, ensuring that restoration efforts are aligned with the broader goals of protecting both the built environment and the local community.

In summary, these images provide critical documentation that will serve as a foundation for the YADES project's integrated platform, contributing to better preparedness, efficient response, and sustainable reconstruction of the Old Fortress of Corfu. The focus on both structural analysis and environmental context ensures that all factors influencing the fortress's resilience are addressed comprehensively.

5 Aitoliko

Aitoliko is a small town in the municipality of Mesolongi, located approximately ten kilometers northwest of the city of Mesolongi, with a population of 7,345. What makes Aitoliko unique is its development on a small island situated in the middle of the Aitoliko-Mesolongi lagoon, creating a distinctive cultural and environmental landscape. The town is connected to the mainland via two stone arch bridges, each originally around 300 meters in length, which link the town to the east and west.

The town's location in the lagoon, along with its architectural features and historical significance, makes it a key area of focus for the YADES project. YADES aims to protect and preserve historic areas like Aitoliko by employing advanced tools and technologies, such as satellite imaging and machine learning, to assess vulnerabilities and plan for resilience in the face of multi-hazard risks, including natural disasters and environmental degradation.

The town of Aitoliko is an example of how natural and cultural heritage must be integrated into a comprehensive resilience strategy, as proposed by YADES. The use of innovative technologies and local community participation will contribute to developing a holistic approach that not only focuses on safeguarding Aitoliko's physical structures but also its unique ecosystem and cultural history.

The two stone bridges, in particular, are vital links between Aitoliko and the mainland, both literally and figuratively. They symbolize the connection between past and present, between nature and human endeavor. By mapping and assessing these structures using YADES' advanced methodologies, the project aims to ensure their longevity, even in the face of multi-hazard risks.

