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Research paper

Systems information modelling: Enabling digital asset management

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ABSTRACT

Having access to the right information at the right time has been, and remains a pervasive problem during operations and maintenance (O&M) and thus hinders an asset owner's ability to ensure their facilities performance are being optimized. Typically, asset managers are often confronted with 'As-built' documentation that is prepared using Computer-Aided-Design (CAD) and is often incomplete, erroneous and/or redundant, which adversely impacts an asset's integrity and productivity during O&M. With this mind, the quality of information contained within 'As-Built' electrical documentation for an 'Underground Railway Station' is evaluated by quantifying the errors and omissions contained within them. The cost to document information using CAD compared to the development of a System Information Model (SIM) is determined. A retrospective SIM is constructed and a bi-directional link with a three dimensional (3D) model is established to ensure the integrity of the information required for O&M. The use of a SIM instead of CAD can provide engineers with a new medium and process for preparing the design and documentation of electrical systems as it provides them with an ability to obtain significant productivity and cost benefits. The empirical research presented in this paper provides the impetus for future research in the fertile and unexplored area of Digital Asset Management for infrastructure projects.

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1. Introduction

Having appropriate and reliable information about an asset (e.g. spatial information, specifications, product data, warranties, reliability and preventative maintenance schedule) is pivotal for enabling management to support decision-making, planning and execution of activities and tasks, particularly during operations and maintenance (O&M). Yet, having access to the right information at the right time, has been and remains a pervasive problem during O&M, which hinders an asset owner's ability to ensure their facilities performance is being optimized. Typically, asset managers are often confronted with 'As-built' documentation that is incomplete, erroneous or redundant.

'As-Built' documentation is a revised set of drawings submitted by a contractor upon completion of the works they were contracted to undertake. They reflect all changes made in the specifications and working drawings during the construction process, and show the exact dimensions, geometry, and location of all elements of the work completed under a contract. However, there is a proclivity for errors, which can also take the form of omissions, to be contained in the 'As-Built' documentation as they are prepared using two-dimensional (2D) Computer-Aided-Design (CAD), particularly within the field of electrical engineering [16,18,38].

Increasing competition, schedule and financial pressures can result in engineers preparing tender documentation that is incomplete and does not reflect the scope of works that is required [19]. As a result, tender prices may increase as contractors account for potential risks. Moreover, construction drawings may need to be amended as Requests for Information (RFIs) and change orders arise. Such amendments are 'simply' highlighted on selected drawings rather than all those where the information has been presented.

Research undertaken by Love et al. [16], for example, found a component or device may occur on as many as 20 drawings in electrical contracts. When a change is required to a 2D drawing, the drawing and each corresponding view has to be manually updated thus a 1: n relationship exists. In this case, every single drawing that contains a component or device will have to be up-dated, which increases costs to an engineering firm, and thus adversely impacts their fee if a fixed fee had been agreed. Contrastingly, if a cost reimbursement contract is awarded to an engineering firm, then the financial considerations associated with amending documentation are accommodated; they are in this

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