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Dear Editors-in-Chief,

By: Qiwei Wan, Changjie Xu∗, Kewang Zhang, Haibin Ding, Gang Wei

We are pleased to submit our review article **“A State-of-the-Art Review on Space–Air–Ground Integrated Intelligent Monitoring for Large-Scale Deep Excavation Engineering”** for consideration as a *Review Article* in ***Journal of Construction Engineering and Management (JCEM)***.

JCEM emphasizes advanced sensing, information modeling, construction risk management, and life-cycle cost effectiveness—precisely the themes addressed here. Deep urban excavations now underpin transit hubs, high-rise basements, and underground utility corridors; yet the project-management community lacks a consolidated guide on integrating satellite, UAV, and ground sensors into a real-time digital-twin workflow that meets modern safety and scheduling constraints. Our manuscript bridges that gap.

**Novel contributions**

1. **Regulatory matrix for construction monitoring**—compares six major jurisdictions (China, UK, Singapore, Australia, Germany, U.S.) on trigger limits, data-rate mandates, and formal acceptance of remote sensing.
2. **Sensor principle–performance map**—links InSAR, UAV LiDAR/photogrammetry, robotic total stations, and MEMS arrays to six excavation health indicators, clarifying when each modality adds value.
3. **Cost-benefit optimisation**—shows that a tri-modal satellite + UAV + ground scheme confines wall-top displacement forecasts to ±2 mm while reducing life-cycle monitoring cost by >40 % (Shanghai East, Shenzhen CBD, Crossrail Farringdon case studies).
4. **Scenario-oriented data-fusion matrix**—benchmarks eight algorithms (UKF, PF, D–S, Bayesian Net, GPR, RF, CNN-LSTM, Transformer) across real-time filtering, post-hoc inversion, and long-horizon prediction, guiding practitioners to the right tool for latency and accuracy demands.
5. **Four-layer edge–cloud architecture**—demonstrates how a 15-min early-warning loop can be achieved within common project IT constraints, offering a replicable blueprint for digital-twin deployment on complex construction works.

**Manuscript particulars**

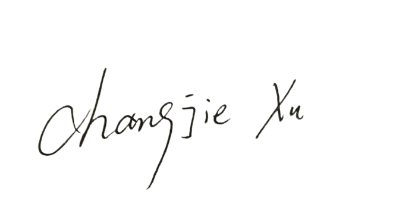
* Length: ≈9 000 words (main text), 17 figures, 8 tables, 96 references
* Data: PRISMA-ScR selection of **522 peer-reviewed sources** (2006-2025)
* Supplementary material: code snippets and example datasets available on GitHub for replication

**Compliance statements**

* The work is **original, not under review elsewhere, and all authors approve this submission**.
* Funding: National Key R&D Program of China (Grant No. 2023YFC3009400).
* Conflicts of interest: none.
* Data availability: all data and scripts used to generate figures are openly accessible at https://github.com/QiQiWan/SAG-Review/tree/main/other\_files.
* Ethical compliance: the research contains no human or animal subjects.

We believe the manuscript will provide JCEM readers with actionable strategies for integrating multi-scale sensing into construction decision making, thereby enhancing safety, schedule reliability, and cost control on large excavation projects.

Thank you for considering our submission. We look forward to your feedback.

Yours sincerely,

Changjie Xu

Encl.