SPACE FOR CONSTRUCTION MONITORING USE-CASES

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1. INTRODUCTION

This document lists the use cases to be used as part of the 'Space for Construction Monitoring' thematic call for proposals.

The use cases presented result from the cooperation between the European Space Agency (ESA) and key stakeholders in the infrastructure sector. It aims to support the study and demonstration of services enabled by satellite technologies that are uniquely positioned to solve issues in the infrastructure sector.

When writing the initial proposal (APQ/APQ+), the applicant will make clear which use case(s) their solution will address.

2. CONSTRUCTION MONITORING USE CASES

ESA and key stakeholders have identified the below focus areas and use-cases within which satellite data and technology may add value. Prospective bidders to this thematic call for proposals are invited to submit proposals addressing the below use-cases, or to submit alternative ideas within the overarching theme based on their own preference.

2.1. Ferrovial

Ferrovial is a global infrastructure operator committed to developing innovative and sustainable solutions for a world on the move. With more than 70 years of experience, its family of companies holds leadership positions in transportation infrastructure, construction, waterworks, and energy. The company operates in 15 countries, employs more than 4,000 people across the U.S. and over 20,000 around the world. Ferrovial is dually listed on the Dutch and Spanish stock exchanges. For more information, visit www.Ferrovial.com.

2.1.1. Satellite Earth Observation for Construction Progress Monitoring

At present, construction progress monitoring is carried out via quarterly drone flights and intermittent survey team trips. This approach leads to visibility gaps for stakeholders and high

costs driven by expenses associated with drone (or helicopter) operations and on-site travel. The aim of this use-case is to assess the feasibility of carrying out construction progress monitoring using high-resolution satellite imagery and advanced analytical techniques to obtain higher frequency and accuracy updates than are currently achievable. This is targeted across multiple, disparate construction sites, concurrently. The ultimate target is a scalable satellite imagery-based solution that enables improved visibility, reduced costs, and less need for on-site travel.

The use-case initially targets *feasibility studies* that leverage historical *archived* satellite imagery to validate the capability of identifying and detecting changes in certain parameters over time. Existing drone-derived data from the targeted sites will be provided for validation and ground-truthing of the satellite imagery analysis. Studies should conclude within a maximum duration of **6 months**, thus high technology-readiness level (TRL) solutions are sought. Within this period, it is expected that the work will be broken into phases, including appropriate satellite imagery analysis and selection, processing of said imagery, algorithm training, validation of the algorithms, and delivery of the outputs (i.e. through a Proof-of-Concept to demonstrate the capabilities achieved). The features that should be monitored are split into baseline and stretch targets, the former representing the minimum capability expected, and the latter the aspirational targets. Adequate monitoring of these features may be achievable using various satellite datasets (optical, thermal, radar) or combinations thereof. Furthermore, there may be scope to adapt assets deployed on-site to aid monitoring (e.g. using radar reflectors to enhance detectability of assets) if this does not compromise the commercial viability.

The features to be monitored, and required performance measures, are described below.

2.1.1.1. Baseline Case

The baseline case should cover overall construction progress monitoring. Features identifiable should include accurate identification of:

- Mapping and change detection of vegetation, and areas and distances as pertaining to earth-moving activities and asphalt areas.

- The presence of land equipment such as excavators, bulldozers, and cranes.
- Automatic detection (presence, classification, position and area occupation) of vehicles (including cars and trucks), and presence of metallic objects.
- Automatic detection of logistic centres such as supply hubs, staging areas, and storage sites.
- Security monitoring (such as detection of unauthorised personnel or activity during non-operational hours)
- Authority verification (such as monitoring compliance with restricted zones and highway traffic controls like safety barrier placements, work zone signals, etc…).

The temporal resolution of the monitoring should be between daily and weekly, with higher frequency monitoring being favoured though still optimising for cost efficacy. The solution should also have large area coverage to provide monitoring capabilities for dispersed and remote projects, concurrently (in which a single, typical linear project spans 30-50km^2).

2.1.1.2. Stretch Targets

Stretch targets include the measurement and monitoring of 3D parameters such as earth-moving *volumes* and comparisons of these over time. Additionally, detection of smaller objects, such as traffic management and safety equipment (e.g. the presence and location of traffic barrels), is sought. Finally, integration of satellite-derived data analysis with project planning tools to automatically identify and notify stakeholders of delays, breaches of compliance, and safety hazards, across many sites at the national and international level, would be highly valued.

2.1.1.3. Follow-Up Demonstration

Should the feasibility studies conclude with a positive outcome, there will be the opportunity to progress to an operational trial using up-to-date satellite imagery with Ferrovial. This trial would allow to validate key metrics such as the quality of outputs, commercial sustainability, and operational efficiency on a larger scale. Beyond this, a successful operational trial could lay the groundwork for broader deployment across projects, providing real-time insights, reducing

manual monitoring costs, and enhancing decision-making capabilities at each phase of construction.

2.1.1.4. APQ+

Bidders addressing this use-case should complete the APQ+ (i.e. the APQ form as well as the additional questions hosted at the end of the APQ form, entitled Section AP.5).