Enhancing QA/QC Processes in the Construction of Tailings Storage Facilities through Automated Workflows

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# ABSTRACT

Construction quality assurance (CQA), alongside quality control (QC) and construction vs design intent verification (CDIV), form a systematic process to ensure compliance with technical, contractual, and regulatory requirements, and ensure that the original design intent remains valid. In earth-structure projects such as tailings storage facilities (TSFs), CQA often requires manually handling large volumes of data—including field reports and laboratory results—organised in basic folder structures. This method is labour-intensive, requiring significant personnel hours, making data entry errors hard to detect. Transcription mistakes are common.

This paper presents an automated CQA workflow for tailings dam construction, integrating AI-powered optical character recognition (OCR), Python scripting, and email-based classification to extract, verify, and record test results and organise other documents such as survey reports, ITPs and technical queries. The system manages multiple PDF-based test certificates (including particle size distributions, Atterberg limits, Dynamic Cone Penetration and density tests), recording results, verifying them against existing records, and flagging potential anomalies, like incorrect coordinates or repeated data. The script takes about 21 seconds to extract and compile raw data from each PDF into a spreadsheet, running in the background, freeing engineers for other tasks. This cuts transcription time to the spreadsheet by approximately 92%, shifting manual effort to data verification.

The resulting improvements in data management and verification facilitate more efficient preparation of time-sensitive construction records reports. A case study is presented. The study involved a forensic geotechnical investigation. The project required processing around 500 compaction test certificates embedded in a CQA report of more than 5 000 pages. The data was processed in a few days. The efficiencies demonstrate the adaptability of the workflow. The outcome highlighting how the judicious integration of AI and encryption leads to more reliable data management in geotechnical engineering projects. This automated approach not only minimises transcription errors and reduces costs through higher efficiency but also allows engineers to focus on higher-value tasks, improving overall project quality and compliance.