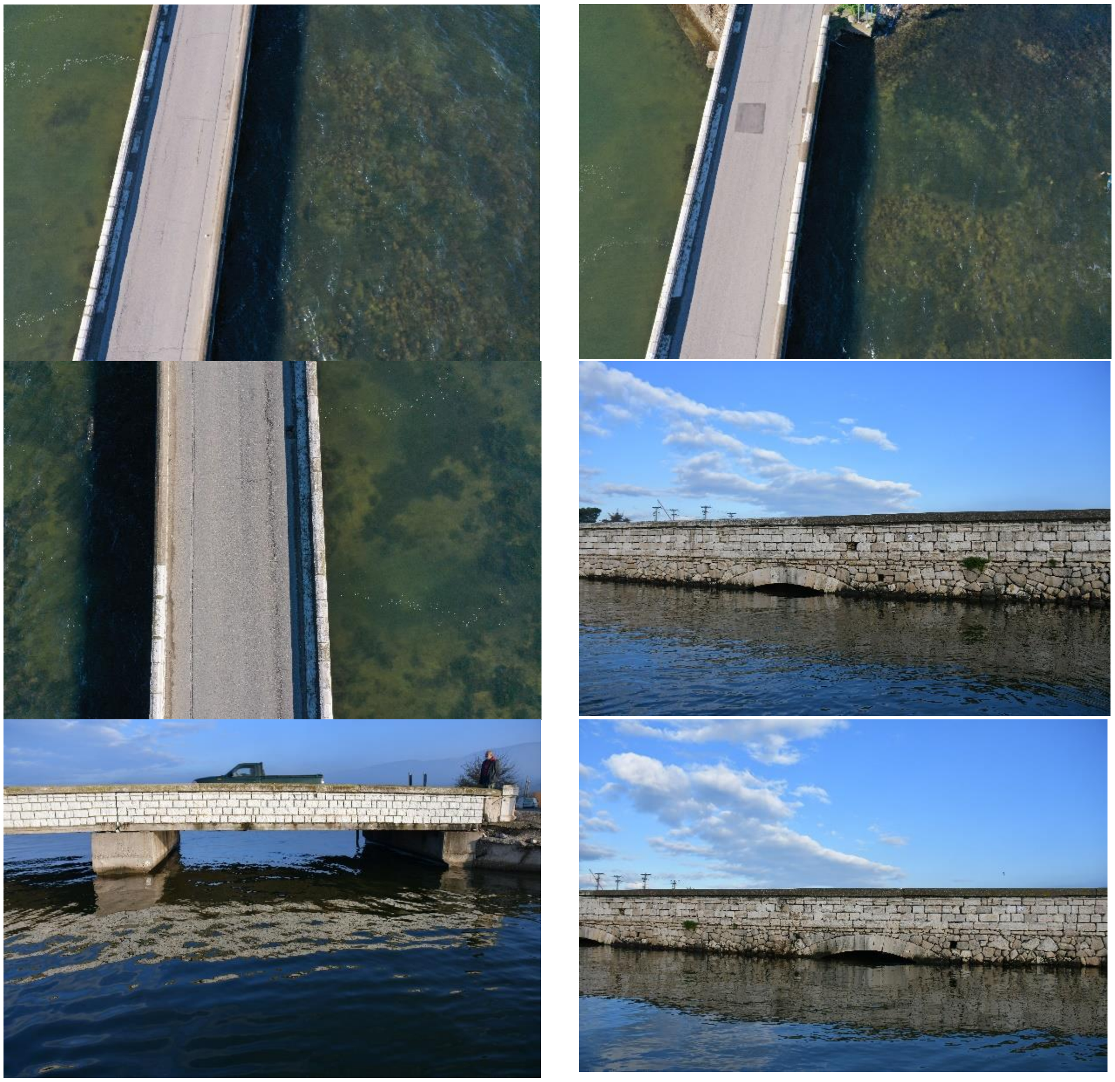

Figure 2: Photos of the stone bridge in Aitoliko

Figure 2 presents images of the historic stone bridge in Aitoliko, an important architectural structure that connects the small island town to the mainland. This bridge, with its stone arches and solid masonry, is a critical part of Aitoliko's heritage, both as a functional infrastructure and a significant piece of cultural history. The bridge spans across the Aitoliko-Mesolongi lagoon, offering not only passage but also serving as a key element of the local landscape, deeply intertwined with the town's identity.

The photos highlight the bridge's robust design, featuring characteristic stonework that has withstood the test of time and the elements. The carefully placed stones in the arches and supporting walls reflect traditional construction methods, providing a sense of durability and endurance. However, upon closer inspection, some visible cracks and wear on the surface can be observed. These indications of aging and environmental exposure underscore the need for regular maintenance and careful monitoring, especially given the bridge's exposure to the lagoon waters and potential natural hazards such as flooding or erosion.

From an aerial perspective, the bridge's integration with the lagoon is also evident. The shadows cast by the bridge over the water, along with the clarity of the water beneath, provide insight into the interactions between the built and natural environments. Such visual data can help assess the bridge's resilience against ongoing water flow and the impact of seasonal weather patterns.

By documenting the bridge through both ground-level and aerial imagery, YADES can create detailed models that inform maintenance and preservation strategies. These images are not only valuable for assessing the current condition of the bridge but also for predicting how it may be affected by future environmental changes.

6 Mytilene

Mytilene, the ancient city on the east coast of the island of Lesbos, is steeped in history, having played a pivotal role in the region since ancient times. Originally confined to a small offshore island, Mytilene was later joined to the main island of Lesbos through the construction of a channel. This channel created two harbors, north and south, which were connected by white stone bridges. The significance of these structures, including the ancient harbors and bridges, is of particular interest to the YADES project as they represent both cultural and architectural heritage in need of preservation.

The city's history is marked by its ancient infrastructure, particularly the white stone bridges that connected the two bodies of land, facilitating both trade and defense. These bridges, along with the channel that once ran through what is now Ermou Street, were crucial to the city's development, allowing ships to pass between the north and south harbors. The channel was wide enough for ancient warships like the triremes, which further emphasizes the historical importance of Mytilene as a maritime and military hub. These stone bridges, some of which were made of marble, not only served a practical purpose but also represented the architectural advancement of the time, showcasing the city's wealth and power.

Over the centuries, however, natural processes such as the accumulation of silt and human intervention, particularly for the defense of the Castle of Mytilene, led to the eventual filling in of the strait. The remnants of these ancient structures, now buried beneath layers of earth, provide a rich archaeological record that tells the story of Mytilene's transformation from a bustling ancient city to its modern form.

Mytilene's historical and cultural significance is further highlighted by its association with some of the most famous figures of the ancient world. It was home to the poets Sappho and Alcaeus, as well as the statesman Pittacus, one of the Seven Sages of Greece. These illustrious citizens underscore Mytilene's reputation as a center of culture and learning in the ancient world. The city also produced a significant number of electrum coins from the late sixth to mid-fourth centuries BC, further testament to its economic prosperity and influence in the region.

Figure 3: Aerial photos from a Church in Mytilene

Figure 3 presents images from a church in Mytilene, highlighting its structural details and surrounding environment. The aerial view offers a comprehensive perspective of the building's roof, which appears to have been recently restored with new red tiles. The roof's clean lines and uniformity indicate that careful attention has been given to preserving the structural integrity of this historical building while maintaining its traditional aesthetic.

In addition to the roof, the lower sections of the church are supported by scaffolding, suggesting that restoration work is ongoing. This is particularly important for the preservation of the church's exterior walls, which are constructed from intricately placed stone blocks. The walls display some signs of aging, with visible cracks and minor structural deterioration in certain areas, indicating the necessity of the restoration efforts. The second image also focuses on the church's windows, with protective iron bars and the surrounding stonework, both of which appear to be in need of careful preservation to ensure the building's longevity.

The combination of old and new elements in these photos underscores the balance between preserving the church's historical features while updating its structure to withstand current environmental and structural challenges. This approach is consistent with the aims of projects like YADES, which emphasize the sustainable preservation of cultural heritage sites.

Figure 4: Photos from an old building in Mytilene

Figure 4 depicts an old building in Mytilene, showcasing its characteristic stone walls and red-tiled roof. The masonry displays signs of wear, with visible cracks and areas where the stones appear to have shifted over time. The windows are protected with iron bars, typical of older architectural styles that prioritized security. The overall structure appears to have undergone some degree of preservation, with visible marks and symbols on the walls, likely indicating areas under observation or restoration. The rounded sections of the building, as seen in the photos, suggest a possible ecclesiastical origin or a structure from a historically significant era.

The wear on the stones and the presence of restoration markers highlight the need for continued conservation efforts. The roof tiles, although newer, blend well with the traditional aesthetic, maintaining the historical integrity of the structure. The attention to detail in the design, from the arched windows to the carefully laid stones, emphasizes the building's cultural and architectural significance. This documentation is essential in preserving such heritage sites, ensuring that future generations can continue to appreciate their historical value.

7 Conclusion

The data collected through the YADES project forms the basis of a comprehensive resilience strategy for cultural heritage areas at risk from natural and environmental hazards. By employing both aerial and ground-level imaging techniques, the project has ensured a holistic understanding of the structural and environmental vulnerabilities present at these historic sites. The integration of these datasets into the YADES platform will support informed decision-making, enabling the development of effective risk mitigation strategies and sustainable reconstruction plans.

As the project moves forward, the data collected will be instrumental in protecting the cultural heritage and history of these significant sites. The combination of modern technology and community involvement ensures that YADES not only addresses immediate risks but also provides a framework for the long-term preservation and resilience of cultural heritage in Greece and beyond.

In particular, the success of the YADES project is intrinsically tied to the active involvement of its diverse stakeholders, including local communities, cultural organizations, municipal authorities, and international bodies. By fostering collaboration through participatory workshops, feedback mechanisms, and capacity-building initiatives, the project ensures that resilience strategies are not only scientifically robust but also culturally sensitive and community-driven. The integration of stakeholder insights has enhanced the accuracy of data collection and the relevance of proposed solutions, creating a shared vision for the sustainable preservation of cultural heritage sites. As the project advances, this ongoing engagement will remain central to aligning technological innovation with the needs and values of those who directly interact with and depend on these historic sites. This approach ensures that the preservation efforts under YADES are both effective and deeply rooted in the communities they aim to protect.